US Army Corps of Engineers®

PERMANENT ENHANCEMENT OF THE ICS FACILITIES

FINAL REPORT
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Prepared for

U.S. Army Corps of Engineers
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EXECUTIVE SUMMARY

The intent of this study is to determine the requirements for enhancing the existing ICS facilities so that the facilities could achieve a 50 year design life. The enhancements also address pump capacity improvements and operation and maintenance issues.

The ICS facility modifications required at the three canals include:

- Removal of the Phase 1 and Phase 2 pumps and power units. New 350 cfs form suction intake pumps and power units would be installed in place of the removed pump units.
- Provide an enclosure around the Phase 1 engine platforms and the Phase 3 pump platforms to protect the equipment from wind blown debris.
- Provide butterfly valves on the existing discharge pipes.
- Replace the existing knife gates and hoisting equipment with roller gates and hydraulic hoisting equipment.
- Provide coating and corrosion protection on the exposed steel material.

The ICS facility pump capacity improvements include:

- An additional 8-350 cfs form suction intake pumps at 17th Street along with two additional 9' diameter discharge pipes and a pump platform with a protective enclosure.
- An additional 2-350 cfs form suction intake pumps at Orleans Avenue along with one additional 9' diameter discharge pipes and a pump platform and a protective enclosure.
- An additional 6-350 cfs form suction intake pumps at London Avenue along with two additional 9' diameter discharge pipes and a pump platform with a protective enclosure.

The Capitol Costs and associated Operation and Maintenance costs for the enhanced facilities were evaluated. Tables E-1 and E-2 document the Capitol Costs and the Life Cycle Costs associated with the enhanced ICS facilities. Generally, the O&M requirements for the enhanced ICS facilities will be greater than the O&M requirements for the proposed Permanent Pump Stations. The reason for this is that the ICS facilities were not planned and constructed in a manner to reduce operation and maintenance needs. They were planned and constructed as an emergency action to temporarily protect the outfall canals and adjacent communities from flooding that might occur if a hurricane event occurred prior to construction of the permanent protection system.

Table E-1 – Cost Estimate for Enhanced ICS Facilities

Facility	Permanent Enhancements of ICS			
	ICS Enhancement Costs	Maint. Facility Costs	Capacity improvement Costs	TOTALS
A. 17th STREET CANAL	$ 125,039,826	X	$ 56,188,253	$ 181,228,079
B. ORLEANS AVE. CANAL	$ 68,487,729	X	$ 15,015,699	$ 83,503,428
C. LONDON AVE. CANAL	$ 82,598,997	X	$ 42,903,197	$ 125,502,194
D. MAINTENANCE FACILITY	X	$ 41,556,365	X	$ 41,556,365
TOTALS =	$276,126,552	$ 41,556,365	$ 114,107,149	$ 431,790,066

Facility	Life Cycle Costs for Permanent Enhancements of ICS				
	Initial Capitol Costs ($)	50 Year LCC Operating	50 Year LCC Maintenance	Historic O&M Costs from S&WB	Total Life Cycle Costs
A. 17th STREET CANAL	$ 181,228,079	$ 8,765,499	$ 14,180,752	$ 6,475,000	$ 231,150,470
B. ORLEANS AVE. CANAL	$ 83,503,428	$ 7,747,030	$ 10,190,011	$ 4,550,000	$ 162,395,443
C. LONDON AVE. CANAL	$ 125,502,194	$ 6,450,798	$ 5,354,002	$ 2,100,000	$ 104,057,245
TOTALS =	$ 431,790,066	$ 22,963,327	$ 29,724,765	$ 13,125,000	$ 497,603,158

Table E-2 – Life Cycle Cost for Enhanced ICS Facilities

1. INTRODUCTION

Interim Control Structures (ICS) are located in the 17th Street, Orleans Avenue and London Avenue Canals near the confluence with Lake Pontchartrain. The ICS facilities generally are assumed to have a 5 year life. The ICS facilities include a substantial amount of infrastructure consisting of non-overflow structures, gate closure structures, pumps and pump power units, pump platforms and engine platforms. An investigation was performed to determine what modifications are required to extend the life of the ICS facilities from a 5 year design life to a 50 year design life. The investigation answered three primary questions. These questions are:

A. What modifications are required in order to make the ICS permanent assuming a 50 year design life as the basis?

B. What modifications will have to be made to allow the capacity of the ICS to be increased to the required capacity at each of the three sites?

C. What are the estimated Operations and Maintenance costs of the permanent facility?

Modifications to upgrade the ICS facilities to a 50 year design life considered aesthetic considerations, maintainability, operability, accessibility, corrosion protection, lightening protection, longevity and replacement of components, accessibility, safe room for operators, standby power, controls and other associated issues. The considerations are evaluated against their current state and the desired state with required modifications identified.

The evaluation of the hydraulic requirements of the ICS facilities intake and discharge capacity is based on model studies performed by ERCD. Additional, information associated with overall pump capacities is further evaluated by comparison the required canal flow rate and anticipated pump capacity to maintain the water elevation in the canals at a safe water elevation.

2. ICS FACILITIES - 50 YEAR LIFE

2.1 Existing ICS Facility Description

Review of the existing ICS facilities included review of existing reports, and contract plans. A site inspection of all three ICS facilities was performed to further understand the layout and overall size of the facilities. The following information was reviewed:

- Phase 2 Conceptual Design Services for Permanent Flood Stations and Canal Closures at Outfalls, Alternative Considerations Report, prepared by Black & Veatch, dated December 2006.
- ICS Phase 1 Construction Plans for the 17th Street Canal and Construction Plan Modifications, prepared by Linfield, Hunter, & Junius, INC., dated January 2006.
- ICS Phase 1 Construction Plans for the Orleans Avenue, prepared by URS, January 2006.
- ICS Phase 1 Construction Plans for the London Avenue prepared by URS, January 2006.
- Data Report on Phase 1 Model Study of Interim Pumping Station at London Avenue Canal, by Dr. Stephen T. Maynord, dated October 2006.
- Data Report on Model Study of Interim Pumping Station at 17th Street Canal- Existing 18 Hydraulic Pumps and Original Design of 11 Direct Drive Pumps, by Dr. John E. Hite, Jr. and Dr. Stephen T. Maynord, dated February 2007.

The ICS facilities are comprised of non-overflow structures, a gate closure structure, and pump systems. These facilities were constructed in three phases. Phase 1 included the non-overflow structures, the gate closure structure, MWI hydraulic pumps and pump platforms, power units and the engine platforms. Phase 2 included additional MWI hydraulic pumps, power units and pump platforms. Phase 3 included Fairbanks Morse and Patterson direct drive diesel pumps, power units and pump platforms. The 17th Street Canal ICS includes all three construction phases; the Orleans Avenue Canal ICS includes phase 1 construction only; and the London Avenue Canal ICS includes phases 1 and 3.

2.1.1 Non-Overflow Structures

The non-overflow structures transition from the existing line of protection to the gate closure structure. In all cases, the non-overflow structures are sheet pile cofferdams that are filled with soil. Table 1 documents the specific geometry and cell types for each ICS Facility. The Orleans Avenue and London Avenue non-overflow structures are wider and the cell sheet piles are embedded to greater depths.

Table 1 – Non-Overflow Information

Parameter	ICS Facility		
	17th Street	Orleans Ave	London Ave
Length of Left Non-Overflow	~315’	~125’	~97’
Length of Right Non-Overflow	NA (Ties Into Existing Protection)	~125’	~97’
Cofferdam Cell Type	Arch	Cellular	Cellular
Cell Width (Gravity Section)	24'-10.25"	60.59’	45.94’
Cell Height Above Grade	~12.0’	~16.0’	~16.0’
Sheet Pile Penetration into Soil	-27.00'	-50.00’	-54.00’
Sheet Pile Type	PZ 27.5	PZ 27.5	PZ 27.5
Soil Fill	Yes	Yes	Yes
Cell Cap Material	Crushed Stone	Reinforced Concrete Cap	Reinforced Concrete Cap
Steel Piles (Placed in Interior of Cells to Support Concrete Cap)	NA	H14x73 Tip Elev. -70.0	H14x73 Tip Elev. -66.25’

2.1.2 Gate Closure Structure

The primary elements of the closure structures are foundation soil improvements (not provided at London Avenue ICS), riprap protection, structural steel substructure, structural steel superstructure, grated platform, abutments, gate seal, bulkheads, bulkhead hoist and bulkhead slots. Further investigation shows that scour pads and erosion prevention measures were constructed upstream, downstream and along the sides of the gate closure structures to ensure the closure remains in place during significant storm events. The gate closure structures house bulkheads that can be lowered through static water to separate the canals from Lake Pontchartrain. Table 2 summarizes the gate closure opening dimensions and capacity. A comprehensive description of the existing gate closure structures is provided in Appendix A.

Table 2 – Gate Closure Dimensions and Capacities

Parameter	ICS Facility		
	17th Street	Orleans Ave	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
Flow-rate	12500 cfs	3390 cfs	8980 cfs
Water Velocity	10.08 ft/sec	7.35 ft/sec	7.49 ft/sec

2.1.3 Pumping Facilities

The pump facilities include the pumps, power units, pump platforms, discharge piping and engine platforms. The pump facilities can be organized in phases that reflect the construction activity at the ICS facilities. Details of the structures installed during each phase is provided in Appendix B (includes phase 1 description only, no specific data was provided for the phase 2 and 3 construction activities). The pump installation phases are defined as follows:

- Phase 1 – Hydraulically driven pumps made by MWI with power units placed at the engine platforms on the protected side of the canals (except the west side engine platform at 17th Street is on the non-protected side of the canal.
- Phase 2 – Hydraulically driven pumps made by MWI with power units placed at the phase 2 pump platforms.
- Phase 3 – Diesel direct drive pumps made by Fairbanks Morse and Patterson with power unit at the phase 3 pump platforms.

During Phase 1, hydraulically driven pumps by MWI were installed on platforms over the canals. The hydraulic power units were placed on the engine platforms located on the high bank on each side of the canal. One of the engine platforms was constructed on the un-protected side of the canal levees due to site restrictions.

In a second phase, 6 hydraulically driven pumps by MWI were installed at 17th Street. Except in this installation, both the hydraulically driven pumps and the hydraulic power units were installed together on new platforms over the canals. These pump/power unit platforms are structural steel frames that support galvanized steel grating.

In the third phase which is currently under construction, 11 new Fairbanks Morse pumps are being installed at 17th Street and 8 Patterson pumps are being installed at London Street. These pumps are line-shaft pumps direct driven by diesel engines through a right angle drive. Both the pump and engine are installed on platforms over the canal. Also installed as part of the third phase were 14 additional MWI hydraulically driven pumps. These pumps are being installed in two rows along the gate closure platform just upstream of the knife gates. The hydraulic power units are being installed on the gate structure platform over the canal.

Table 3 shows the number of pumps, type of pumps and the location of the power units for each ICS Facility for each pump installation phase.

Table 3 – Pump Systems at Each ICS Facility

Parameter			ICS Facility		
			17th Street	Orleans Ave	London Ave
Phase 1	Number of Pumps		12	10	12
	Pump Type		MWI	MWI	MWI
	Power Unit Location		Engine Platforms	Engine Platforms	Engine Platforms
Phase 2	Number of Pumps		6	NA	NA
	Pump Type		MWI	NA	NA
	Power Unit Location		Pump Platform	NA	NA
Phase 3	Number of Pumps		11/14	NA	8
	Pump Type		Fairbanks Morse/MWI	NA	Patterson
	Power Unit Location		Pump Platform/Gate Closure Platform	NA	Pump Platform

Shop drawings were not available for review of the MWI, Fairbanks Morse, or Patterson Pumps. The pumping facilities are fairly consistent from canal to canal except for overall pump capacity. The pumps are placed in a line parallel to the flow in the canal. In some cases, the pumps are isolated with baffles and screens and in other cases they are not. At the 17th Street Canal, where a larger pumping capacity is required, the pumps are spread out along both sides of the canal and along the closure structure platform. The generator units are located below an open-air canopy (engine platforms) on pump platforms near the canal and on the closure structure platform.

The MWI pumps are fabricated pumps with the propellers made of stainless steel and carbon steel housings. The propeller is driven by a hydraulic motor directed attached to the propeller. As such, the drive unit is normally submerged in the canal where it is subject to leakage and corrosion. The hydraulic motor is driven by hydraulic fluid at pressures in excess of 3000 psig. The pressure is created by a hydraulic power unit which consists of a diesel engine and a hydraulic pump. Four 3 inch and 2 smaller hydraulic lines connect the hydraulic motor to the hydraulic power unit. To power the 32 MWI units at 17th Street, there is approximately 10 miles of hydraulic pipes and hoses with over half of these over the canal.

The original MWI units were hung from the platform into the canal without any baffling. The second set of pumping units were also hung from platforms, but divider walls were provided between the units and a back wall provided behind the pumps which was an improvement in the hydraulic design. The Fairbanks Morse and Patterson pumps are being installed with COE Type 10 Formed Suction Inlets (FSI), which is an improvement over the baffled chambers. The set of MWI pumps installed at the 17th Street gate closure structure are not baffled.

2.1.4 Existing ICS Electrical System

The electrical systems are somewhat consistent at each of the three facilities. Generally, the 17th Street, Orleans Avenue and London Avenue ICS facility electrical and communication systems are almost identical in configuration.

2.1.4.1 Monitoring & Control Communication

The monitoring and control functions at each of the ICS facilities are accomplished through a common Supervisory Control and Data Acquisition (SCADA) system. Canal level data is collected from level sensors ranging in quantities from 6 to 7, located along the length of the canal. This information is culminated during each SCADA scan which is approximately every second, through Data Collection Panel (DCP) located near each sensor. The DCP identification is the nearest east-west street which the panel is located. Data is culminated from each of the panels via one pair of a 12 pair fiber optic (FO) cable which routes through the length of the canal. This FO cable has nine spare pairs with the two remaining used for remote control and Ethernet communications. The FO cable terminates at the SCADA cabinet located in the ICS safe house, housing the SCADA server. SCADA monitoring and control of diesel engine and hydraulic pumping systems is accomplished through Modbus communications with the associated equipment control panels.

Primary communication from the ICS facilities is via microwave communications between the ICS facility and with their respective primary pumping stations, Drainage Pumping Stations (DPS) 3, 4, 6 and 7. The microwave system has two channels available which offers one channel for operation and a second for redundancy. Ultimately, all communications are received by DPS 6 which in turn transmits this information to the Emergency Operations Control (EOC) Center located in the USACE office via Southern Bell's communication network. Additional communication redundancy is through satellite communications via rivergages.com. Rivergages.com polls canal level information every 15 minutes, capturing comparisons between the last reading and the most current.

The SCADA system, as well as the diesel and hydraulic pumping equipment controls derive their primary power from the local utility. The utility service is backed up through an automatic transfer switch by redundant emergency diesel generation units, of which the selection of emergency generation unit operation is via a manual transfer switch. The SCADA system is additionally supported with an Uninterruptible Power System. System monitoring and control is performed at the EOC. At this location, operators are able to monitor the entire system, as well as monitor and control each canal and its associated ICS structure operating components through drill down screens on the human-machine interface (HMI) monitor/server. At present, SCADA monitoring and control of the gate structure equipment is being considered in a current modification.

2.1.4.2 Electrical Systems Installation

The above grade electrical cable and raceway at each ICS facility consists of galvanized rigid steel conduit which is customary in industrial applications. Electrical boxes and enclosures installed are of the appropriate type and rating for there application.

2.1.5 Corrosion Protection System

The ICS facilities were evaluated to determine construction materials and if corrosion protection was provided. The Phase I features, construction material and corrosion protection system that were installed at the three ICS facilities is presented in Table 4. The remaining Phase II and Phase III components at each location will be evaluated as the design information becomes available. The complete corrosion protection system investigation and evaluation is provided in Appendix C.

Table 4 – Existing Corrosion Protection System (Phase 1 Construction)

Location	Structure	Type of Construction	Materials	Existing Corrosion Protection
17th Street ICS Facility	Non-Overflow Section	Sheet Piling	Carbon Steel	None
	Gate Closure Structure Substructure	Pipe Piling	Carbon Steel	Protective Coating
	Pumps	Vertical Turbine	Information Not Available	Protective Coating and Cathodic Protection
	Pump Platform Substructure	H Piling and Sheet Piling	Carbon Steel	None
	Power Unit Platform Substructure	Pipe Piling	Carbon Steel	None
Orleans Avenue ICS Facility	Non-Overflow Section	Sheet Piling	Carbon Steel	None
	Gate Closure Structure Substructure	Pipe Piling	Carbon Steel	Protective Coating
	Pumps	Vertical Turbine	Information Not Available	Protective Coating and Cathodic Protection
	Pump Platform Substructure	H Piling	Carbon Steel	None
	Power Unit Platform Substructure	H Piling	Carbon Steel	None
London Avenue ICS Facility	Non-Overflow Section	Sheet Piling	Carbon Steel	None
	Gate Closure Structure Substructure	Pipe Piling	Carbon Steel	Protective Coating
	Pumps	Vertical Turbine	Information Not Available	Protective Coating and Cathodic Protection
	Pump Platform Substructure	H Piling	Carbon Steel	None
	Power Unit Platform Substructure	H Piling	Carbon Steel	None

2.2 ICS Facility Design, Operation and Maintenance Requirements

In order to determine whether the existing ICS facilities are acceptable or need to be modified, requirements need to be established that define the basic intent of the facility. Generally, the basic requirements associated with enhancing the existing facilities so that they achieve a 50 year design life were determined based on O&M issues, technical design and flood fighting issues. The following is the list of requirements each facility was evaluated against to determine if modification of the ICS facility was required:

- Pump Capacity – the pump capacities for each canal need to achieve the required canal capacity. These capacities for each canal are 12500 cfs, 3390 cfs, and 8980 cfs for the 17th Street, Orleans Avenue and London Avenue Canals respectively.
- Pump Availability – the pumps need to have the appropriate start-up time and availability to pump as necessary. The pump systems should be designed to allow for efficient start up times so that operations personnel have time to prepare the ICS facility for a potential storm event.
- Pump O&M – the existing pump arrangement needs to be arranged to reduce the overall level of operation and maintenance or at least allow for acceptable levels of operation and maintenance.
- Pump Controls – placement of pump controls to allow for operation from a centralized location on site needs to be provided. Remote operation of the pumps will allow for efficient and safe operation during storm events.
- Electrical and Communications – the electrical and communications systems need to be reliable and redundant.
- Non-Overflow Sections – the structural and geotechnical systems need to be able to transfer the storm event loading into the foundation safely.
- Gate Closure Structure – the structural and geotechnical systems need to be able to transfer the storm event loading into the foundation safely.
- Canal Erosion – the channel upstream and downstream of the gate closure structure needs to be protected against erosion.
- Knife Gates (Bulkheads) – allow for remote operation of the knife gates and ability to close gates through differential head.
- Corrosion Protection – protection to prevent failure of the structural systems. The exposed steel needs to be protected against corrosion to reduce maintenance costs associated with replacing or repairing damage structural steel members.
- Flood Fighting Philosophy – provide access to the power units and fuel systems to allow for operation of pumps as necessary. The pump power units, hydraulic piping, fuel storage tanks and gate hoisting equipment need to be protected against flying debris associated with hurricane storm events.

2.3 ICS Facilities Evaluation

A list of deficiencies associated with the existing ICS facilities was developed based on comparison against the operation and maintenance requirements. The primary purpose of the list is to identify aspects of the existing facility that need to be modified to allow the ICS facilities to

function as permanent facilities with a 50 year life. A comprehensive list of the deficiencies for each ICS facility are included in Appendix D. The deficiencies are organized around the five main ICS features: non-overflow structures, gate closure structures, pumps, power units, and miscellaneous features.

The deficiencies documented in Appendix D were further screened to determine the best solution for modifying the ICS facilities. During the screening process the deficiencies and solutions were organized around main deficiency categories. The screening of the deficiencies showed that they could be organized around the following main categories:

- Pump Operation and Maintenance
- Hydraulic Fluid/Oil Control
- Power Unit Operation and Maintenance
- Gate Operation
- Coating Issues
- Need for a Maintenance Facility

Solutions for the main deficiency categories where then determined through a project team brainstorming process. Tables 5, 6 and 7 document the primary deficiencies and potential solutions for each deficiency. Other observations regarding the ICS facilities were documented as well.

2.3.1 Non-Overflow Structures

The non-overflow structures appear to be stable against potential flood related loading conditions; however this should be verified. The depth of sheet pile, steel pile and concrete pile embedment matches and exceeds similar flood control foundation systems located in New Orleans. The most stable structures appear to be those installed at Orleans Avenue. The Orleans Avenue non-overflow cofferdam cell diameter (60 feet) is larger than the cofferdams constructed at 17th Street and London Avenue. The cofferdam cells are capped with reinforced concrete slabs that are supported by steel piles with a tip elevation of -70.0. London Avenue is similar to Orleans except that the cell diameter is 45 feet. An arch cellular cofferdam was installed at 17th Street. The arch depth is ~25 feet and the sheet piles are embedded to -27 feet. The cells are capped with gravel. In all cases, the non-overflow structures should be evaluated against the proposed loading conditions to confirm that the structures are stable. The 17th Street non-overflow section appears to be less conservative than the non-overflow sections constructed at Orleans and London Avenues.

2.3.2 Gate Closure Structures

The gate closure structures appear to be stable against potential flood related loading conditions; however, this should be verified with a detailed analysis. The depth of sheet pile, steel pile and concrete pile embedment matches and exceeds similar flood control foundation systems located in New Orleans. The most stable structures appear to be those installed at 17th Street Canal. The 17th Street ICS gate closure structures include robust abutments with sheet pile embedment to elevation -64.0 feet. 28-30” diameter steel pipe piles are driven down in the interior of the

abutment cofferdams. The pipe piles have a tip elevation of -122.0'. The cofferdam is filled with granular fill from existing grade (varies from -5 to +0) and capped with a 1' thick reinforced concrete cap. The substructure of the gate closure structure is founded on 161-30" diameter steel pipe piles with a top elevation of -14.0' and a tip elevation of -106.0'. The pipe piles support an 8' thick reinforced concrete cap that has a top elevation of -10.0'. These piles are surrounded by jacket structure that is comprised of sheet pile (PZ-36 sheets) with a top elevation of -10.0' and a tip elevation of -64.0'. There is a 200 foot riprap pad upstream and downstream of the gate closure monolith. The soil below the 3' thick riprap pad was improved using soil mixing techniques down to elevation -70.0'. The soil mixing extends 50 feet upstream and downstream of the closure structure and as far as 200 feet in some locations. The Orleans Avenue ICS gate closure monolith includes a gate closure structure, and upstream and downstream soil mixing and riprap. The gate closure structure is founded on 18-24" diameter steel pip piles with a tip elevation of -112.0 feet and extend up to elevation +13.0 feet. Concrete is placed in the pipe piles from elevation -60.0 feet to elevation +13.0 feet. The soil mixing extends upstream and downstream of the closure structure 50 feet. The riprap area extends upstream and downstream of the closure structure 300 feet. London Avenue foundation system is similar to Orleans, except that no soil mixing was included. The connection between the closure structure and the non-overflow cofferdams appears to have been field modified due to either miss-alignment or poor contract plan details. On both sides of the gate closure structure, sheet pile pieces are welded and bolted together to bridge between the two systems. This area appears to be susceptible to failure during flood loading conditions.

2.3.3 Knife Gate Closure

The most likely scenario that would result in a need to close the knife gates is a hurricane event. The current standard operating plan for closing of the gates includes use of divers to remove sediment and closure while through static water conditions. The process to close the gates may take as long as 5 days. The closure time should be reduced to less that an hour.

The current gate closing process requires divers to remove sediment form the seal area. At all ICS facilities the gate seal is a recessed area that accumulates silts and debris. Removal of the recessed seal will eliminate the need for divers. Additionally, most emergency scenarios for closing the gates will require that the gates move through differential head. Gates with rollers are required to move through differential head.

2.3.4 Pump Systems

The phase 1 and phase 2 pumps are hydraulic MWI pump units and the phase 3 pumps are diesel driven direct line Fairbanks Morse and Patterson pumps. The advantages and disadvantages of each are as follows:

Phase 1and 2 MWI pump unit disadvantages are that the pump units are in-efficient; the hydraulic motor is submerged and subject to corrosion and leakage; the MWI units have six hydraulic hoses submerged in the canal; the units require two hydraulic cooling coil in the canal where it is subject to fouling with biologic growth and floating material; the units require a significant amount of hydraulic fluid which can be a disposal problem when changed, and has

the potential to leak a great deal of hydraulic fluid into the canal; and the Phase 1 pumps and power units are too far apart. The distance between the pumps and power units exceed the recommended distance per the manufacturer. The hydraulic fluid pressure in the pipe may exceed the allowable 3000 psi capacity of the pipe.

Indications from MWI catalogs indicate that potentially bio-degradable hydraulic fluid may be available, but without shop drawings it is unknown whether that can be used in this installation. Even if bio-degradable hydraulic fluid is used, leakage and spills will have a negative visual impact on the canal if not an environmental impact.

The main advantage of the Fairbanks and Patterson units are that the units are direct driven by the engines. This eliminates the in-efficiency of converting diesel power to a hydraulic pump, hydraulic losses in the long hydraulic pipelines, and than converting hydraulic energy at the pump through the hydraulic motor. This installation also eliminates the potential of major spills of hydraulic fluid. The disadvantage of this installation is that it has an internal shaft from the top of the platform down to the impeller. Steady bearings are required to keep the shaft straight. Failure of the bearing lubrication system can result in dramatic and catastrophic failure of the pump.

2.3.5 Corrosion Protection.

Black & Veatch has assumed that the soils along each ICS installation vary widely in corrosive characteristics. Some areas are relatively noncorrosive, but many areas have the potential to be quite corrosive, especially when wet. The corrosive characteristics are low electrical resistivity and high concentrations of chloride and sulfate salts. Because of the potential for encountering corrosive soils, cathodic protection of the ICS structures will be necessary. Impressed current type cathodic protection is proposed for the structure.

Black & Veatch has assumed that the Lake Ponchartrain water around each ICS installation has the potential to be quite corrosive, especially when salinity levels increase. The corrosive characteristics of the lake water are low electrical resistivity and high concentrations of chloride and sulfate salts. Because of the potential for encountering corrosive waters in the splash, tidal and continuously submerged zones, a combination of protective coatings and cathodic protection of the ICS structures will be necessary. Coal tar epoxy, surface tolerant epoxies, epoxy mastics and polyurethane coating materials are proposed for the structure. Impressed current type cathodic protection is proposed for the structure.

The equations determining the allowable corrosion (sacrificial steel) at any point in the non-overflow structure sheet piling indicate there is a large safety factor in the cofferdam design. About 0.25 inches (250 mils) of corrosion can be tolerated without catastrophic results. Based on the average (4.5 mils/year) and maximum (9.0 mils/year) submerged zone corrosion rates given in Appendix C Table 1.4-1, the estimated service life of the non-overflow structure is in the range of 28 to 55 years. Note that the estimated service life is calculated based on corrosion rates taken from the literature. Actual corrosion rates at each ICS can differ from the estimated corrosion rate by as much as an order of magnitude. A method for determining the actual corrosion rate at each ICS location is presented in Appendix C Section 6.0.

Due to the lack of actual and historical information relative to the site corrosivity, the effect of corrosion allowance on the structure life has not been considered. For the purpose of this analysis, supplemental corrosion protection has been proposed so that net metal loss due to corrosion is negligible over the 50 year structure life.

2.3.6 Electrical and Communication Systems.

The only observed lightning protection at each of the ICS was on the tower structures supporting the microwave communication hardware. As indicated on the construction drawings, grounding has been considered in all power circuitry. Grounding is provided at the equipment platform structures.

Though the diesels are rated for outdoor applications, all electrical starting and operating components are subject to the environment. This will attribute to connection corrosion and component life.

Table 5 – 17th Street Canal ICS Primary Deficiencies and Solutions

Main Deficiency Category	Description of Deficiency Issues	Potential Solutions for Each Issue
Pump Maintenance	a. Existing pumps will require annual maintenance, thus need for pump lifting facility b. Pump supports at platforms include shear tabs and other shims to align with platform framing, may lead to significant vibrations c. Layout of 17th Street ICS increases O&M requirements to the point that daily maintenance may need to be performed to ensure proper operation.	a/b/c. Remove phase 1 pumps and replace with generator/motor set. Motor at pump platform and generator at engine platform along side of canal. Will require removal of existing platform and replacement with new pump platform.
Hydraulic Fluid/Oil Control	a. Power Unit location over canal will allow for leakage of hydraulic fluid into canal. Phase 1 pumps only. b. Hydraulic fluid piping is single wall pipe, with fluid pressures near allowable pressure limits and exposed to hurricane wind blown debris. Fuel storage tanks are single walled tanks that are exposed to hurricane wind blown debris. c. Hydraulic fluid piping runs are too long. d. No fluid makeup or waste storage available on site. This will hamper proper O&M of the pump systems..	a/c. Remove phase 1 pumps and replace with generator/motor set. Motor at pump platform and generator at engine platform along side of canal. Will require removal of existing platform and replacement with new pump platform. b. Replace single wall piping and tanks with double wall piping and tanks. d. Need a site fluid storage facility.
Power Unit Maintenance	a. Phase 1 power units are located at engine platform along the canal bank, while phase 2 power units are located at pump platforms in canal. This complicates maintenance, exposes canal to leakage, and may place personnel in dangerous working conditions due to congestion at canal platforms. b. Phase 1, 2 and 3 power units are all exposed to hurricane wind blown debris.	a. Move all phase 2 power units to engine platform with phase 1 power units. This will improve O&M of the pump systems. Provide an enclosure around the phase 3 pump an d power units at the pump platform. b. Provide hurricane enclosures for all power units. This will include protection around canal phase 3 and upper bank phase 1 and 2 based units.
Gate Operation	a. Gates with rollers to allow for response to emergency closures during differential head conditions. The operation of the gates will most likely occur during differential head situations. b. Need quicker response time for placement of gates. The preparation time needed to operate the existing gates is 5 days. c. Hoisting equipment is exposed to hurricane blown debris. d. Remote operation of gates is needed to protect personnel during storm events..	a/b Rolling Gates c. Protection of Hoisting Equipment with housing. d. Location of Controls at Safe House
Coating Issues	a. No coating provided on all major elements of the facility.	a.. Provide coating and cathodic protection for all major elements of facility.
Need for a Maintenance Facility	a. Lack of maintenance facility with room for storage of parts, maintenance bays, and O&M manual/as-built storage.	a. Construct maintenance facility, may be one facility that services all three ICS facilities.

Table 6 – Orleans Avenue Canal ICS Primary Deficiencies and Solutions

Main Deficiency Category	Description of Deficiency Issues	Potential Solutions for Each Issue
Pump Maintenance	a. Existing pumps will require annual maintenance, thus need for pump lifting facility b. Pump supports at platforms include shear tabs and other shims to align with platform framing, may lead to significant vibrations	a/b. Remove phase 1 pumps and replace with generator/motor set. Motor at pump platform and generator at engine platform along side of canal. Will require removal of existing platform and replacement with new pump platform
Hydraulic Fluid/Oil Control	a. Power Unit location over canal will allow for leakage of hydraulic fluid into canal. Phase 1 pumps only. b. Hydraulic fluid piping is single wall pipe, with fluid pressures near allowable pressure limits and exposed to hurricane wind blown debris. Fuel storage tanks are single walled tanks that are exposed to hurricane wind blown debris. c. Hydraulic fluid piping runs are too long. d. No fluid makeup or waste storage available on site. This will hamper proper O&M of the pump systems..	a/c. Remove phase 1 pumps and replace with generator/motor set. Motor at pump platform and generator at engine platform along side of canal. Will require removal of existing platform and replacement with new pump platform. b. Replace single wall piping and tanks with double wall piping and tanks. d. Need a site fluid storage facility.
Power Unit Maintenance	a. Power units are not protected from hurricane wind blown debris.	a. Provide hurricane enclosures for all power units. This will include protection around the upper bank based units.
Gate Operation	a. Gates with rollers to allow for response to emergency closures during differential head conditions. The operation of the gates will most likely occur during differential head situations. b. Need quicker response time for placement of gates. The preparation time needed to operate the existing gates is 5 days. c. Hoisting equipment is exposed to hurricane blown debris. d. Remote operation of gates is needed to protect personnel during storm events..	a/b Rolling Gates c. Protection of Hoisting Equipment with housing. d. Location of Controls at Safe House
Coating Issues	a. No corrosion protection provided for various ICS features.	a.. Provide coating and cathodic protection for all major elements of facility.
Need for a Maintenance Facility	a. Lack of maintenance facility with room for storage of parts, maintenance bays, and O&M manual/as-built storage.	a. Construct maintenance facility, may be one facility that services all three ICS facilities.

Table 7 – London Avenue Canal ICS Primary Deficiencies and Solutions

Main Deficiency Category	Description of Deficiency Issues	Potential Solutions for Each Issue
Pump Maintenance	a. Existing phase 1 pumps will require annual maintenance, thus need for pump lifting facility b. Phase 1 pump supports at platforms include shear tabs and other shims to align with platform framing, may lead to significant vibrations	a/b. Remove phase 1 pumps and replace with generator/motor set. Motor at pump platform and generator at engine platform along side of canal. Will require removal of existing platform and replacement with new pump platform.
Hydraulic Fluid/Oil Control	a. Power Unit location over canal will allow for leakage of hydraulic fluid into canal. Phase 1 pumps only. b. Hydraulic fluid piping is single wall pipe, with fluid pressures near allowable pressure limits and exposed to hurricane wind blown debris. Fuel storage tanks are single walled tanks that are exposed to hurricane wind blown debris. c. Hydraulic fluid piping runs are too long. d. No fluid makeup or waste storage available on site. This will hamper proper O&M of the pump systems..	a/c. Remove phase 1 pumps and replace with generator/motor set. Motor at pump platform and generator at engine platform along side of canal. Will require removal of existing platform and replacement with new pump platform. b. Replace single wall piping and tanks with double wall piping and tanks. d. Need a site fluid storage facility.
Power Unit Maintenance	a. Power units are not protected from hurricane wind blown debris.	a. Provide hurricane enclosures for all power units. This will include protection around the upper bank based units.
Gate Operation	a. Gates with rollers to allow for response to emergency closures during differential head conditions. The operation of the gates will most likely occur during differential head situations. b. Need quicker response time for placement of gates. The preparation time needed to operate the existing gates is 5 days. c. Hoisting equipment is exposed to hurricane blown debris. d. Remote operation of gates is needed to protect personnel during storm events..	a/b Rolling Gates c. Protection of Hoisting Equipment with housing. d. Location of Controls at Safe House
Coating Issues	a. No corrosion protection provided for various ICS features.	a.. Provide coating and cathodic protection for all major elements of facility.
Need for a Maintenance Facility	a. Lack of maintenance facility with room for storage of parts, maintenance bays, and O&M manual/as-built storage.	a. Construct maintenance facility, may be one facility that services all three ICS facilities.

2.4 Alternative Screening.

The Project Team screened the ICS alternatives versus four primary alternatives. The primary alternatives are as follows:

Alt 1. Cover Up Existing ICS Facilities.
Alt 2. Do Nothing to Existing ICS Facilities and Simply Account for O&M Requirements.
Alt 3. Develop a New Pump Facility using the ICS Non-Overflow and Gate Closure Structures.
Alt 4. Re-Arrange and Replace Existing ICS Facility and Equipment.

The Project Team compared the deficiency solutions versus the primary alternatives. Table 8 documents the alternative screen process and defines the overall primary alternatives for each ICS Facility. The Alternative costs for each facility are built around these primary alternatives.

Table 8 – Alternatives Screening

ICS Facility	Primary Alternative	Alternative Screening
17th Street Canal ICS Facility	Alt 1	Not Acceptable, due to risk of hydraulic fluid spills into canal, and overall maintenance problems associated with layout of facility.
	Alt 2	Not Acceptable because O&M requirements would demand daily maintenance over 50 year life and risk associated with hydraulic fluid spills and oil spills into canal.
	Alt 3	**Acceptable, a new plant incorporating non-overflow and gate closure structures.**
	Alt 4	**Acceptable, re-arrangement of power units and replacement of pumps would reduce O&M, improve reliability and provide greater protection against fluid spills into canal.**
Orleans Avenue Canal ICS Facility	**Alt 1**	**Acceptable with replacement of the phase 1 pumps with new pumps. The pumps would have a motor at the pump platforms and a generator unit at the engine platform.**
	Alt 2	Not Acceptable because O&M requirements would demand daily mainteance over 50 year life and risk associated with hydarulic fluid spills and oil spills into canal.
	Alt 3	**Accetable, a new plant incorporating non-overflow and gate closure structures; however, scurtiny of the canal hydraulic operations scenario implies this may be unnecessary.**
	Alt 4	Not Applicable based on Alt 1 Solution.
London Avenue Canal ICS Facility	**Alt 1**	**Acceptable with replacement of the phase 1 pumps with new pumps. The pumps would have a motor at the pump platforms and a generator unit at the engine platform. The Phase 3 pump platforms would be protected by a building enclosure.**
	Alt 2	Not Acceptable because O&M requirements would demand daily mainteance over 50 year life and risk associated with hydarulic fluid spills and oil spills into canal.
	Alt 3	**Accetable, a new plant incorporating non-overflow and gate closure structures; however, scurtiny of the canal hydraulic operations scenario implies this may be unnecessary.**
	Alt 4	Not Applicable based on Alt 1 Solution.

2.5 ICS Facility Modification Recommendations

2.5.1 Alternate 3 – All ICS Facilities

Construction of replacement pump stations at the 17th Street Canal, Orleans Avenue Canal and the London Avenue Canal is based on the phase 1 permanent pump station study.

2.5.2 Alternative 4 – 17th Street ICS Facility Modifications

The 17th Street ICS facility requires the following modifications to allow the facility to achieve a 50 year design life.

A. Pump and Power Unit Replacement. Replace Phase 1 and Phase 2 Pumps and Power Units with a pump that is similar to the Phase 3 pumps, but has a motor at the pump platform and a generator at the engine platform. The existing pump platform and suction basin will remain. The pump platform decking support beams may need to be re-positioned to fit the new pumps. The new pumps will be ~350 cfs direct drive pumps. Specific construction activities associated with the replacement are as follows:

- Remove 12 Phase 1 MWI Hydraulic Pumps (6 located on each side of channel)
- Remove 12 Phase 1 MWI Hydraulic Pump Power Units (6 located on each side of channel on existing engine platforms)
- Remove 6 Phase 2 MWI Hydraulic Pumps (4 located on west side of canal and 2 located on east side of canal)
- Remove 6 Phase 2 MWI Hydraulic Pump Power Units (4 located on west side phase 2 pump platforms and 2 located on east side phase 2 pump platforms)
- Install 18 new 350 cfs form suction intake pumps. The new pumps will be similar to the Phase 3 pumps.
- Install 18 new electric drive power units.
- It is assumed the phase 1 and phase 2 pump platform decking and beam systems may need to be re-arranged to accommodate the new pumps.
- Remove the 14 temporary MWI Hydraulic Pumps and all appurtenances located on the gate closure structure access platform.
- Remove the 14 temporary MWI Hydraulic Power Units located on the gate closure structure.
- Remove the associated discharge piping. Assume approximately 30 feet of 3’ diameter steel discharge piping per pump.
- Install butterfly valves on existing 7-9’ diameter steel discharge pipes. The butterfly valves will provide a positive cut-off to prevent water from flowing from the lake surge into the canal in the event that a discharge pipe fails.
- Remove and replace gate closure access platform with a platform of enhanced support capacity.

B. Engine Platform. The area of the Engine Platform needs to be increased to accommodate four additional power units on the west side and two additional power units on the east side. Options are to increase the size of the existing engine platform or to construct a stand-alone platform adjacent to the existing platform. The engine platform expansion will match the construction of the existing platforms. The existing engine platforms need to be expanded to house the 6 additional power units. Each power unit is allocated ~493 square feet (12.33' x 40 ') of floor space. The estimate provides for a 2500 SF area stand-alone platform both for east and west sides.

C. Engine Platform Enclosure. The expanded engine platforms will be enclosed with a structure that protects the power units from hurricane wind blown debris, from daily weather and to improve the ability to perform maintenance and operation. The enclosure will also protect personnel from wind blown debris and rain during a hurricane event. The enclosures will require the following construction activity:

- Demolish the existing security/debris fencing
- Demolish the metal roofing and siding, including all siding and roof purlins
- Assume the addition of new structural steel frames matching the existing frames are required, and new support columns at ends of the structure.
- Assume purlins are installed that match the existing purlin size.
- Assume a 6 inch thick reinforced pre-cast concrete wall panels are placed around the perimeter of the generator units.
- Assume the roofing system is a standing seam metal roof is supported off a metal deck that is connected to the purlins.

D. Phase 3 Pump Platform Enclosure. Provide a building around the Phase 3 pump platform to protect the power units from hurricane wind blown debris, from daily weather and to improve the ability to perform maintenance and operation. This enclosure is estimated to be similar to the engine platform enclosures. Specific details of the phase 3 pump platforms were not provided.

E. Knife Gate Replacement. The existing gates will be demolished and new gates with rollers will be installed. The new gates will require new gate guides, and hoisting equipment. No demolition of the existing gate structure is required. The existing gate sill may need local demolition to allow the sill depression to be filled with concrete. The new gate hoisting equipment will be provided with an enclosure to protect against wind blown debris. Installation of new gate guides and new rolling gates will require a cofferdam system to dewater the area just upstream and downstream of the gate closure structure. The roller gate construction activities will include:

- Install a steel sheet pile cofferdam both upstream and downstream of the gate closure structure. The cofferdam will tie-into the abutment cells.
- Remove and dispose of the existing 11 knife gates.
- Attach new structural steel wide flange gate guides to the existing gate guides.

- Weld a sill plate in between the new wide flange guides at the concrete sill cap. Plate to be leveled as required to align with bottom of new gates.
- Place grout under the sill plate and in the existing sill depression.
- Cap the sill depression with a plate that is welded to the existing metal embedments.
- Install 11 new rolling gates.
- Install horizontal channels and plates to form hoisting equipment rack at the top of the new gate guides. The channels and plates shall be attached to the gate guides using bolted connections.
- Install hoisting equipment for each gate. The hoisting equipment shall be motor driven hydraulic gate operators and be attached to the hoisting equipment rack.
- Install metal housing around hoisting equipment to protect the equipment from wind blown debris.
- Make electrical connection between gate operation control box and each gate motor.

F. Removal of Hydraulic Fluid Piping. Remove and dispose of the existing 3" dia. and 1" dia. existing hydraulic piping. The hydraulic systems are being replaced with electrical direct drive pumps that are operated using diesel fuel. The existing piping shall be drained, flushed & cleaned prior to offsite removal. The electrical power supply conduit to operate the new pump motors will be placed on the existing hydraulic pipe supports.

G. Fuel Tank Replacement. Replace single wall fuel storage tanks with double wall storage tanks. The new tanks shall have a 20,000 gallon capacity. The maximum size of the tanks shall be 10.5 feet in diameter and 31 feet long. The existing single-wall tank shall be drained, flushed & cleaned prior to offsite removal.

2.5.3 Alternative 1 - Orleans Avenue ICS Facility Modifications

The Orleans Avenue Canal ICS alternative includes the following requirements based on the deficiency evaluation:

A. Pump and Power Unit Replacement. Replace Phase 1 Pumps and Power Units with a pump that is similar to the Phase 3 pumps, but has a motor at the pump platform and a generator at the engine platform. The existing pump platform and suction basin will remain. The pump platform decking support beams may need to be re-positioned to fit the new pumps. Specific construction activities associated with the replacement are as follows:

- Remove 10 Phase 1 MWI Hydraulic Pumps (5 located on each side of channel)
- Remove 10 Phase 1 MWI Hydraulic Pump Power Units (5 located on each side of channel on existing engine platforms)
- Install 10 new 350 cfs FSI pumps. The new pumps will be similar to the Phase 3 pumps.
- Install 10 new electric drive power units.
- It is assumed the phase 1 pump platform decking and beam systems may need to be re-arranged to accommodate the new pumps.

- Install butterfly valves on the existing 4-9' diameter steel discharge pipes. The butterfly valves will provide a positive cut-off to prevent water from flowing from the lake surge into the canal in the event that a discharge pipe fails.

B. Engine Platform Enclosure. The engine platforms will be enclosed with a structure that protects the power units from hurricane wind blown debris, from daily weather and to improve the ability to perform maintenance and operation. The enclosure will also protect personnel from wind blown debris and rain during a hurricane event. The enclosures will require the following construction activity:

- Demolish the existing security/debris fencing
- Demolish the metal roofing and purlins and siding, incl all siding and roof purlins
- Assume three additional structural steel frames matching the existing frames are required.
- Assume purlins are installed that match the existing purlin size.
- Assume a 6 inch thick reinforced pre-cast concrete wall panels are placed around the perimeter of the generator units.
- Assume the roofing system is a standing seam metal roof is supported off a metal deck that is connected to the purlins.

C. Knife Gate Replacement. The existing gates will be demolished and new gates with rollers will be installed. The new gates will require new gate guides, and hoisting equipment. No demolition of the existing gate structure is required. The existing gate sill may need local demolition to allow the sill depression to be filled with concrete. The new gate hoisting equipment will be provided with an enclosure to protect against wind blown debris. Installation of new gate guides and new rolling gates will require a cofferdam system to dewater the area just upstream and downstream of the gate closure structure. The roller gate construction activities will include:

- Install a steel sheet pile cofferdam both upstream and downstream of the gate closure structure. The cofferdam will tie-into the abutment cells.
- Remove and dispose of the existing 5 knife gates.
- Attach new structural steel wide flange gate guides to the existing gate guides.
- Weld a sill plate in between the new wide flange guides at the concrete sill cap. Plate to be leveled as required to align with bottom of new gates.
- Place grout under the sill plate and in the existing sill depression.
- Cap the sill depression with a plate that is welded to the existing metal embedments.
- Install 5 new rolling gates.
- Install horizontal channels and plates to form hoisting equipment rack at the top of the new gate guides. The channels and plates shall be attached to the gate guides using bolted connections.
- Install hoisting equipment for each gate. The hoisting equipment shall be motor driven hydraulic gate operators and be attached to the hoisting equipment rack.
- Install metal housing around hoisting equipment to protect the equipment from wind blown debris.
- Make electrical connection between gate operation control box and each gate motor.

D. Removal of Hydraulic Fluid Piping. Demolish existing hydraulic piping. The hydraulic systems are being replaced with electrical direct drive pumps that are operated using diesel fuel. The electrical conduit to operate the pump motors will be placed on the existing hydraulic pipe supports. The existing piping shall be drained, flushed & cleaned prior to offsite removal.

E. Fuel Tank Replacement. Replace single wall fuel storage tanks with double wall storage tanks. The new tanks shall have a 20,000 gallon capacity. The maximum size of the tanks shall be 10.5 feet in diameter and 31 feet long. The existing single-wall tank shall be drained, flushed & cleaned prior to offsite removal.

2.5.4 Alternative 1 - London Avenue ICS Facility Modifications

The London Avenue Canal ICS alternative includes the following requirements based on the deficiency evaluation:

A. Pump and Power Unit Replacement**.** Replace Phase 1 Pumps and Power Units with a pump that is similar to the Phase 3 pumps, but has a motor at the pump platform and a generator at the engine platform. The existing pump platform and suction basin will remain. The pump platform decking support beams may need to be re-positioned to fit the new pumps. Specific construction activities associated with the replacement are as follows:

- Remove 12 Phase 1 MWI Hydraulic Pumps (5 located on each side of channel)
- Remove 12 Phase 1 MWI Hydraulic Pump Power Units (5 located on each side of channel on existing engine platforms)
- Install 12 new 350 cfs FSI pumps. The new pumps will be similar to the Phase 3 pumps.
- Install 12 new electric power units.
- It is assumed the phase 1 pump platforms decking and beam systems may need to be re-arranged to accommodate the new pumps.
- Install butterfly valves on the existing 8-9’ diameter steel discharge pipes. The butterfly valves will provide a positive cut-off to prevent water from flowing from the lake surge into the canal in the event that a discharge pipe fails.

B. Engine Platform Enclosure. The engine platforms will be enclosed with a structure that protects the power units from hurricane wind blown debris, from daily weather and to improve the ability to perform maintenance and operation. The enclosure will also protect personnel from wind blown debris and rain during a hurricane event. The enclosures will require the following construction activity:

- Demolish the existing security/debris fencing
- Demolish the metal roofing and purlins
- Assume three additional structural steel frames matching the existing frames are required.
- Assume purlins are installed that match the existing purlin size.
- Assume a 12 inch thick reinforced pre-cast concrete wall panels are placed around the perimeter of the generator units.

- Assume the roofing system is a standing seam metal roof is supported off a metal deck that is connected to the purlins.

C. Phase 3 Pump Platform Enclosure. Provide a building around the Phase 3 pump platform to protect the power units from hurricane wind blown debris, from daily weather and to improve the ability to perform maintenance and operation. This enclosure is estimated to be similar to the engine platform enclosures. Specific details of the phase 3 pump platforms were not provided.

D. Knife Gate Replacement. The existing gates will be demolished and new gates with rollers will be installed. The new gates will require new gate guides, and hoisting equipment. No demolition of the existing gate structure is required. The existing gate sill may need local demolition to allow the sill depression to be filled with concrete. The new gate hoisting equipment will be provided with an enclosure to protect against wind blown debris. Installation of new gate guides and new rolling gates will require a cofferdam system to dewater the area just upstream and downstream of the gate closure structure. The roller gate construction activities will include:

- Install a steel sheet pile cofferdam both upstream and downstream of the gate closure structure. The cofferdam will tie-into the abutment cells.
- Remove and dispose of the existing 13 knife gates.
- Attach new structural steel wide flange gate guides to the existing gate guides.
- Weld a sill plate in between the new wide flange guides at the concrete sill cap. Plate to be leveled as required to align with bottom of new gates.
- Place grout under the sill plate and in the existing sill depression.
- Cap the sill depression with a plate that is welded to the existing metal embedments.
- Install 13 new rolling gates.
- Install horizontal channels and plates to form hoisting equipment rack at the top of the new gate guides. The channels and plates shall be attached to the gate guides using bolted connections.
- Install hoisting equipment for each gate. The hoisting equipment shall be motor driven hydraulic gate operators and be attached to the hoisting equipment rack.
- Install metal housing around hoisting equipment to protect the equipment from wind blown debris.
- Make electrical connection between gate operation control box and each gate motor.

E. Removal of Hydraulic Fluid Piping**.** Demolish existing hydraulic piping. The hydraulic systems are being replaced with electrical direct drive pumps that are operated using diesel fuel. The electrical conduit to operate the pump motors will be placed on the existing hydraulic pipe supports. The existing piping shall be drained, flushed & cleaned prior to offsite removal.

- **F.** Fuel Tank Replacement. Replace single wall fuel storage tanks with double wall storage tanks. The new tanks shall have a 20,000 gallon capacity. The maximum size of

the tanks shall be 10.5 feet in diameter and 31 feet long. The existing single-wall tank shall be drained, flushed & cleaned prior to offsite removal.

2.5.5 Maintenance Facility

Each ICS facility needs a maintenance and storage building. Construction of a common heavy maintenance facility that includes storage space for parts, tools and equipment and maintenance areas (with overhead cranes) would significantly reduce the redundancy of constructing three separate buildings. The 25,000 square foot single story building will be a pre-engineered rigid frame building with a roof deck supporting a standing seam metal roof. The foundation system will include standard shallow footings with a slab on grade working floor level.

2.5.6 Fluid Storage Facility (On-site)

Each ICS facility needs a fluid storage facility. A 2,000 square foot waste oil storage, make up oil storage and maintenance building would be constructed at each ICS facility. This would allow for on-site operation and maintenance support. These buildings would be constructed using similar structural systems as the larger maintenance building.

2.5.7 Corrosion Modifications to ICS Facilities

Corrosion protection at each ICS facility is required to allow the structures to maintain a 50-year life. The corrosion protection recommendations are as follows:

- Atmospheric Zone - Steel structures exposed in the atmospheric zone should be protected against corrosion by application of a protective coating. ICS components that require coating include the: 1) engine platform substructures, 2) hydraulic piping and pipe supports, 3) pump platform substructures, 4) discharge piping supports, 5) discharge piping internal surfaces, 6) non-overflow substructures and 7) gate closure structures.

  Acceptable, alternative coating materials and methods of application are listed in Table 9.

Table 9 – Atmospheric Zone Coating Materials and Methods

Coating System	Number of Coats	DFT (mils)	Surface Preparation
Coal Tar Epoxy	2	16 - 20	Commercial Blast Cleaning (SP6)
Surface Tolerant Epoxy / Urethane	2	6 - 8	High Pressure Water Jetting (SP 12)
Epoxy Mastic (Aluminum Pigmented)	2	12-16	Power Tool Clean (SP 3)

- **Splash Zone** - Steel structures exposed in the splash zone should be protected against corrosion by application of a protective coating. ICS components that require coating

include the: 1) hydraulic piping supports, 2) pump platform substructures, 3) discharge piping supports, 4) non-overflow substructures and 5) gate closure structures.

Acceptable, alternative coating materials and methods of application are listed in Table 10.

Table 10 - Splash Zone Coating Materials and Methods

Coating System	Number of Coats	DFT (mils)	Surface Preparation
Coal Tar Epoxy	2	16 - 20	Commercial Blast Cleaning (SP6)
Surface Tolerant Epoxy / Surface Tolerant Epoxy	2	10 -12	High Pressure Water Jetting (SP 12)
Epoxy Mastic (Aluminum Pigmented)	2	12-16	Power Tool Clean (SP 3)

- **Tidal Zone** - Steel structures exposed in the tidal zone should be protected against corrosion by application of a protective coating and impressed current cathodic protection. ICS components that require coating and cathodic protection include the: 1) hydraulic piping supports, 2) pump platform substructures, 3) discharge piping supports, 4) non-overflow substructures and 5) gate closure structures.

  Acceptable, alternative coating materials and methods of application are listed in Table 11.

  Protective coatings should extend to elevation 3 feet below MLW. To accomplish this, dewatering of the structure on the protected side and flood site will be required.

Table 11 - Tidal Zone Coating Materials and Methods

Coating System	Number of Coats	DFT (mils)	Surface Preparation
Coal Tar Epoxy	2	16 - 20	Near White Metal Blast Cleaning (SP 10)
Surface Tolerant Epoxy / Surface Tolerant Epoxy	2	10 -12	High Pressure Water Jetting (SP 12)
Elastomeric Polyurethane	1	30	Near White Metal Blast Cleaning (SP 10)

- **Continuously Submerged Zone** - Steel structures exposed in the continuously submerged zone should be protected against corrosion by application of an impressed current cathodic protection system. ICS components that require cathodic protection include the: 1) hydraulic piping supports, 2) pump platform substructures, 3) discharge piping supports, 4) non-overflow substructures and 5) gate closure structures.
- **Soil Zone** - Steel structures exposed in the soil zone should be protected against corrosion by application of an impressed current cathodic protection system. ICS

components that require cathodic protection include the: 1) engine platform substructures, 2) hydraulic piping supports, 3) pump platform substructures, 4) discharge piping supports, 5) non-overflow sub structures and 6) gate closure structures.

2.5.8 Electrical Improvements

Lightning protection is recommended for the gate structure, equipment platforms & enclosures, any other proposed structure, or existing structures not otherwise grounded.

Though metal handrails, platforms and supporting members form a contiguous assembly through both welded and bolted connections, the integrity of the later can vary over time due to corrosion. To aid in the protection of facility personnel, it is recommended that additional earthen ground connections be provided through exothermic connections. Additionally, the equipment platform enclose structure and the fabric of the equipment platform security fence should be grounded.

Based on facility visits, the observation and recommendation is to include additional fastening of exterior walkway lighting fixture supports to both horizontal members of the walkway handrails.

Based on the recommendation that motor driven pumps replace the existing hydraulic driven pumps, diesel engine driven generators with associated motor circuit protection and starter will be provided to support each pump motor. Due to the size of the motors, medium voltage (MV) generation, circuit protection, motor starting equipment and circuit cabling has been considered within the costing alternatives.

2.5.9 Communications

It is considered that incremental SCADA (Supervisory Control And Data Acquisition) interface will be required, but the magnitude may be minimal based on the systems present interface with the diesel driven hydraulic assembly as compared to a diesel driven generator with respective circuit protection and starting equipment.

Incremental SCADA modifications to interface with ICS enhancements. Provide for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system. Includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system. Includes SCADA upgrades per pump and to remote motors. Assume existing SCADA system is adequate for all Phase 3 monitoring.

It is considered that incremental SCADA interface will be required, but the magnitude may be minimal based on the systems present interface with the diesel driven hydraulic assembly as compared to a diesel driven generator with respective circuit protection and starting equipment.

3.0 ICS HYDRAULIC CAPACITY

The process of modifying the ICS facilities to allow them to achieve a 50 year design life included an evaluation of the existing pump capacity. The ICS facility gate system will be closed for certain lake surge situations. When the gates close, the pump systems will be used to transfer canal water into Lake Pontchartrain.

The 17th Street ICS facility currently has a total of 43 pumps (phase 1, 2 and 3 combined) while the Orleans Avenue ICS facility has 10 total pumps (phase 1) and the London Avenue ICS facility has 20 pumps (phase 1 and 3 combined). These pumps need to match the canal maximum flow capacity of 12500 cfs, 3390 cfs, 8980 cfs for the 17th Street, Orleans and London Canals respectively.

The pump capacity of the ICS facilities was determined based on review of model study reports produced in December 2006 and February 2007, and using pump curves acquired from the manufactures for the type of pumps at each facility.

Based on review of this information, the total ICS pump capacity does not achieve the canal flow capacity for normal lake conditions and surcharged lake conditions. Thus, additional pump capacity is required at each ICS facility.

3.1 Existing ICS Facility Pump Capacities

Performance curves for the three pumps were obtained from the pump manufactures. There are 32 pumps manufactured by MWI at the 17th Street ICS facility, 10 pumps manufactured by MWI at the Orleans ICS facility and 12 pumps manufactured by MWI at the London Avenue ICS facility. Additionally, there are 11 pumps manufactured by Fairbanks Morse at the 17th Street ICS facility and 8 pumps manufactured by Patterson at the London Avenue ICS facility.

A review of the performance curves indicate that the MWI pumps were rated for a maximum head of approximately 16.5 feet. The new Patterson Pumps and Fairbanks Morse Pumps are rated for over 20 feet of head. The exact head ratings are not clear from the data obtained. A note on the MWI curve indicates that the engine furnished is rated 720 horsepower. A review of the MWI performance curves demonstrates that at similar heads that the MWI pumps will overload the 720 horsepower engines.

At 20 feet of head, the MWI units have a brake horsepower requirement of about 720. Allowing for the efficiency of the hydraulic pumps, hydraulic motor, and losses in the hydraulic pipes and hoses, the brake horsepower requirement of the units should be well in excess of the nameplate rating of the engine.

Therefore it is doubtful that the MWI pumps can operate at lake levels resulting from a lake surge. The core requirement for the permanent pumping stations for the enhanced ICS facilities is that they should be able to pump the full canal capacity during a lake surge.

Based on the performance curves obtained from the manufactures, the estimated flow rate of the ICS facilities is indicated in Tables 12, 13, and 14. The pump capacity of each station as currently configured is not capable of matching the required capacity of the canal when the gates are closed. These values are rough estimates based on acquired information and are not based on any hydraulic calculations. Additionally, the supplied performance curves are not specific to the installed pumps. Performance curves for the supplied pumps were not available.

Table 12 – 17th Street ICS Facility Existing Pump Capacity

Parameter			17th Street ICS Facility		
			MWI Pumps	Fairbanks Morse Pumps	Patterson Pumps
Capacity with No Storm Surge	No. of Pumps		32	11	0
	Capacity (each cfs)		190	350	0
	Pump Type Total Capacity (cfs)		6,080	3,850	0
	ICS Total Capacity (cfs)		9,930		
	Total Canal Capacity (cfs)		12,500		
Capacity with Storm Surge	No. of Pumps		32	11	0
	Capacity (each cfs)		0	350	0
	Pump Type Total Capacity (cfs)		0	3,850	0
	ICS Total Capacity (cfs)		3,850		
	Total Canal Capacity (cfs)		12,500		

Table 13 – Orleans Avenue ICS Facility Existing Pump Capacity

Parameter			Orleans Avenue ICS Facility		
			MWI Pumps	Fairbanks Morse Pumps	Patterson Pumps
Capacity with No Storm Surge	No. of Pumps		10	0	0
	Capacity (each cfs)		190	0	0
	Pump Type Total Capacity (cfs)		1,900	0	0
	ICS Total Capacity (cfs)		1,900		
	Total Canal Capacity (cfs)		3,390		
Capacity with Storm Surge	No. of Pumps		10	0	0
	Capacity (each cfs)		0	0	0
	Pump Type Total Capacity (cfs)		0	0	0
	ICS Total Capacity (cfs)		0		
	Total Canal Capacity (cfs)		3,390		

Table 14 – London Avenue ICS Facility Existing Pump Capacity

Parameter			London Avenue ICS Facility		
			MWI Pumps	Fairbanks Morse Pumps	Patterson Pumps
Capacity with No Storm Surge	No. of Pumps		12	0	8
	Capacity (each cfs)		190	0	350
	Pump Type Total Capacity (cfs)		2,280	0	2,800
	ICS Total Capacity (cfs)		5,080		
	Total Canal Capacity (cfs)		8,980		
Capacity with Storm Surge	No. of Pumps		12	0	8
	Capacity (each cfs)		0	0	350
	Pump Type Total Capacity (cfs)		0	0	0
	ICS Total Capacity (cfs)		2,800		
	Total Canal Capacity (cfs)		8,980		

3.2 Modified ICS Facility Pump Capacities

The modified ICS facilities include replacement of the MWI pump systems with new 350 cfs form suction intake pumps. Using the manufacturer acquired pump rating curves, these pumps appear to have the capacity to pump against the potential lake surge near the rated capacity. Review of the pump capacities of the modified plants show that additional pumps need to be added to the 17th Street, Orleans Avenue and London Avenue ICS facilities to match the canal flow capacity. The pumps will require additional pump platforms, power units, oil supply lines, controls, and other support items. The additional pumps required to match the canal capacity are developed into pump capacity alternatives.

The pump capacity of each modified ICS facility along with the additional pumps required to meet or exceed the canal flow capacity are documented in Tables 15, 16, and 17.

Table 15 – Modified 17th Street ICS Facility Pump Capacity With Additional Pump Capacity

Parameter			Modified 17th Street ICS Facility		Additional FSI Pumps to Meet or Exceed Canal Capacity
			Fairbanks Morse Pumps	Patterson Pumps	
Capacity with No Storm Surge	No. of Pumps		18	11	**8**
	Capacity (each cfs)		350	350	**350**
	Pump Type Total Capacity (cfs)		6,300	3,850	**2,800**
	ICS Total Capacity (cfs)		12,950		
	Total Canal Capacity (cfs)		12,500		
Capacity with Storm Surge	No. of Pumps		18	11	**8**
	Capacity (each cfs)		350	350	**350**
	Pump Type Total Capacity (cfs)		6,300	3,850	**2,800**
	ICS Total Capacity (cfs)		12,950		
	Total Canal Capacity (cfs)		12,500		

Table 16 – Modified Orleans Avenue ICS Facility Pump Capacity With Additional Pump Capacity

Parameter			Modified Orleans Avenue ICS Facility		Additional FSI Pumps to Meet or Exceed Canal Capacity
			Fairbanks Morse Pumps	Patterson Pumps	
Capacity with No Storm Surge	No. of Pumps		0	10	**2**
	Capacity (each cfs)		0	350	**350**
	Pump Type Total Capacity (cfs)		0	3,500	**700**
	ICS Total Capacity (cfs)		4,200		
	Total Canal Capacity (cfs)		3,850		
Capacity with Storm Surge	No. of Pumps		0	10	**2**
	Capacity (each cfs)		0	350	**350**
	Pump Type Total Capacity (cfs)		0	3,500	**700**
	ICS Total Capacity (cfs)		4,200		
	Total Canal Capacity (cfs)		3,850		

Table 17 – Modified London Avenue ICS Facility Pump Capacity With Additional Pump Capacity

Parameter			Modified London Avenue ICS Facility		Additional FSI Pumps to Meet or Exceed Canal Capacity
			Fairbanks Morse Pumps	Patterson Pumps	
Capacity with No Storm Surge	No. of Pumps		0	20	**6**
	Capacity (each cfs)		0	350	**350**
	Pump Type Total Capacity (cfs)		0	7,000	**2,100**
	ICS Total Capacity (cfs)		9,100		
	Total Canal Capacity (cfs)		8,980		
Capacity with Storm Surge	No. of Pumps		0	20	**6**
	Capacity (each cfs)		0	350	**350**
	Pump Type Total Capacity (cfs)		0	7,000	**2,100**
	ICS Total Capacity (cfs)		9,100		
	Total Canal Capacity (cfs)		8,980		

3.3 ICS Facility Intake and Discharge Hydraulics

Evaluation of the ICS facility intake and discharge hydraulics is based on comparison to established standards, review of the model studies and information gathered during site inspections.

The standards set up by the Hydraulic Institute provides recommendations for pump intake layout and size. This information is often used to perform initial pump design. As long as significant deviations from the standards are not made, then the designer may assume that the pumps will move water near their rated capacity.

The Hydraulic Institute recommendations provides guidance that accounts for many aspects of pump performance. The guidance accounts for the following:

- Isolate the pumps to prevent pump interference. The inflow to one pump should never have to flow under or past the inlet to a second pump as this causes increased velocity under the second pump.
- Confine the flow to the pump intake by providing a narrow baffled channel to the pump. The channel width should not exceed twice the diameter of the inlet to the pump.
- Provide fillets at the edges of the channel and under the pump to further confine the flow and to prevent underwater vortices from forming.
- Provide a straight length of approach to the pump that is five times the diameter of the inlet to the pump.

- Provide screens at the entrance to the channel where the main flow is at right angles to the channel to reduce the rotation at the entrance of the channel due to the right angle change of direction in the channel.

- Minimize the ratio of cross-flow velocity. The velocity of the main flow should not be greater than 1.5 times the velocity in the pump channel. This helps reduce the tendency to develop rotation in the pump inlet.

The MWI pumps are propeller pumps. Propeller pumps position the pump propeller very close to the pump inlet. Thus, the propeller is sensitive to the inlet flow conditions to the pump. The Hydraulic Institute has set up standards designed to provide uniform flow to the pump and minimize the amount of swirl or rotation of the water under the inlet. Unsteady flow into the impeller can result in un-balanced loading of the propeller with increased vibration, cavitation, reduced flow and shortened pump life. Swirl or rotation under the impeller changes the angle of attach of the propeller which can result in reduced flow and reduced horsepower or increased flow and increased horsepower depending on whether the swirl is in the same direction or opposite direction of the propeller.

If the pumping station does not meet the Hydraulic Institute recommendations for pump intake layout and size, the Hydraulic Institute recommends a physical model test of the pump station be performed. The model test should evaluate the affects the proposed intake and discharge geometry may have on pump performance. Features such as baffling, fillets, flow vanes, etc should be modeled to evaluate their affects on performance.

Physical model tests were performed on the 17th Street and London Avenue Pumping Stations. The reports indicated that the modeling was preliminary and the model tests did not completely model the pumping stations as they are actually configured. Sometime after the model testing was initiated, the Phase 3 pumps were provided with Formed Suction Inlets (FSI). Some effort was made to test the effect of the FSI. However, the impact of the FSI units was not modeled beyond the preliminary evaluation.

The report indicated that the performance of the pumping station intakes was un-acceptable. There were strong vortices shown for many of the pump locations. Almost all pump locations had un-acceptable pre-swirl or pre-rotation of the water in the pumps. Both of these conditions will lead to operational problems such as reduced capacity, excessive power draw, excessive vibration, and pre-mature failure of the pumping units.

The report indicated potential fixes such as vertical baffle plates around the pump to straighten the flow and prevent the pre-rotation and a horizontal grating suspended from the platform to break up surface vortices. Preliminary evaluation of the impacts of these fixes was performed; however, a complete evaluation of these fixes was not modeled.

Replacement of the existing phase 1 and phase 2 pumps with form suction intake pumps is recommended. Future physical model testing at the time of the Phase 1 and 2 pump replacement should explore the impact that baffling and screening may have on the performance of the FSI units.

The following observations were made regarding the pumping station intake hydraulics:

- The pumping units installed during the three phases of pump installation had increasing levels of compliance.

- The first set of pumps just hang into the canal with limited baffling or channelization. The 17th Street Pumps were provided with baffles behind the pumps and end plates at the ends of the pumping station with no internal baffles. The Orleans and London Avenue ICS facilities have the pumps hanging free into the canal from a platform with no baffles. Based on review of the Hydraulic Institute recommendations and the model studies, this pump configuration will reduce the performance of the pumps. This pump configuration will result in high vibration, low capacity, shortened bearing life, and high pump wear. This inlet layout is unacceptable for the existing pumps. Replacement of the existing pumps with FSI pumps appears to be acceptable. Though a model study of this configuration with the FSI pumps should be performed.
- The 17th Street ICS phase 2 pumps are installed in baffled channels. No drawings were available so the dimensions were not checked. There intake to the pumps was not screened. The cross flow velocities may impact the pump performance without the screens. Again, replacement of the existing pumps with FSI pumps appears to be acceptable. Though a model study of this configuration with the FSI pumps should be performed.
- The phase 3 pumps are direct drive pumps with COE Formed Suction Inlet. These inlets provide a special channelization to the pumps, which is intended to address the inlet hydraulic issues. The FSI do not provide protection against high cross flow velocities or the lack of screens. Model testing of the FSI units is recommended.
- The temporary pumps located on the gate closure structure at 17th Street will increase the velocity of flow in the canal in front of the other pumps. This will increase the cross flow velocity, which will aggravate the unsteady flow situation.

3.4 Pump Capacity Improvements

The proposed ICS facility modification alternatives presented in Section 3 include the recommendation for replacement of the phase 1 and phase 2 pumps with form suction intake pumps. However, the new FSI pumps along with the existing phase 3 pumps do not allow the ICS facilities to match the maximum flow capacity of the canals. Thus, the following Capacity Improvements are recommended for each ICS facility.

A. 17th Street ICS facility Capacity Improvement. Add an additional 8 FSI pumps with diesel driven power units. The construction activities associated with this improvement includes:

- Add 8 additional 350 cfs FSI pump units. Assume all 8 pumps are added along the west bank.
- Add 8 additional diesel driven electric power units.
- Provide a structural steel pump platform. The platform will be similar to the phase 3 pump platforms. The pumps, and power units will be supported on the platform.
- Provide an enclosure around the power units.
- Provide diesel fuel pipe supply lines to the power units.
- Provide SCADA and control connection to the power units.

- Install two 9’ diameter steel discharge pipes. The discharge pipes will be supported on pipe supports similar to the phase 1 pipe supports. The pipes will pass through the cellular cofferdam non-overflow structure.
- A rip-rap scour protection pad will be provided at the discharge pipe outlets. 48” riprap will be placed around the outlets in a 10’ radial pattern.

B. Orleans Avenue ICS Facility Capacity Improvement. Add an additional 2 FSI pumps with diesel driven power units. The construction activities associated with this improvement includes:

- Add 2 additional 350 cfs FSI pump units. Assume all 2 pumps are added along the west bank.
- Add 2 additional diesel driven electric power units.
- Provide a structural steel pump platform. The platform will be similar to the phase 3 pump platforms. The pumps, and power units will be supported on the platform.
- Provide an enclosure around the power units.
- Provide diesel fuel pipe supply lines to the power units.
- Provide SCADA and control connection to the power units.
- Install one 9’ diameter steel discharge pipe. The discharge pipe will be supported on pipe supports similar to the phase 1 pipe supports. The pipe will pass through the cellular cofferdam non-overflow structure.
- A rip-rap scour protection pad will be provided at the discharge pipe outlet. 48” riprap will be placed around the outlet in a 10’ radial pattern.

C. London Avenue ICS facility Capacity Improvement. Add an additional 6 FSI pumps with diesel driven power units. The construction activities associated with this improvement includes:

- Add 6 additional 350 cfs FSI pump units. Assume all 6 pumps are added along the west bank.
- Add 6 additional diesel driven electric power units.
- Provide a structural steel pump platform. The platform will be similar to the phase 3 pump platforms. The pumps, and power units will be supported on the platform.
- Provide an enclosure around the power units.
- Provide diesel fuel pipe supply lines to the power units.
- Provide SCADA and control connection to the power units.
- Install two 9’ diameter steel discharge pipes. The discharge pipes will be supported on pipe supports similar to the phase 1 pipe supports. The pipes will pass through the cellular cofferdam non-overflow structure.
- A rip-rap scour protection pad will be provided at the discharge pipe outlets. 48” riprap will be placed around the outlets in a 10’ radial pattern.

4.0 OPERATION AND MAINTEANCE COSTS FOR THE ICS FACILITIES

The scope of work is to determine operations and maintenance costs of the modified ICS, life cycle costs (LCC) over their design life of 50 years, and the capital costs of the modifications required to allow the Interim Closure Structures to function at full required capacity.

The LCC will be added to the initial capital costs for modifying and improving the ICS facilities and thus allow for comparison with the Permanent Pump Station Options previously presented. Therefore, the LCC will be generated using the same basis as the Permanent Pump Station Options. The fundamental O&M consideration in the previous LCC used a factor provided by the New Orleans Sewerage and Water Board (SWB) of $500,000/1000 cfs as a labor and materials historical O&M factor. This factor remains valid and serves as common point for both the pump stations O&M in the Conceptual Design Report for Permanent Flood Gates and Pump Stations dated July 31, 2006 and for the ICS facilities.

4.1 Operation and Maintenance Staff Requirements

The enhanced ICS facilities will require a full time operation and maintenance staff to perform daily and yearly O&M work. Additional support will be required to accomplish major maintenance activities due to the facility condition and configuration. This additional support operations and maintenance staff is above and beyond that required for a typical permanent facility. The added staff required is indicated below:

Operations Staff:

- Operation and Maintenance Chief (over all three facilities)
- Three Operators (one per facility)

Maintenance Staff:

- Operation and Maintenance Chief (see above)
- Electrical Foreman (over all three facilities)
- Mechanical Foreman (over all three facilities)
- Three Electrical Trade Laborers
- Three Mechanical Trade Laborers

4.2 Specific Operation and Maintenance Requirements

Specific operation and maintenance requirements typical for facilities of this type would include the following:

- The pumps have grease lubricators. Typically these require daily inspection while operating and charging with grease every five days of operation. Inspection and topping off engine fluid levels during the lubrication process is required. Operation and charging with grease occurs quarterly during every year.
- Engines will require an oil change and new oil filters once every year.

- Flush engine radiators after every other oil change (two year).
- Pumps will be pulled for inspection every ten years.
- Check and adjust propeller clearance every five years.
- The form suction intake pumps are susceptible to biological growth. Pumps should be run every two to four weeks to dislodge the growth.
- The engines will require a top end overhaul every 20,000 hours of operation. This will occur once (at the 20th year) during the 50 year design life of the facility.
- The engines will require a full overhaul every 40,000 hours of operation. Assume that this will occur once (at the 40th year) during the 50 year design life of the facility. Truck mounted cranes will remove the engines and place them on flatbed trucks.
- The motors (gear box) will require an oil change every five years. Work will be accomplished on the pump platforms.
- The motors (electric) will require cleaning and inspection every 10 years.
- Pumps (Patterson and Fairbanks) should last the full 50 year design life of the facility. Pumps are pulled for a re-build once (at the 25th year) during the design life of the facility.
- Replace accessory equipment, oil pump, fuel pumps, battery chargers, jacket water heaters, flexible connectors, radiators and related parts every 10 years.
- Inspect and clean engines every ten years.
- Clean and flush fuel oil storage tanks and piping annually.
- Operate the rolling gates annually. The operation of the gates will include an evaluation of the gate hoisting system as well.
- Operate the discharge pipe butterfly valves annually.
- Daily inspection and lubrication of rotating equipment during operation.

4.2.1 Pump & Engine Maintenance Rationale

Historically these pump installations have operated in the range of 150 to 320 hours per year. Following discussions with pump and engine manufacturer representatives it was determined due to this limited run time complete pump and engine overhauls would be estimated to occur once in the life cycle, roughly at the 25th year. A Morrison Pump manufacturer representative recommended to budget 20 percent of the new pump cost for a complete rebuild. Engine O&M costs were provided for routine consumable materials, as well as one complete overhaul, by a local Caterpillar representative, Louisiana Machinery Inc.

4.3 Operation and Maintenance Costs

To identify and quantify the O&M issues, Table 18 provides categorization of O&M functions into groups that indicate the relative degree of O&M effort required for the enhanced ICSs as compared to the permanent pump stations in the Conceptual Design Report for Permanent Flood Gates and Pump Stations dated July 31, 2006. A three tier rating system is employed against these categories to facilitate this comparison. New pump stations similar to the ones described in

the Conceptual Design Report are considered the Baseline (B) and form the benchmark for determining the relative O&M required as described below:

B- Indicates that modified ICS facility will require substantially less O&M funds for the O&M category than baseline

B Indicates that modified ICS facility will require similar O&M funds for the O&M category to baseline

B+ Indicates that modified ICS facility will require substantially less O&M funds for the O&M category than baseline

4.3.1 Operation and Maintenance Cost Rationale.

Calculations utilized to prepare the LCC analysis are being prepared in accordance with Department of the Army Engineering Technical Letter ETL 1110-2-361. This letter, titled Engineering and Design Life Cycle Design and Performance of Structures for Local Flood Protection, presents the following formula for determining life cycle costs; $PV = C (IIF)^n$. Where PV is the present value, C is the current cost of the work, IIF is the inflation interest factor, and n is the number of years. This method seems especially appropriate for life cycle evaluations of infrastructure for flood protection structures which have a long life expectancy and a need for continuous high reliability. IIF is a single parameter which combines the effects of inflation and discounting over long periods of time. This factor of 0.98 represents historic discount rates 2 percent higher than inflation rates.

In addition, the following criteria were used to develop the various costs:

- Electrical energy costs were calculated at $.03024 per kWh
- Functional life of the ICS 50 years.
- Costs of labor are adjusted to reflect "area cost factor" based on Davis-Bacon wage rates as applied to the Jefferson Parrish, Louisiana. Labor costs include base rates and fringes.

Table 18 – O&M Comparison - ICS Facilities & Permanent Pump Stations

O&M Category	Rating	Notes
Labor - Operations	B+	See description in section below for rating rationale
Labor - Maintenance	B+	See description in section below for rating rationale
Structural – includes non-overflow section, platforms, gates and buildings	B	The modifications included in the capital cost increase longevity of modified ICS to 50 years without significant O&M.
Canals/Floodwalls including transitions	B	The corrosion protection modifications included in the capital cost increase longevity of modified ICS to 50 years.
Mechanical including HVAC, piping, and fuel farm	B	The modifications included in the capital cost increase longevity of modified ICS to 50 years without significant O&M.
Electrical including generators, distribution, and communications	B	The modifications included in the capital cost increase longevity of modified ICS to 50 years without significant O&M.
Pumping including pumps, drives, and ancillary equipment	B+	See description in section below for rating rationale
Corrosion Protection including all metallic surfaces on site	B+	See description in section below for rating rationale

4.3.2 Additional Operation and Maintenance Labor Costs.

The staffing requirements are included in the O&M cost analysis. Periodic metal surface preparation, painting, and coating is anticipated to be subcontracted. Thus, additional maintenance staff for these activities has not been considered.

4.3.3 Additional Pumping Unit Costs.

Modified ICS facilities will require additional pumps, pump platforms, power units, oil supply lines, controls, and other support items. These costs are reflected in the cost analysis. In addition to the material costs of the items above, additional energy costs, losses in efficiencies, costs of consumables, and inventories were considered in the lifecycle calculations.

4.3.4 Corrosion Protection Costs.

Steel components of the ICS structures, subject to corrosion, are required to be protected from corrosion to reduce repair and/or replacement costs and maximize life cycle. Various solutions to mitigate corrosion have been estimated and included in the lifetime cycle cost estimate. Mitigation solutions costs include: coal tar epoxy, surface tolerant epoxies, epoxy mastics,

polyurethane coating materials and impressed current cathodic protection systems. In addition to the initial capital costs, periodic inspections, re-applications, energy costs and lifecycle replacements of sacrificial anodes were considered. This periodic metal surface preparation, painting, and coating activities are anticipated to be subcontracted. Thus, additional maintenance staff for these activities has not been considered.

5. COST ESTIMATE

The basis of cost estimate is intended to reflect level of concept development for the designated enhancements of Interim Control Structures (ICS) located in the 17th Street, Orleans Avenue and London Avenue Canals near the confluence with Lake Pontchartrain. These enhancements are applied to extend the present 5-yr life of the ICS to a 50-yr life. Table 19 provides the summary estimated capitol costs for each ICS facility. Table 20 provides the summary of the estimated life cycle costs for each ICS facility. Refer to Appendix E for the cost evaluation documentation.

Application of design and construction contingencies within the evaluation addresses the issues of uncertainties relating to the current level of understanding within this reconnaissance level study. The breakdown description of task items describes the various significant components to which costs are applied.

Quantities associated with material reflect the level of conceptual development defined in this report. Cost of materials is based on application of typical and usual materials applied to an RCC dam project as described in this Study. Costs of various tasks reflect the level of magnitude of concept development. The cost evaluation is developed basis on the level of understanding and uncertainty as described in the Study, and is within the parameters of inclusions, limitations and exclusions as defined within the report.

The cost evaluation develops separate construction costs for ICS enhancements in the 17th Street, Orleans Avenue and London Avenue Canals. Additionally, estimated costs are provided for a common *Maintenance Facility* intended to support maintenance, parts, and records storage. The estimate reflects costs for *Capacity Improvements* associated with report recommendations to provide additional new pumps, associated platforms, and appurtenances to increase pumping capacity at each canal. *Capacity Improvements* construction costs are provided separate from the primary ICS enhancement construction costs. These summary costs are considered of a rough-order-of–magnitude in nature, and are not intended to be interpreted as definitive construction costs, nor are recommended to be utilized for budgetary purposes.

Table 19 – Cost Estimate for Enhanced ICS Facilities

Facility	Permanent Enhancements of ICS			
	ICS Enhancement Costs	Maint. Facility Costs	Capacity improvement Costs	TOTALS
A. 17th STREET CANAL	$ 125,039,826	X	$ 56,188,253	**$ 181,228,079**
B. ORLEANS AVE. CANAL	$ 68,487,729	X	$ 15,015,699	**$ 83,503,428**
C. LONDON AVE. CANAL	$ 82,598,997	X	$ 42,903,197	**$ 125,502,194**
D. MAINTENANCE FACILITY	X	$ 41,556,365	X	**$ 41,556,365**
TOTALS =	**$276,126,552**	**$ 41,556,365**	**$ 114,107,149**	**$ 431,790,066**

Table 20 – Life Cycle Cost for Enhanced ICS Facilities

Facility	Life Cycle Costs for Permanent Enhancements of ICS				
	Initial Capitol Costs ($)	50 Year LCC Operating	50 Year LCC Maintenance	Historic O&M Costs from S&WB	Total Life Cycle Costs
A. 17th STREET CANAL	$ 181,228,079	$ 8,765,499	$ 14,180,752	$ 6,475,000	$ 231,150,470
B. ORLEANS AVE. CANAL	$ 83,503,428	$ 7,747,030	$ 10,190,011	$ 4,550,000	$ 162,395,443
C. LONDON AVE. CANAL	$ 125,502,194	$ 6,450,798	$ 5,354,002	$ 2,100,000	$ 104,057,245
TOTALS =	$ 431,790,066	$ 22,963,327	$ 29,724,765	$ 13,125,000	$ 497,603,158

Appendix A

Gate Closure Monoliths

Each closure structure monolith consists of upstream and downstream soil improvements, erosion protection, abutments, soil improvements, deep soil foundations, steel framing and gates. The specific details for each gate closure monolith are discussed in this appendix.

17th Street Gate Closure Monolith includes:

The 17th Street Gate Closure Monolith can be defined by the following features:

- Abutments
- Upstream and Downstream Erosion Protection
- Closure Monolith Substructure
- Closure Monolith Superstructure
- Bulkheads

Figure 1 shows the overall gate monolith site plan. The existing system appears to be well detailed to prevent erosion damage caused by scouring or head cutting in the canal. The structures are well connected and the foundation systems are robust. The foundation depth appears to be acceptable for these types of structures in the New Orleans area. The major features of the gate closure monolith are indicated.

The left and right abutments of the gate closure structures consist of PZ-35 sheet piles with a top elevation of +16.0 and a tip elev. Of -64.0 feet. The piles are arranged in a rectangular form that measures 27'-5 5/8" by 55'-2 ¾" and 28'-9 ¾" by 55'-2 ¾". Two 9' diameter discharge pipes pass through the abutments at elevation +3.000. The pipes are supported on a 4' thick reinforced concrete slab that rests on 28-30" diameter steel pipe piles. The pipe piles have a tip elevation of -122.0'. The cofferdam is filled with granular fill from existing grade (varies from -5 to +0) and capped with a 1' thick reinforced concrete cap. Figure 2 shows the abutment features.

The left and right abutments of the gate closure structures consist of PZ-35 sheet piles with a top elevation of +16.0 and a tip elevation of -64.0 feet. The piles are arranged in a rectangular form that measures 27'-5 5/8" by 55'-2 ¾" and 28'-9 ¾" by 55'-2 ¾". Two 9' diameter discharge pipes pass through the abutments at elevation +3.000. The pipes are supported on a 4' thick reinforced concrete slab that rests on 28-30" diameter steel pipe piles. The pipe piles have a tip elevation of -122.0'. The cofferdam is filled with granular fill from existing grade (varies from -5 to +0) and capped with a 1' thick reinforced concrete cap.

There is a 200 foot riprap pad upstream and downstream of the gate closure monolith. The soil below the 3' thick riprap pad was improved using soil mixing techniques down to elevation -70.0'. The soil mixing was to achieve 1000 psf cohesion at 28 days. The soil mixing pattern on the upstream or canal side of the gate closure monolith forms a "U" shape that follows the existing canal I-walls that form the canal banks and the gate closure monolith with the open end of the "U" towards the canal. The legs and base of

the “U” are 50 feet wide and the legs of the “U” extend to the downstream end of the riprap. Downstream or on the Lake Side of the gate closure monolith the soil mixing pattern forms an “L” shape that is ~ 50’ wide against the closure monolith and 75’ wide along the east canal bank. The legs of the “L” are located along the gate closure monolith and the east bank line along the existing I-wall that forms the canal banks. The soil mixing along the canal I-wall extends downstream to a pipe outfall structure which is short of the end of the riprap pad.

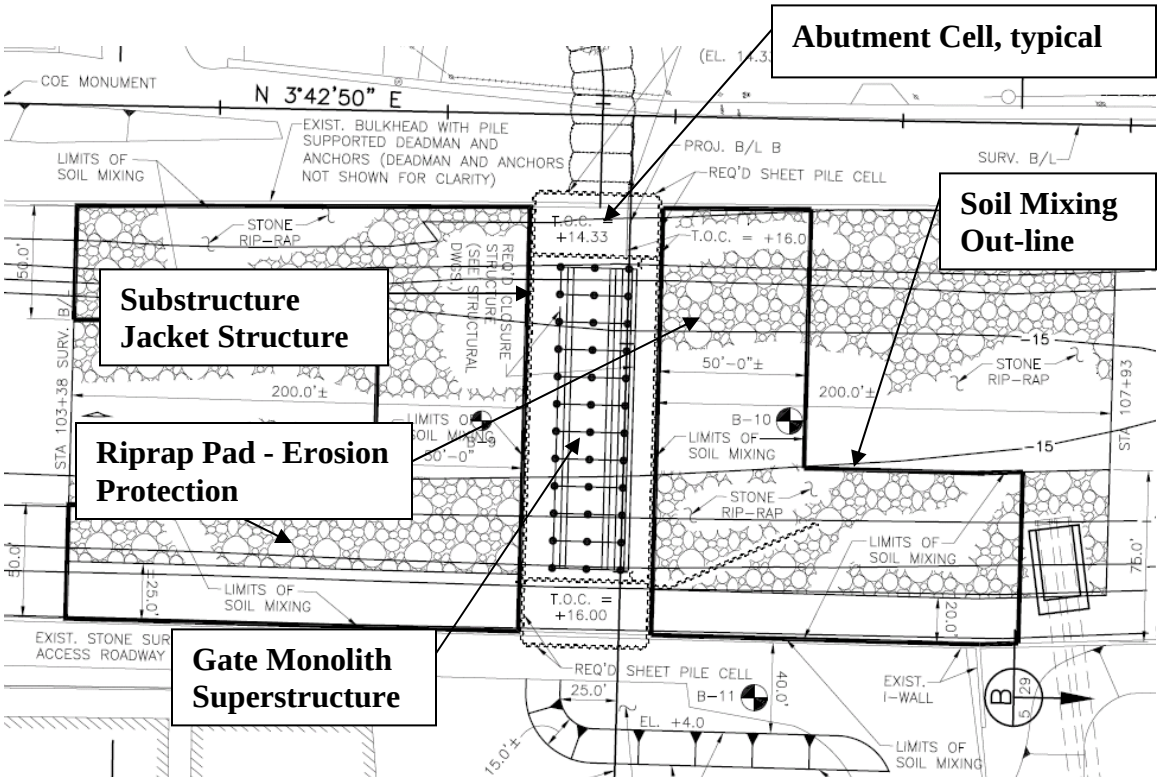

Figure 1 - 17th Street ICS Phase 1 Gate Closure Monolith Site Plan

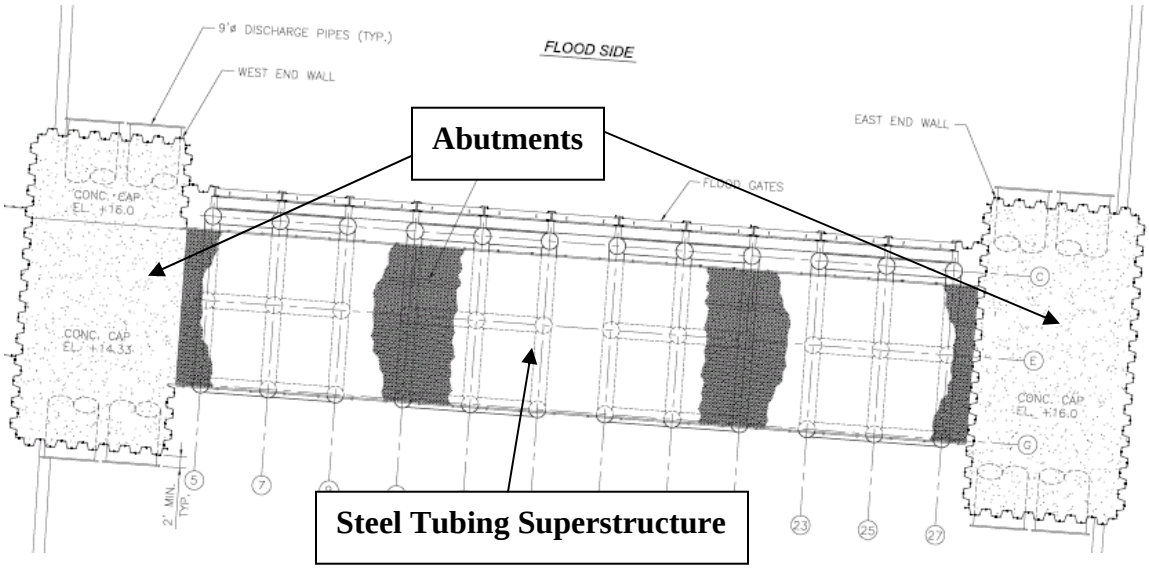

Figure 2 - 17th Street ICS Phase 1 Gate Closure Monolith Plan

The gate closure monolith substructure includes a jacket structure that is comprised of sheet pile (PZ-36 sheets) with a top elevation of -10.0' and a tip elevation of -64.0'. Figure 3 shows the jacket structure and interior pipe piles supporting a concrete slab and the superstructure. The jacket structure sheet piles extend across the canal in line with the upstream and downstream face of the abutments. The interior of the jacket structure is filled with 161-30" diameter steel pipe piles with a top elevation of -14.0' and a tip elevation of -106.0'. The pipe piles support an 8' thick reinforced concrete cap that has a top elevation of -10.0'.

The gate closure monolith super structure is comprised of steel frames made from 30" diameter steel pipe piles that are welded together. Details of the superstructure are shown in Figure 4. The pipe pile frames support a 4" galvanized steel grating that forms the downstream decking for the gate closure monolith. The decking is located at elevation +14.33'. There are 11 bulkheads that can be lowered to separate the canal from Lake Pontchartrain. The support structure for the bulkheads consists of 30" diameter pipe piles that support the bulkhead guides and bulkheads. W21x101 steel beams are used as the guides. The bulkhead guides are embedded in the substructure concrete slab at elevation -10.0' and extend up to elevation +29.0 feet. The guides are tied back to the pipe pile frames with W24x68 lateral support beams.

The bulkhead leafs consist of structural steel plates and W15x49.5 steel shapes that are welded together to support a ½ inch skin plate. The skin plate is located on the upstream side of the bulkheads. The bulkheads do not have wheels and can be lowered through static water.

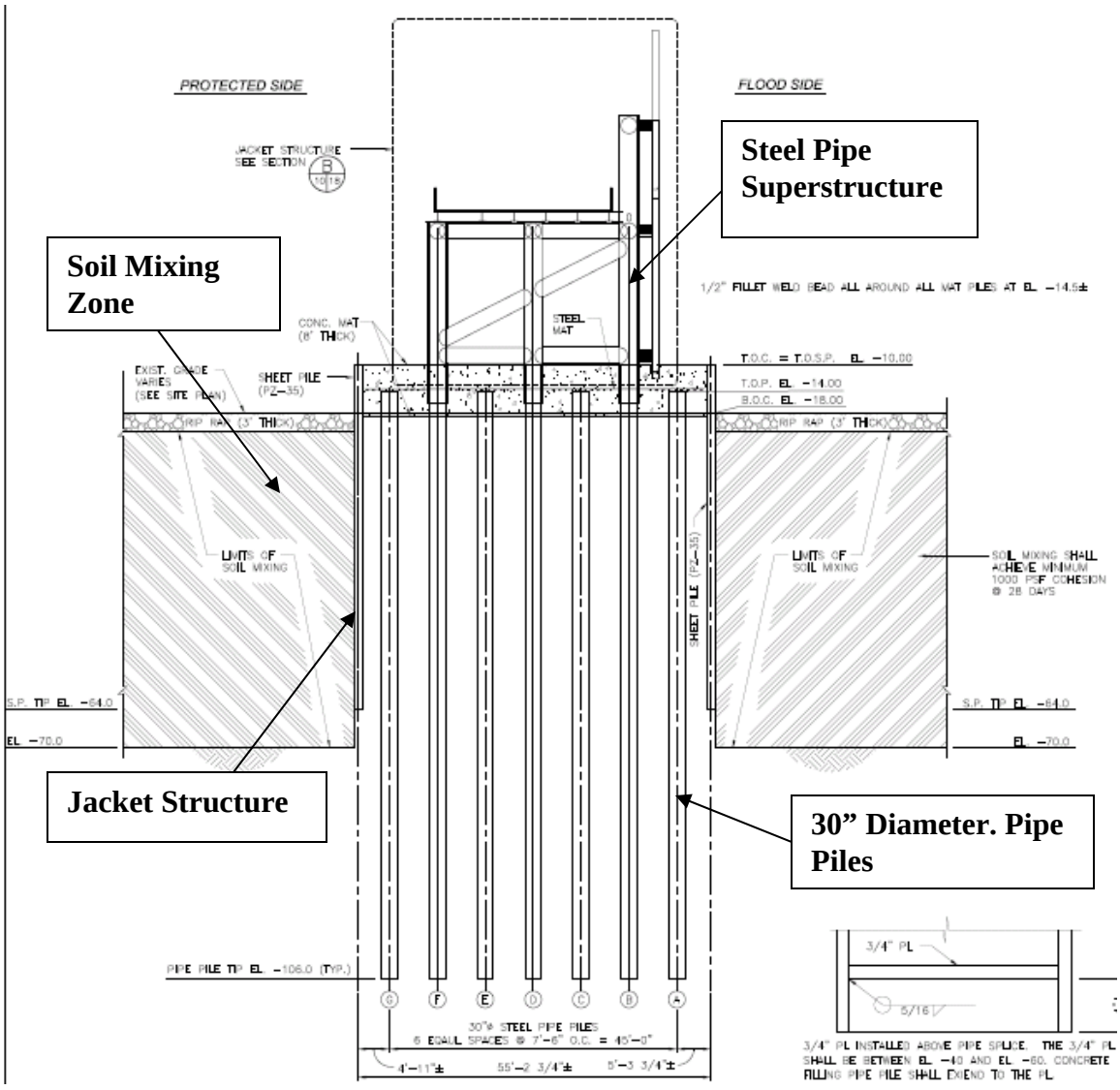

Figure 3 - 17th Street Phase 1 Gate Closure Monolith Substructure

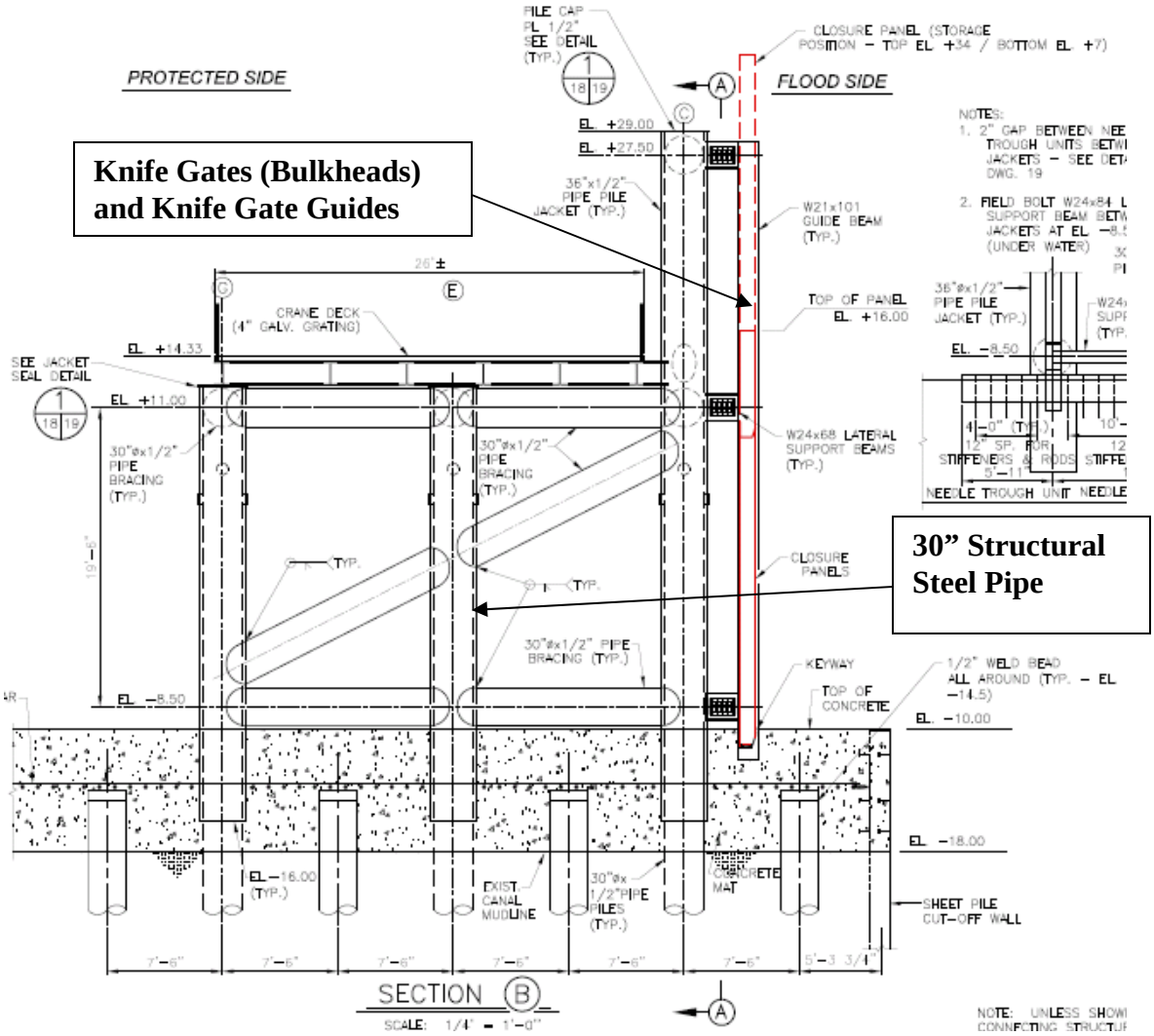

Figure 4 - 17th Street Phase 1 Gate Closure Monolith Superstructure

The riprap protection extends upstream and downstream of the gate seal approximately 300 feet. 36" riprap is placed to elevation -8.0 feet and extends up the channel banks to elevation +5.0 feet. Figures 3, 4, and 5 show general plans and sections of the riprap protection area. 48" riprap is located at the pipe discharge outlet as shown in figure 6.

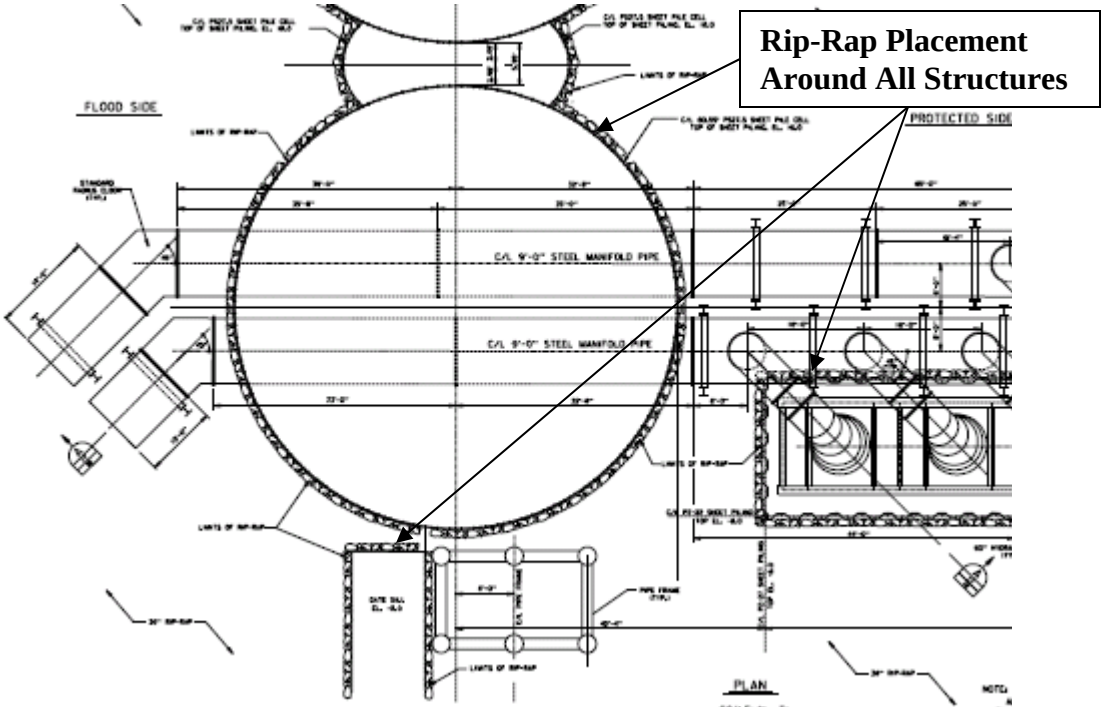

Figure 3 – Orleans Avenues Phase 1 ICS Riprap Details

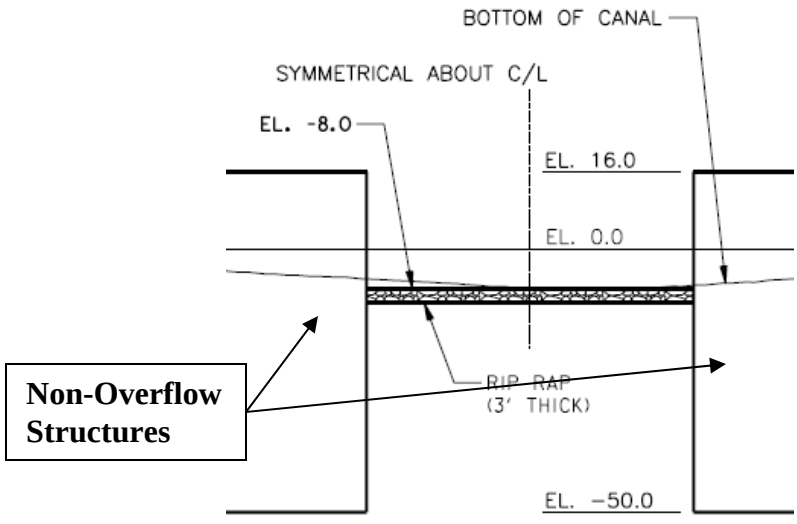

Figure 4 – Orleans Avenue Phase 1 Gate Closure Monolith Riprap Pad Detail

The Orleans Avenue Gate Closure Monolith:

The Orleans Avenue Gate Closure Monolith can be defined by the following features:

- Upstream and Downstream Erosion Protection
- Closure Monolith Substructure
- Closure Monolith Superstructure
- Bulkheads

Figure 1 shows the overall gate monolith site plan. The existing system appears to be well detailed to prevent erosion damage caused by scouring or head cutting in the canal. The non-overflow section performs the abutments of the closure structure monolith and thus acts to prevent scour and head cutting around the closure structure. The foundation depth appears to be acceptable for these types of structures in the New Orleans area. The major features of the gate closure monolith are indicated.

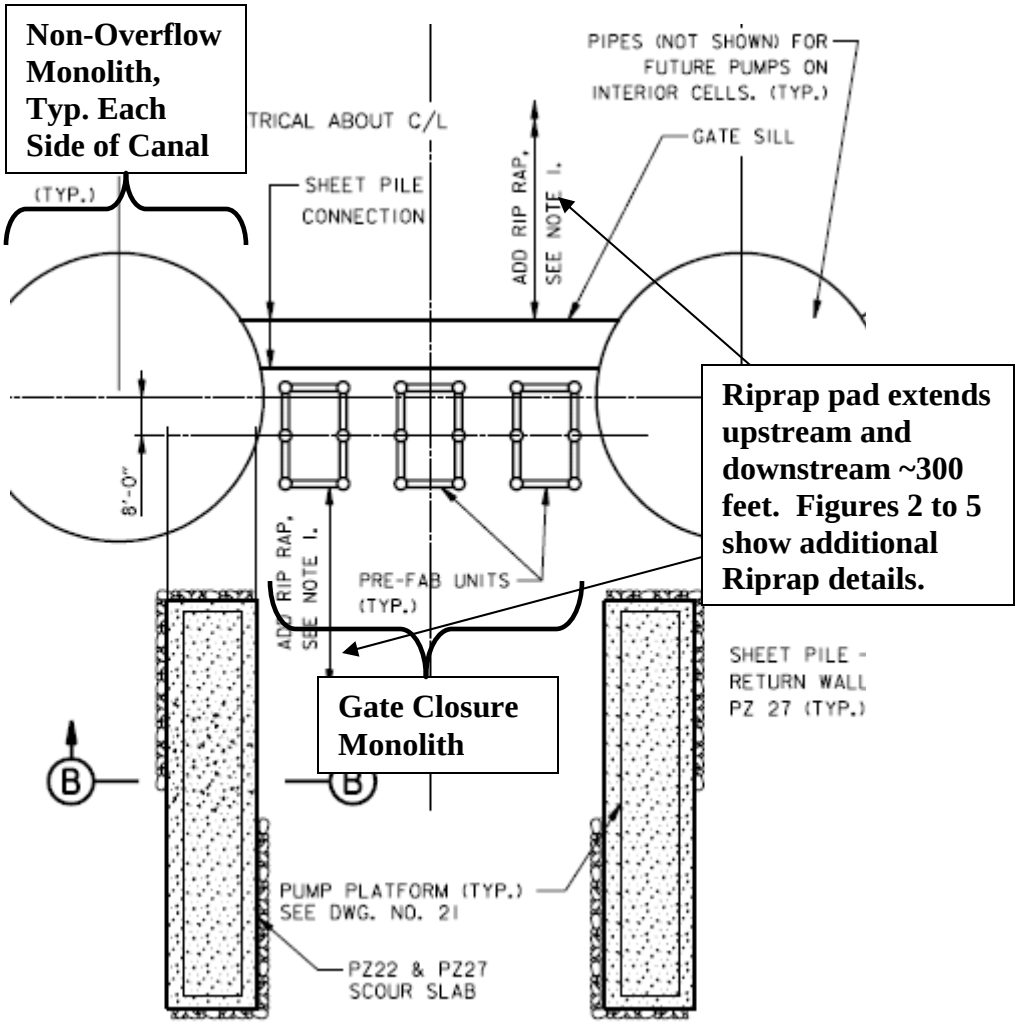

Figure 1 – Orleans Avenue Phase 1 ICS Gate Closure Monolith Layout

The major elements of the Orleans Avenue Gate Closure Monolith substructure consists of soil improvements using deep soil mixing, riprap erosion protection, gate seal and the gate monolith superstructure. Improvement of the foundation soils using soil mixing was performed upstream and downstream of the gate seal. Details of the soil mixing program are shown in Figure 2. Generally, the soil mixing improved the soils directly in the channel bottom for a distance of 50 feet upstream and downstream of the gate seal with a tip elevation of -50.0'. The top elevation of the soil mixing system is -11.0 feet.

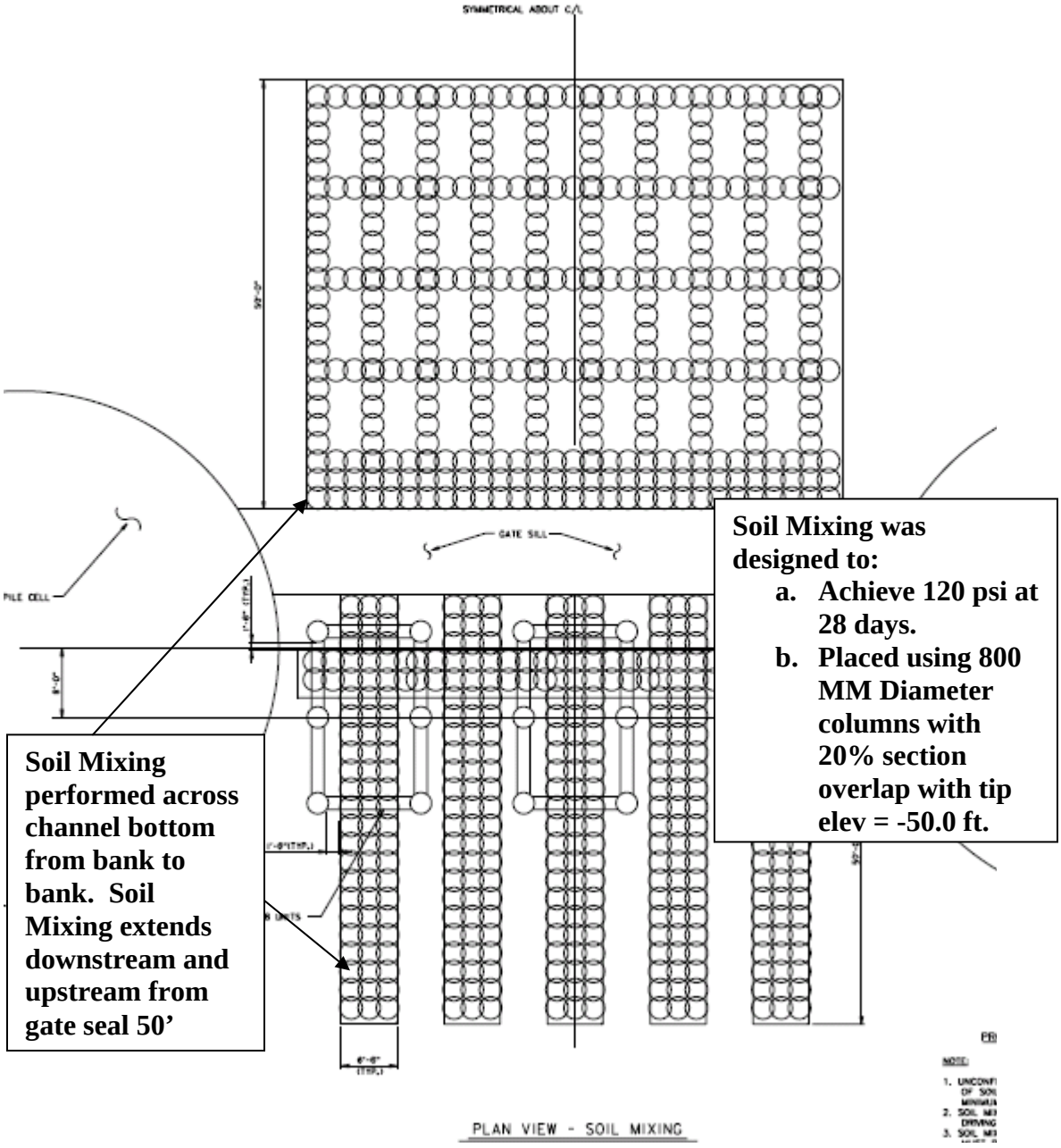

Figure 2 – Orleans Avenue Phase 1 Gate Closure Monolith Soil Mixing Details

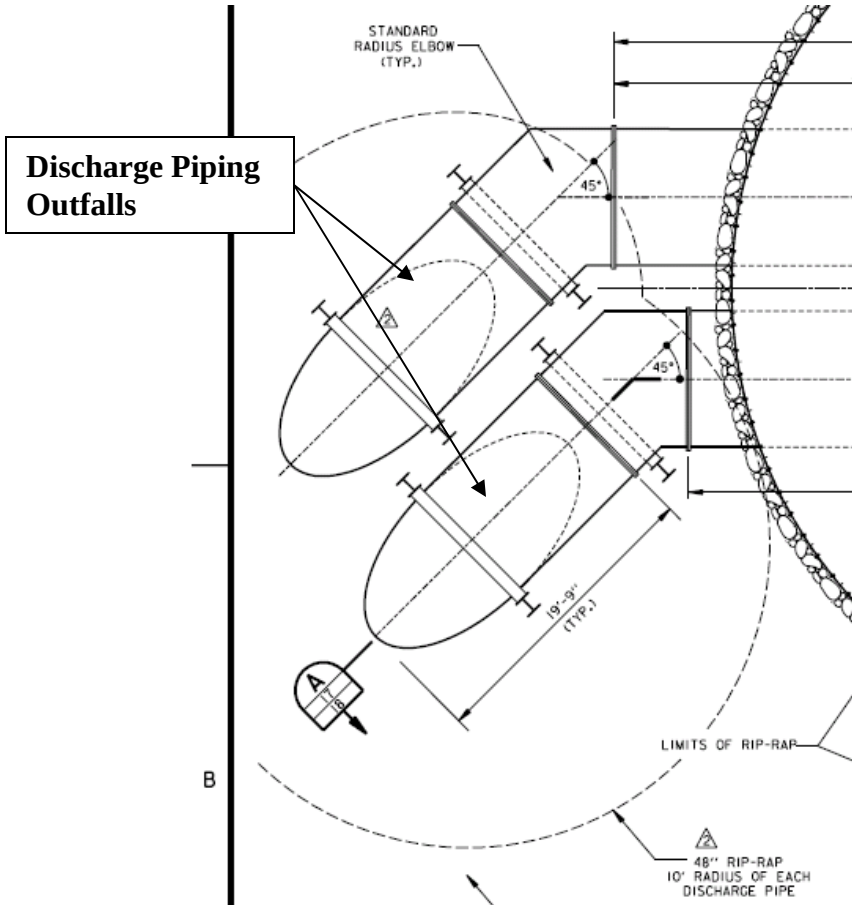

Figure 5 – Orleans Avenues Phase 1 Discharge Pipe Scour Pad

The gate closure monolith substructure consists of 18-24" diameter steel pip piles with a tip elevation of -112.0 feet and extend up to elevation +13.0 feet. Concrete is placed in the pipe piles from elevation -60.0 feet to elevation +13.0 feet. The gate superstructure was constructed by placing a 30" diameter steel pipe pile over the 24" pipe piles from elevation -10.0 feet up to elevation +13.0 feet. The annular space between the pipe piles is filled with grout. Pile shear connectors are used to connect the 24" and 30" piles. 18" and 10" structural steel pile are welded to the 30" steel pipe piles to form a structural frame that supports the closure gate platform. The platform consists of galvanized steel grating that is supported by W16x50 and W14x90 steel beams connected to the pipe frames. The bulkhead guides are fabricated from W21 steel members that are supported off of the pipe frames by W36x150 steel beams and embedded into the gate seal 7 feet (tip elevation -15.0 feet). Figures 6 and 7 show details of the substructure and superstructure.

The gate seal is located downstream of the gate closure monolith superstructure. The gate seal acts to prevent head cutting and to provide a seal for the bulkheads. Two lines of PZ 27 sheet pile are driven into the soil and extend between the left and right non-overflow monoliths. The sheet pile have a top elevation of -8.0 feet and a tip elevation of

-50.0 feet. An 8 foot thick reinforced concrete cap is placed at the top of the gate seal. Studs from the sheet pile tie into the concrete cap. Figures 7 and 8 show the gate seal location and details.

The bulkhead leafs consist of structural steel plates and WT15x45 steel shapes that are welded together to support a ½ inch skin plate. The skin plate is located on the upstream side of the bulkheads. The bulkheads do not have wheels and can be lowered through static water.

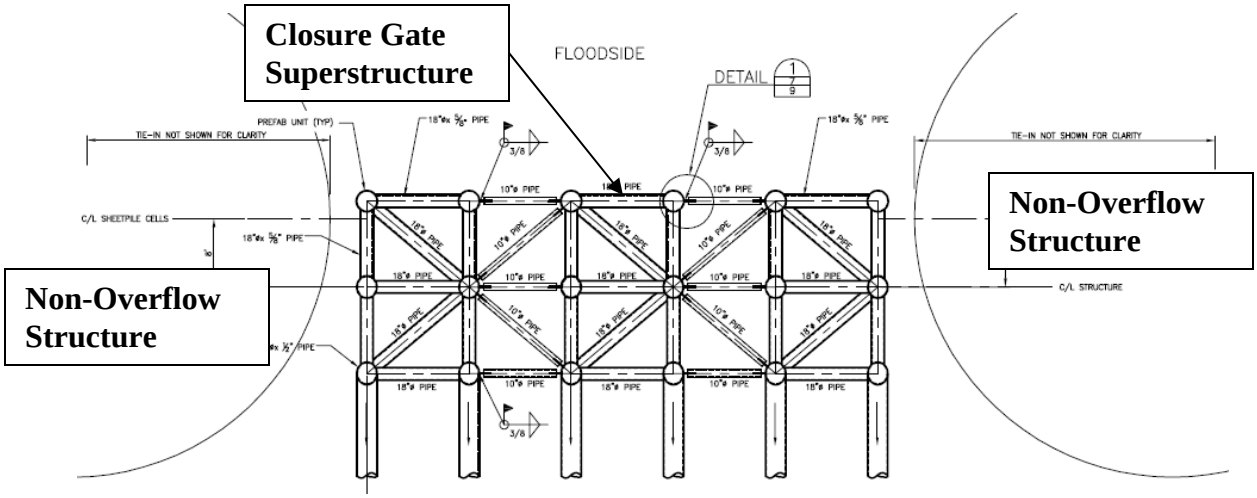

Figure 6 – Orleans Avenue Phase 1 Gate Closure Monolith Superstructure Plan

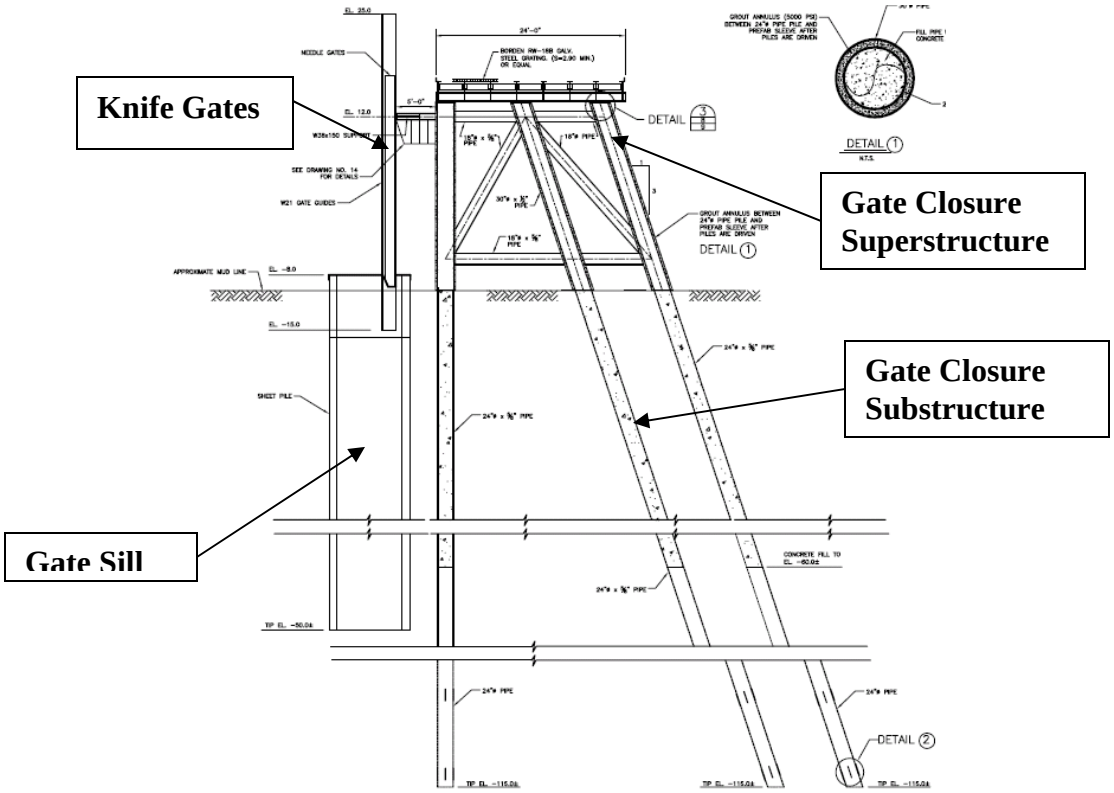

Figure 7 – Orleans Avenue Phase 1 Gate Closure Monolith Substructure and Superstructure

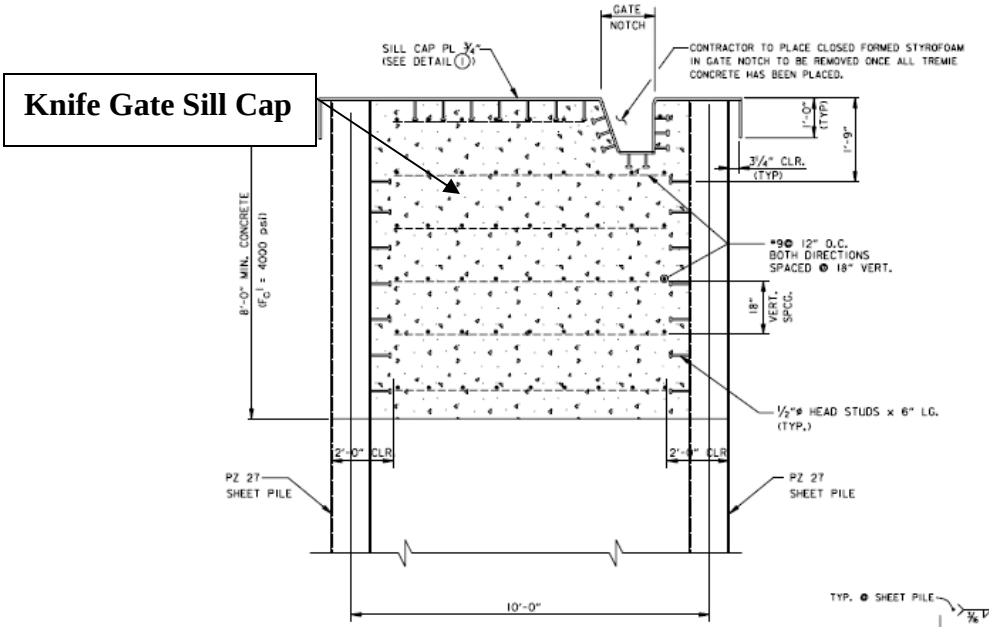

Figure 8 – Orleans Avenue Phase 1 Gate Seal Detail

The London Avenue Gate Closure Monolith:

The London Avenue Gate Closure Monolith can be defined by the following features:

- Upstream and Downstream Erosion Protection
- Closure Monolith Substructure
- Closure Monolith Superstructure
- Bulkheads

Figure 1 shows the overall gate monolith site plan. The existing system appears to be well detailed to prevent erosion damage caused by scouring or head cutting in the canal. The non-overflow section are the abutments of the closure structure monolith and thus act to prevent scour and head cutting around the closure structure. The foundation depth appears to be acceptable for these types of structures in the New Orleans area. The major features of the gate closure monolith are indicated.

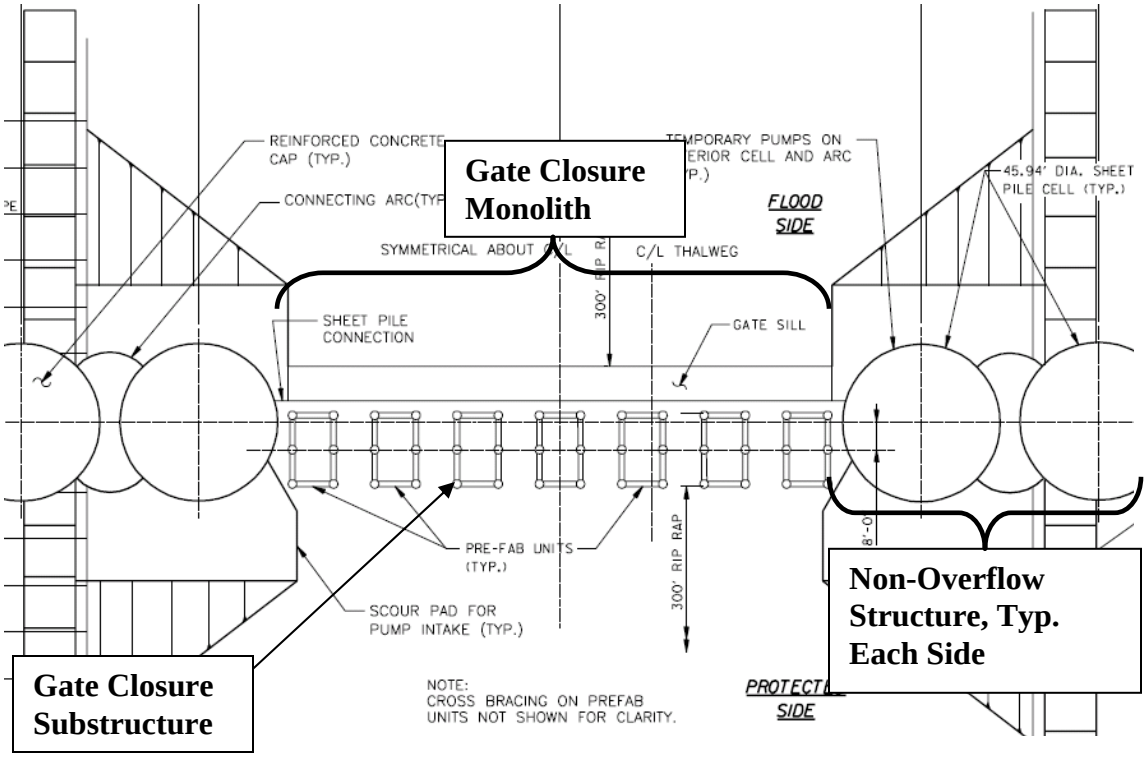

Figure 1 – London Avenue Phase 1 ICS Gate Closure Monolith Plan

The major elements of the London Avenue Gate Closure Monolith substructure consists of riprap erosion protection, gate seal and the gate monolith superstructure. The riprap erosion protection area extends upstream and downstream of the gate seal approximately 300 feet. The 36" riprap is placed with a bottom elevation of -11.0 feet and a top finished elevation of -8.0 feet. The riprap extends up to elevation +5.0 along the canal banks

through the riprap protection area. 48" riprap is placed under the discharge pipe outfall to provided additional scour protection. Figure 2 shows the riprap details at the gate closure monolith.

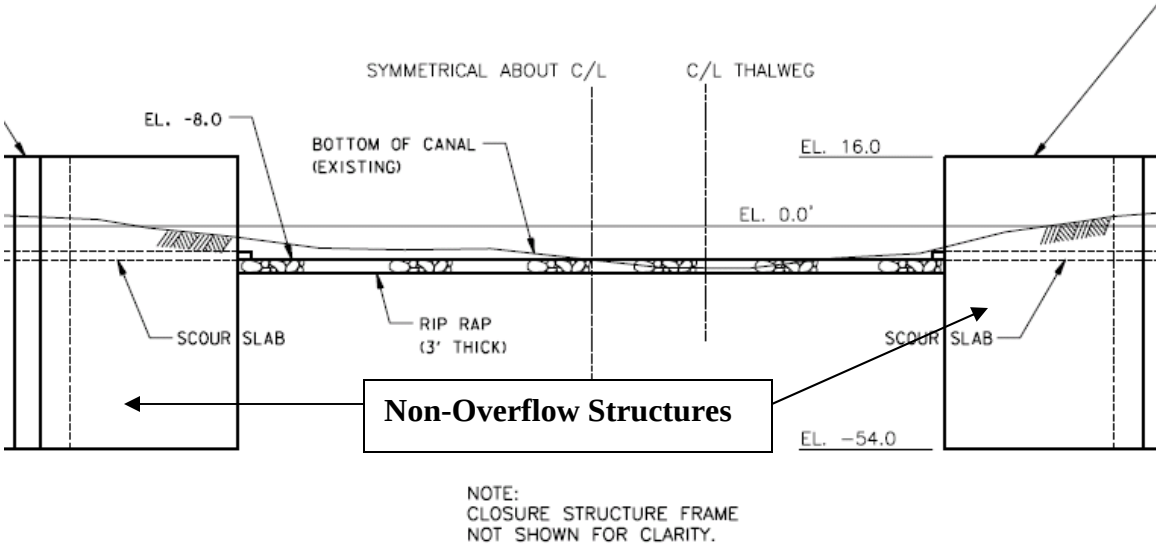

Figure 2 – London Avenue Phase 1 Riprap Protection Pad Detail

The gate closure monolith substructure consists of 42-24" diameter steel pip piles with a tip elevation of -110.0 feet and extend up to elevation +13.0 feet. Concrete is placed in the pipe piles from elevation ~ -20.0 feet to elevation +13.0 feet. The gate superstructure was constructed by placing a 30" diameter steel pipe pile over the 24" pipe piles from elevation -10.0 feet up to elevation +13.0 feet. The annular space between the pipe piles is filled with grout. Pile shear connectors are used to connect the 24" and 30" piles. 18" and 10" structural steel pile are welded to the 30" steel pipe piles to form a structural frame that supports the closure gate platform. The platform consists of galvanized steel grating that is supported by W16x50 and W14x50 steel beams connected to the pipe frames. The bulkhead guides are fabricated from W18 steel members that are supported off of the pipe frames by W36x150 steel beams and embedded into the gate seal 24 feet (tip elevation -30.0 feet). Figures 3, 4 and 5 show details of the substructure and superstructure.

The gate seal is located downstream of the gate closure monolith superstructure. The gate seal acts to prevent head cutting and to provide a seal for the bulkheads. Two lines of PZ 27 sheet pile are driven into the soil and extend between the left and right non-overflow monoliths. The sheet pile have a top elevation of -8.0 feet and a tip elevation of -68.0 feet. An 8 foot thick reinforced concrete cap is placed at the top of the gate seal. Studs from the sheet pile tie into the concrete cap. Figures 6 and 7 show the gate seal location and details.

The bulkhead leafs consist of structural steel plates and WT15x45 steel shapes that are welded together to support a ½ inch skin plate. The skin plate is located on the upstream

side of the bulkheads. The bulkheads do not have wheels and can be lowered through static water.

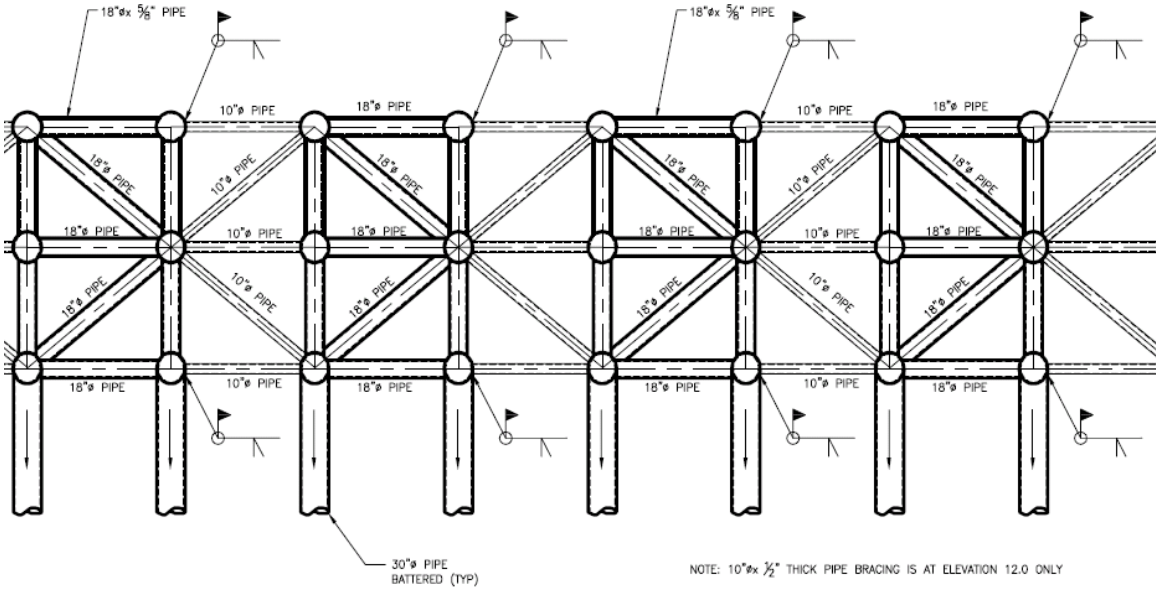

Figure 3 – London Avenue Phase 1 Superstructure Partial Plan

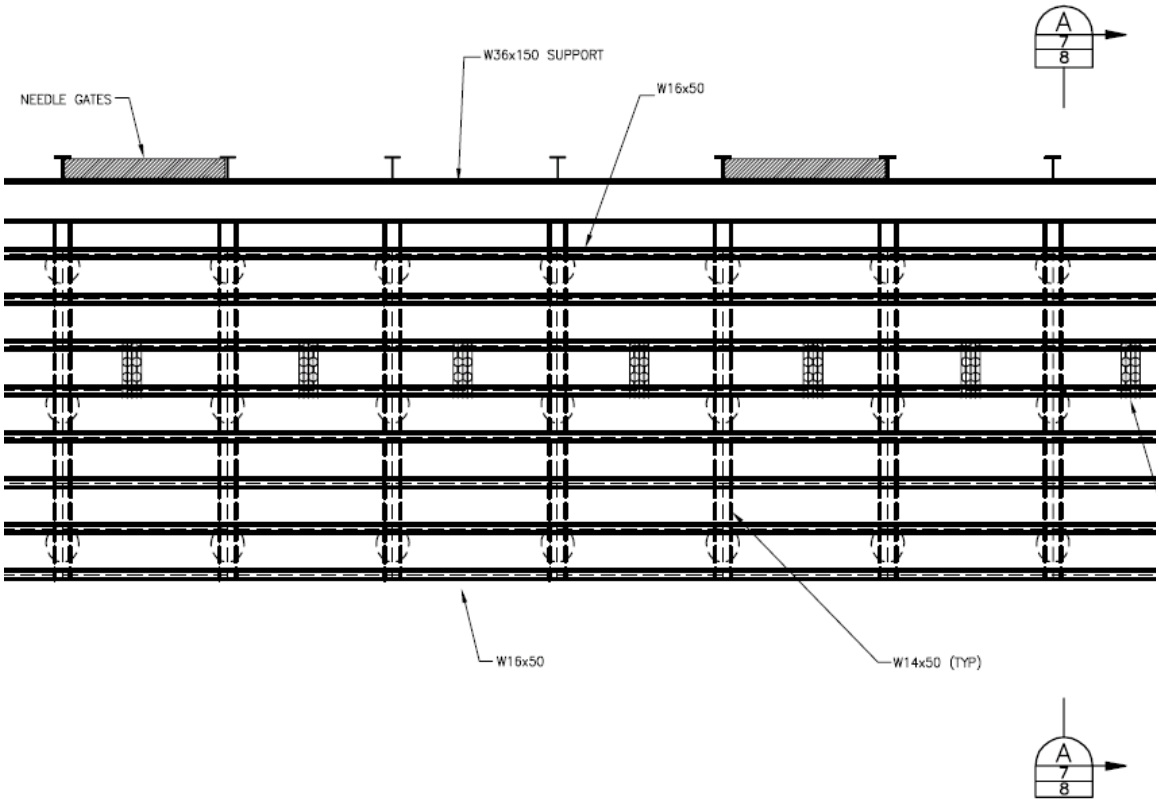

Figure 4 – London Avenue Phase 1 Gate Closure Monolith Decking Partial Plan

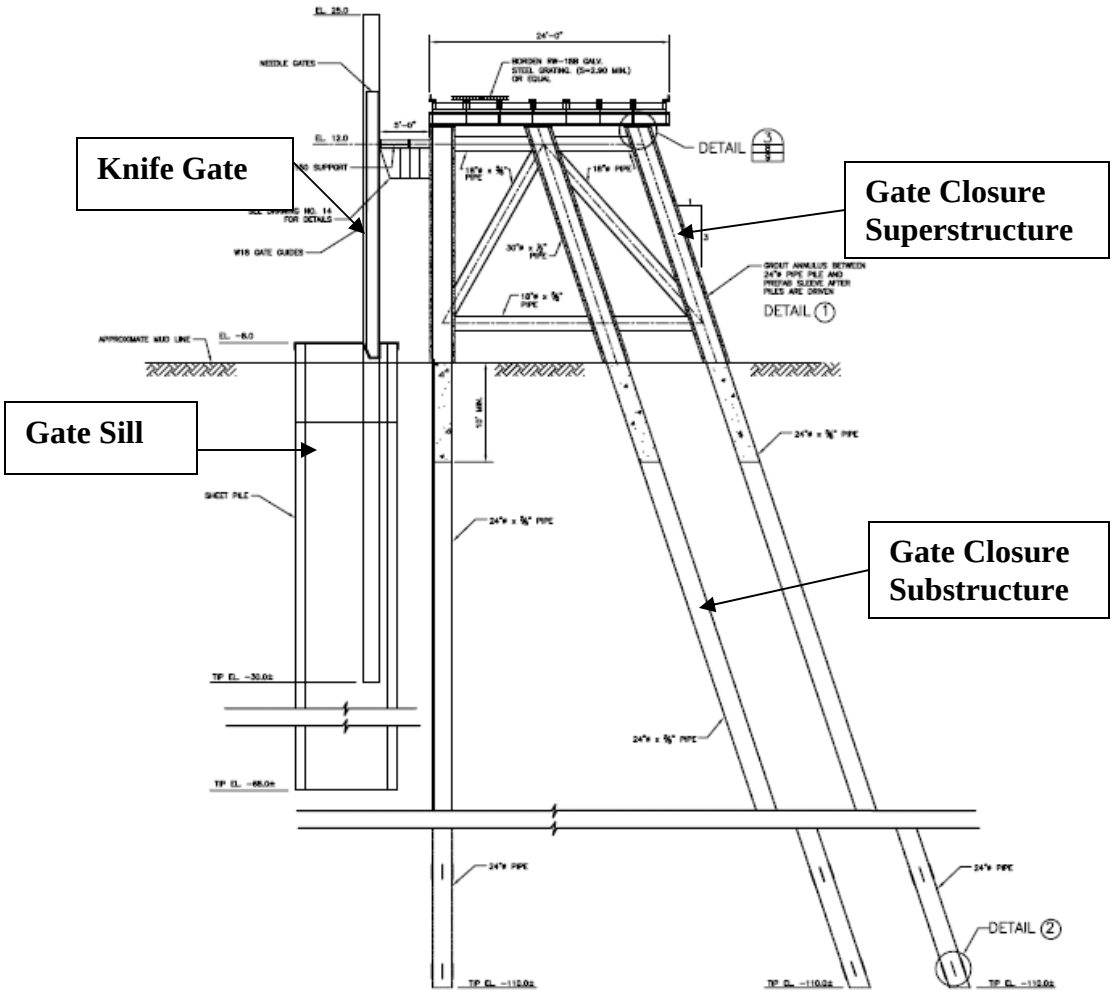

Figure 5 – London Avenue Phase 1 Substructure and Superstructure Cross Section

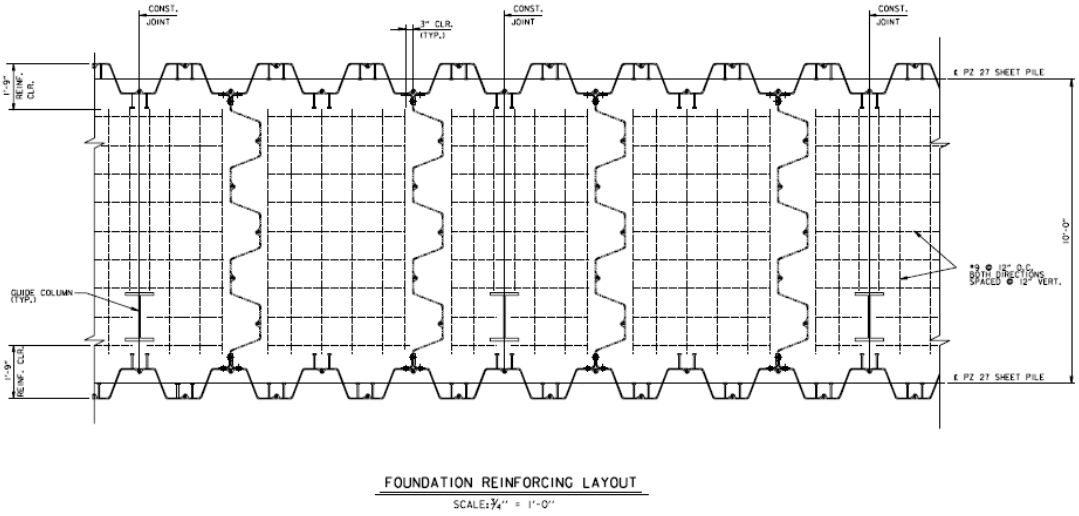

Figure 6 – London Avenue Phase 1 Gate Sill Cap Partial Plan

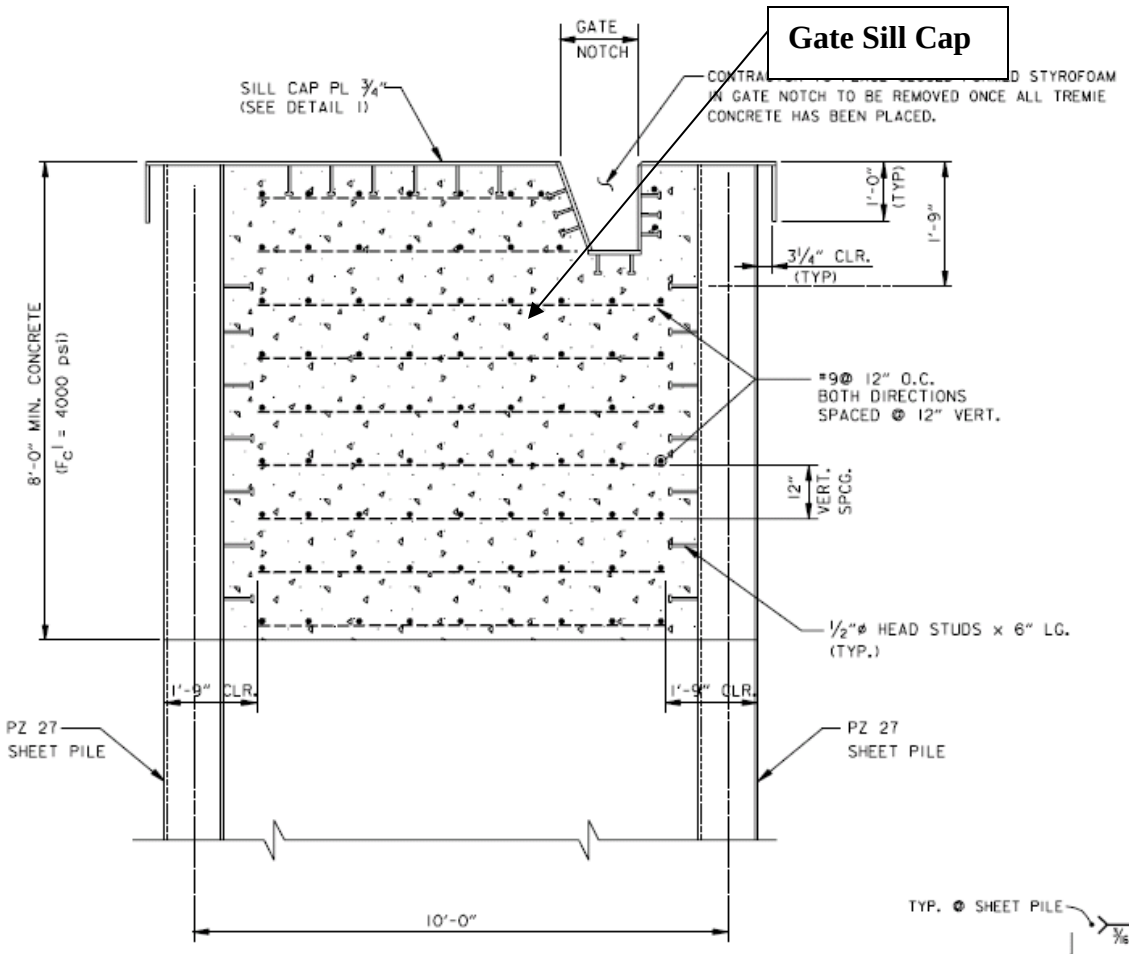

Figure 7 - London Avenue Phase 1 Gate Sill Cap Detail

Appendix B

Types of Facility Installations (By Phases)

There are three pump installation phases. During each phase pumps were added to specific ICS facilities to increase the overall pumping capacity. The pump installation phase includes a significant amount of foundation, substructure and superstructure construction. The type of facility installed during each phases is described below.

Phase 1 Pump Installation.

The phase 1 pump installation included installation of pumps, power units, pump platform foundation substructure, suction basins, pump platform superstructure and discharge piping. Table 1 provides a summary of the number of pumps, pump types and power unit locations for each ICS Facility.

Table 1 – Pump Systems at Each ICS Facility (Same as Table 3 from Main Report)

Parameter			ICS Facility		
			17th Street	Orleans Ave	London Ave
Phase 1	Number of Pumps		12	10	12
	Pump Type		MWI	MWI	MWI
	Power Unit Location		Safe House Platforms	Safe House Platforms	Safe House Platforms
Phase 2	Number of Pumps		6	NA	NA
	Pump Type		MWI	NA	NA
	Power Unit Location		Pump Platform	NA	NA
Phase 3	Number of Pumps		12/14	NA	12
	Pump Type		Fairbanks Morse/MWI	NA	Patterson
	Power Unit Location		Pump Platform/Gate Closure Platform	NA	Pump Platform

17th Street ICS Facility Pump Systems.

The 17th Street Phase 1 Pump Facilities includes 12 MWI pumps, 12 power units, two pump platforms, two safe house platforms, suction basins, and discharge piping. Figure 1 shows the overall plan of the 17th Street ICS facility layout.

There are no specific foundation soil improvements that were performed at the ICS facilities for the pump installation. The foundation substructure includes H-pile and sheet pile installation. This pile system supports a concrete slab and forms the suction basin for each pump.

The 17th Street pump intakes are located at elevation -6.0 feet. This is just above top of the suction basin which is at elevation -9.0. The 17th Street ICS phase 1 pump platform foundation substructure includes 36-HP14x73 piles with a tip elevation of -100.00 feet. PZ 36, 27, and 22 sheet pile was installed to form the perimeter of the suction basin and to separate each basin. However, the sheet pile is cutoff at elevation -9.0 feet which coincides with the top elevation of the suction basin concrete slab. The sheet pile is -50.0 around the suction basin. The suction basin reinforced concrete slab is 14" thick. The pump platform superstructure is comprised of structural steel W shapes and channels that are attached to the HP piles. The structural steel shapes for the support structure for 1 ½" (1 ½" x 3/16" bearing bar) galvanized steel grating and the pumps. The top of steel elevation of the pump platforms is elevation +9.5 feet. Figures 2 through 5 show details of the pump platforms.

The Phase 1 pumps discharge into 9' diameter steel pipes. Three pumps discharge into one 9' discharge pipe. Figures 3 and 4 show the discharge pipe manifold system at the pump platforms. The discharge pipes pass through the gate closure monolith abutments (two through each abutment). The discharge pipe outlets are located just downstream of the gate closure monolith. Figures 6 and 7 show the layout of the discharge pipe outlets. There are an additional 28-HP14x73 piles with a tip elevation of -100.00 supporting the discharge pipes. Structural steel shapes are attached to the piles to form the pile bents, see Figure 8 for a typical pipe support detail at the pump platforms.

The phase 1 pump power units are located on the engine platforms located on each bank. Each engine platform houses a 20,000 gallon single wall fuel tank that is 10.5 feet in diameter and 31 feet long. The other end of the engine platform houses a 4 room safe house that includes a storage area, operator's room, control room and restroom. The pump power units are located in between the fuel tank and safe house. There are 6 power units on each engine platform. Figures 9 through 14 show the various details of the engine platform.

The engine platform is a reinforced concrete slab that is 1'-4" thick and supported by 66-14" diameter concrete piles with a tip elevation of -72.0 feet. The engine platform is protected by a pre-engineered rigid frame building. A security/debris fence is placed around the perimeter of the platform.

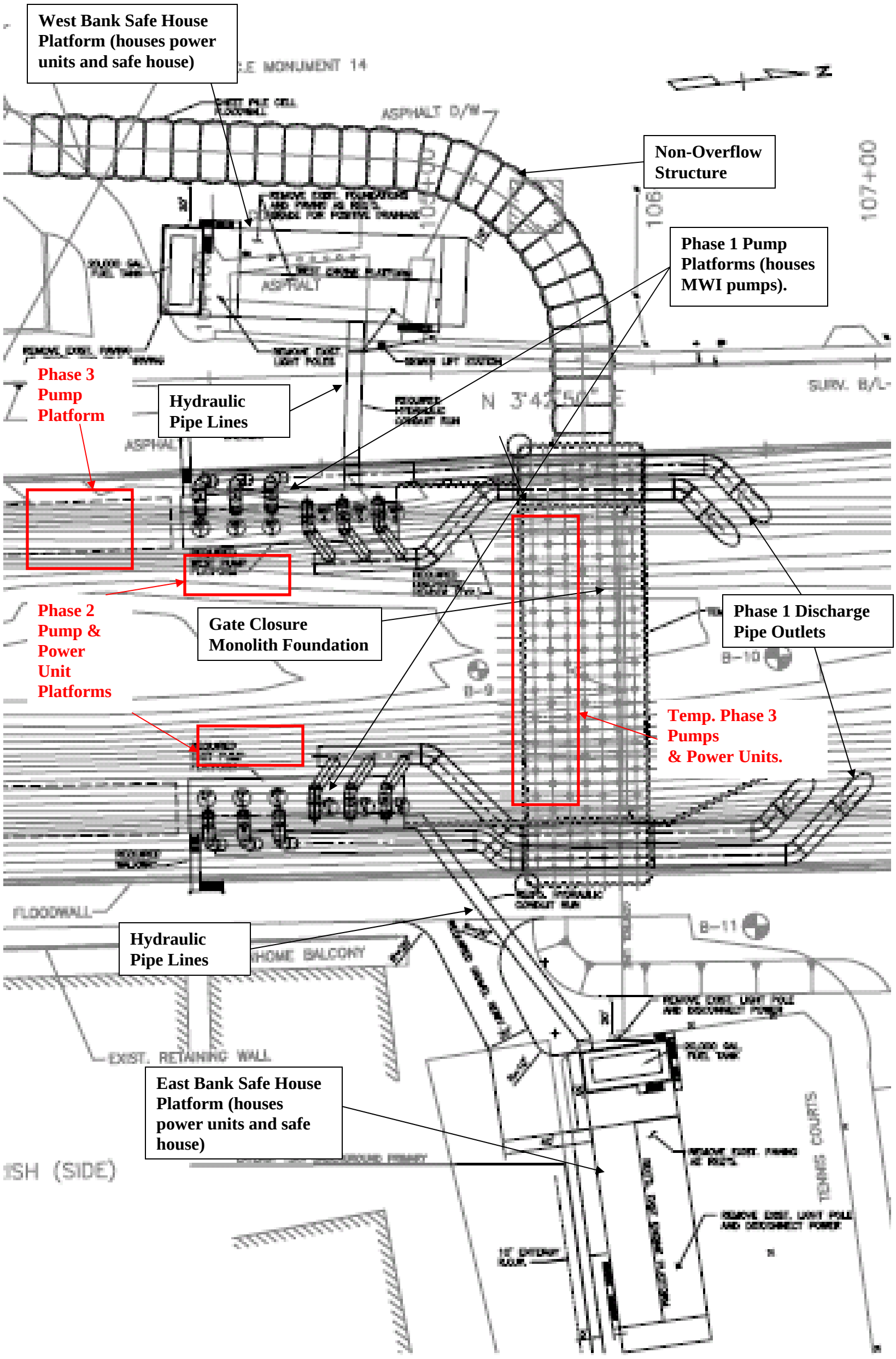

Figure 1 – 17th Street ICS Facility Site Plan

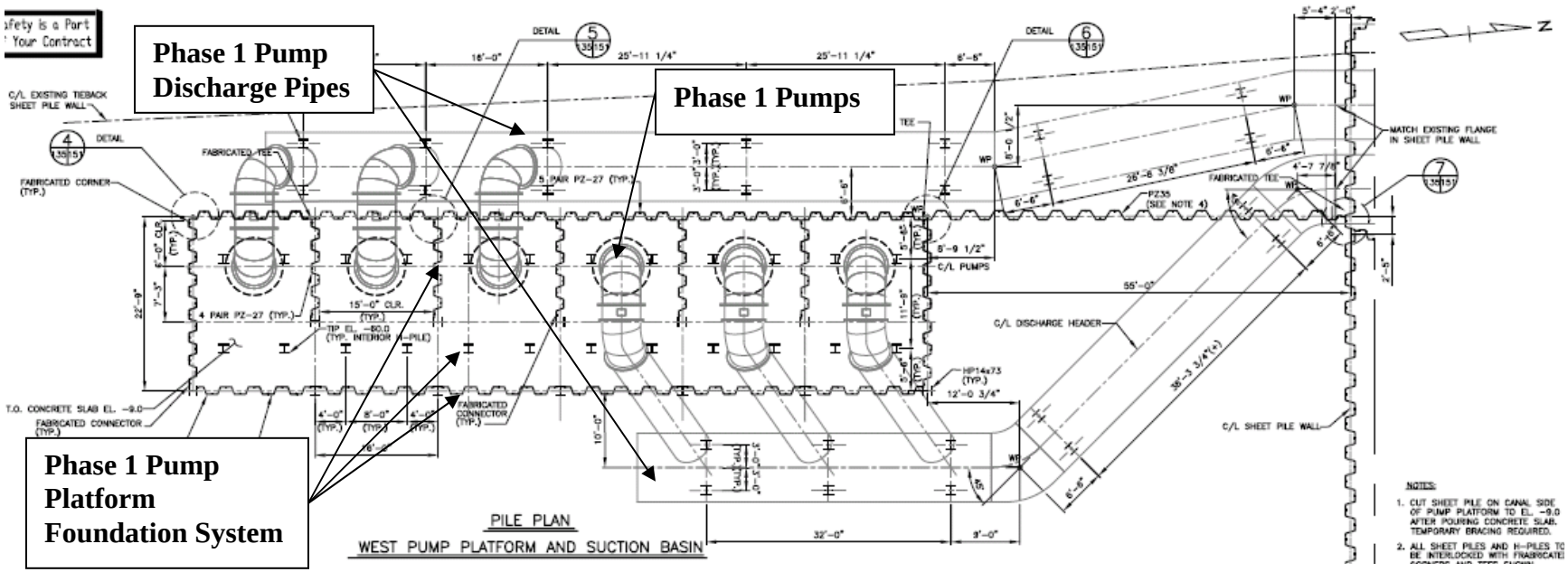

Figure 2 – 17th Street Pump Platform Foundation

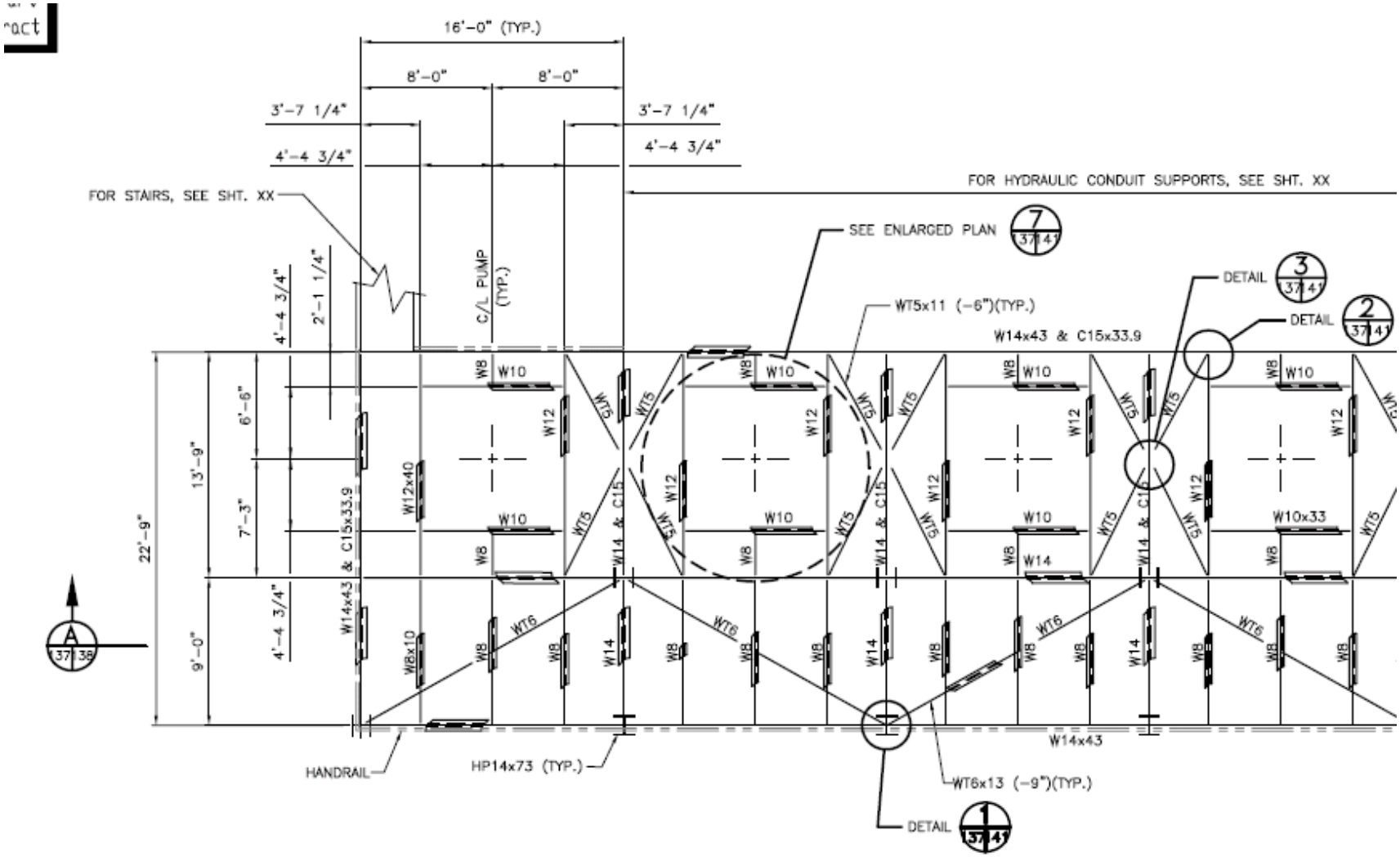

Figure 3 – 17th Street Pump Platform Superstructure

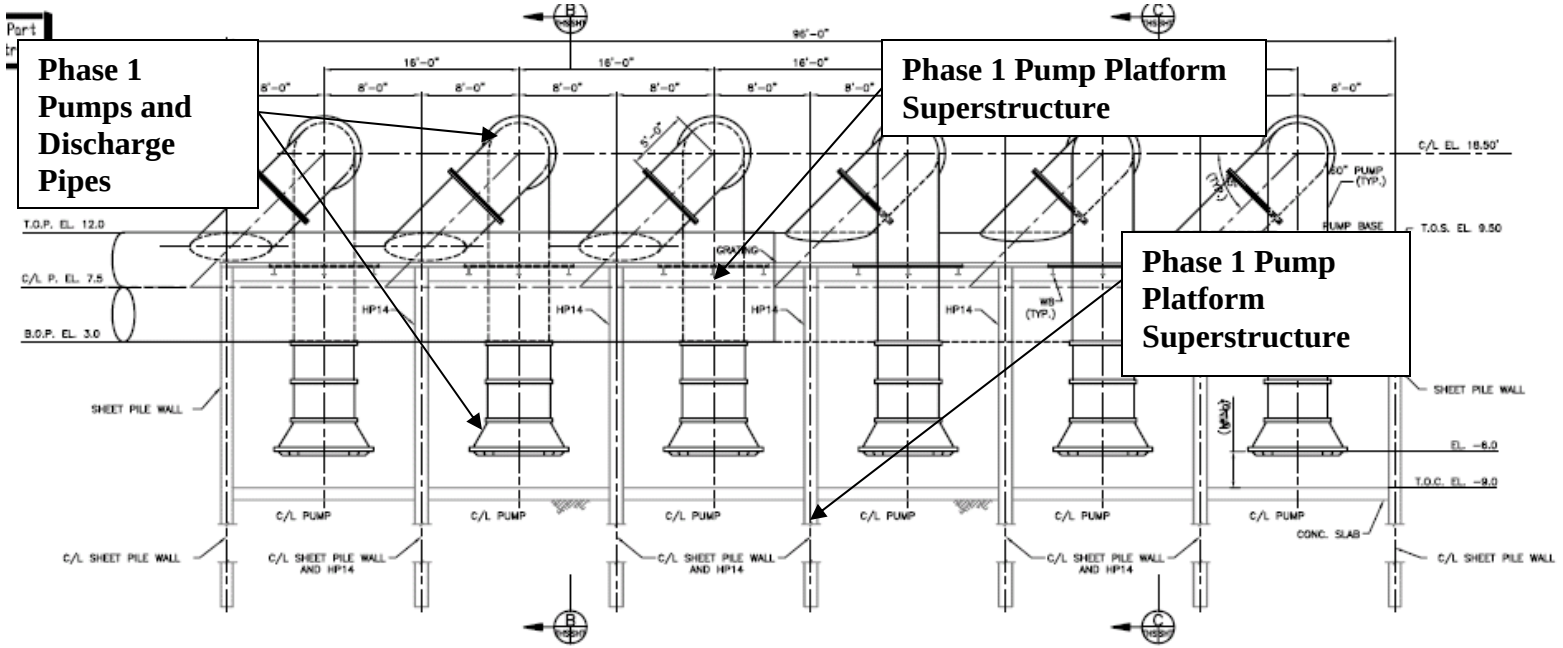

Figure 4 – 17th Street Pump Platform Elevation

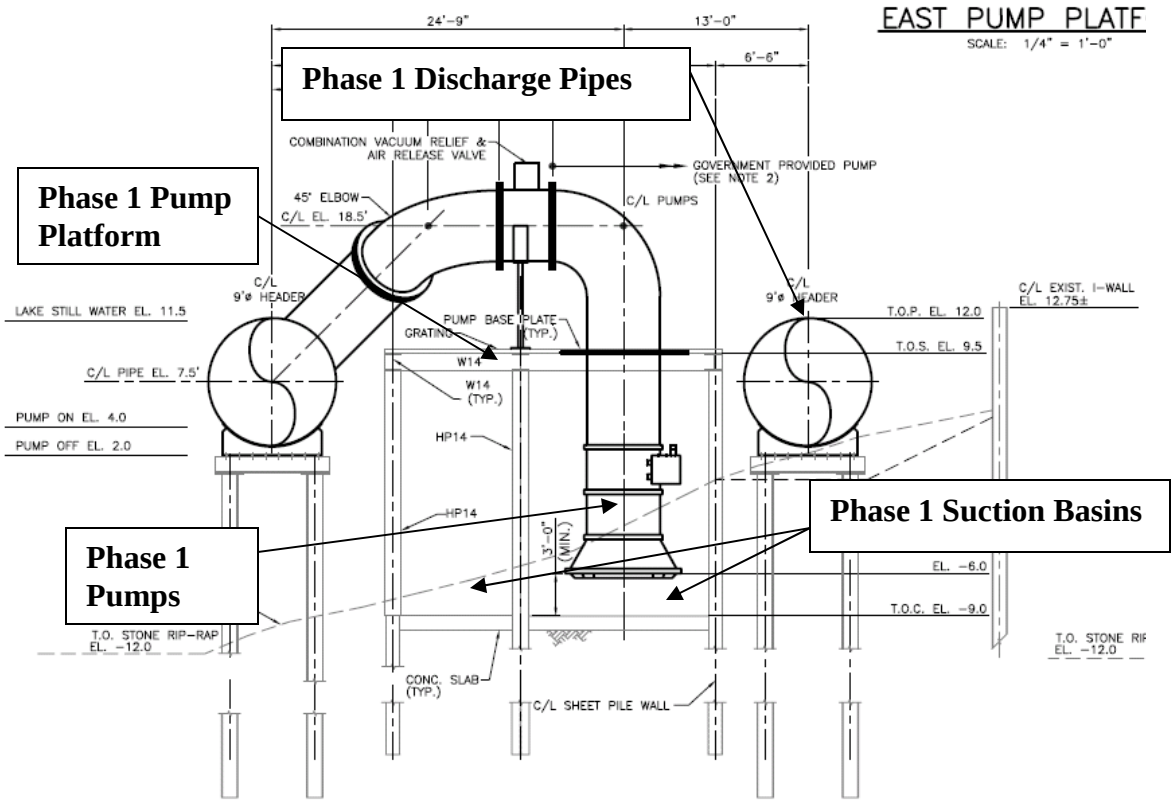

Figure 5 – 17th Street Pump Platform Section

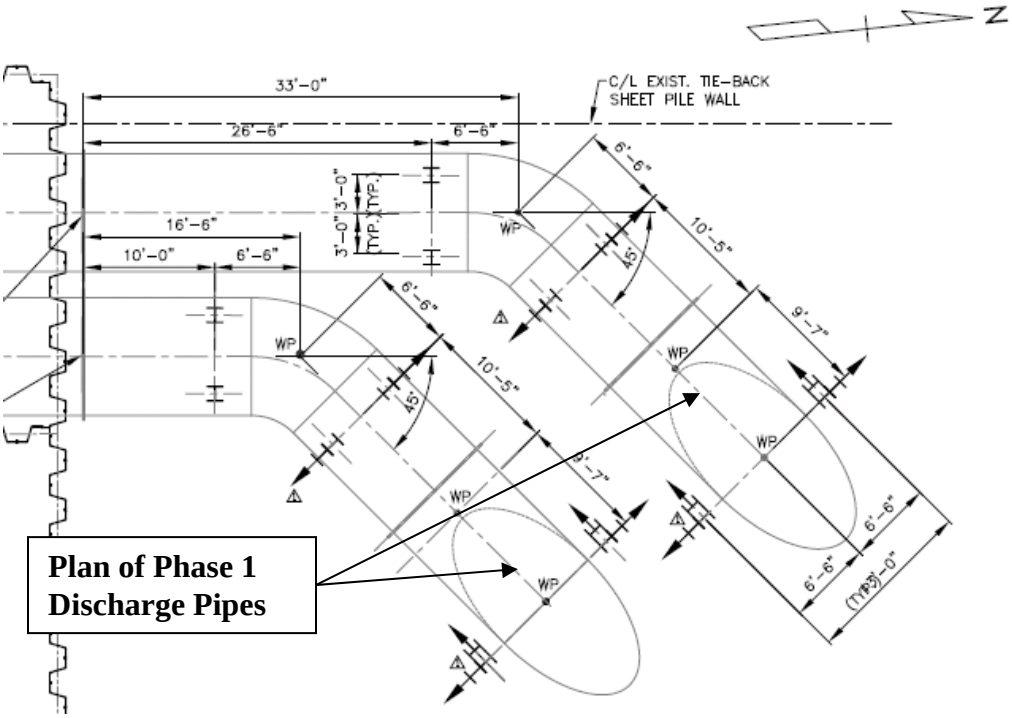

Figure 6 – 17th Street Discharge Pipe Layout West Bank

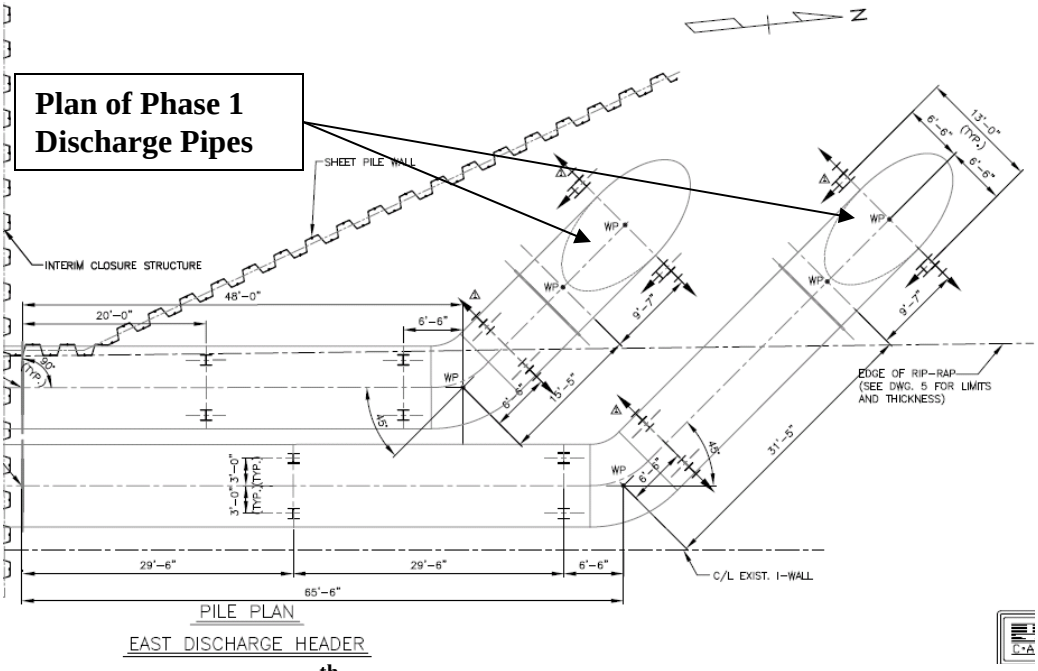

Figure 7 – 17th Street Discharge Pipe Layout East Bank

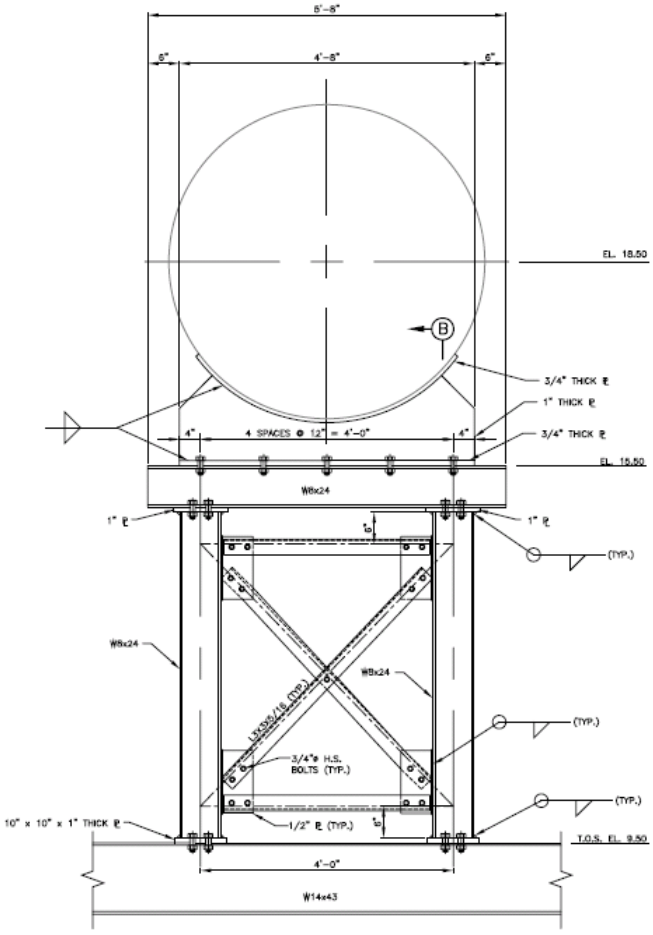

Figure 8 – 17th Street Phase 1 Discharge Pipe Support at Pump Platform

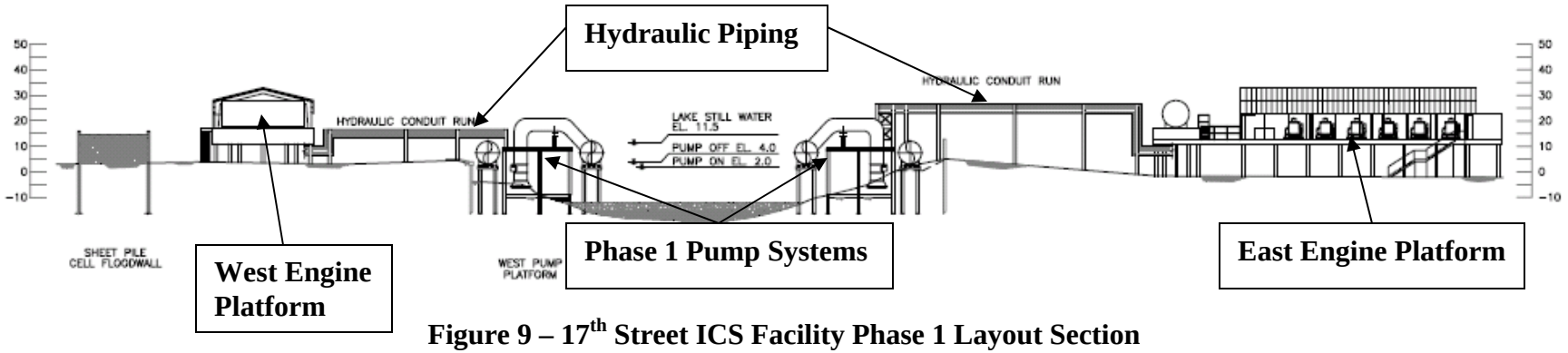

Figure 9 – 17th Street ICS Facility Phase 1 Layout Section

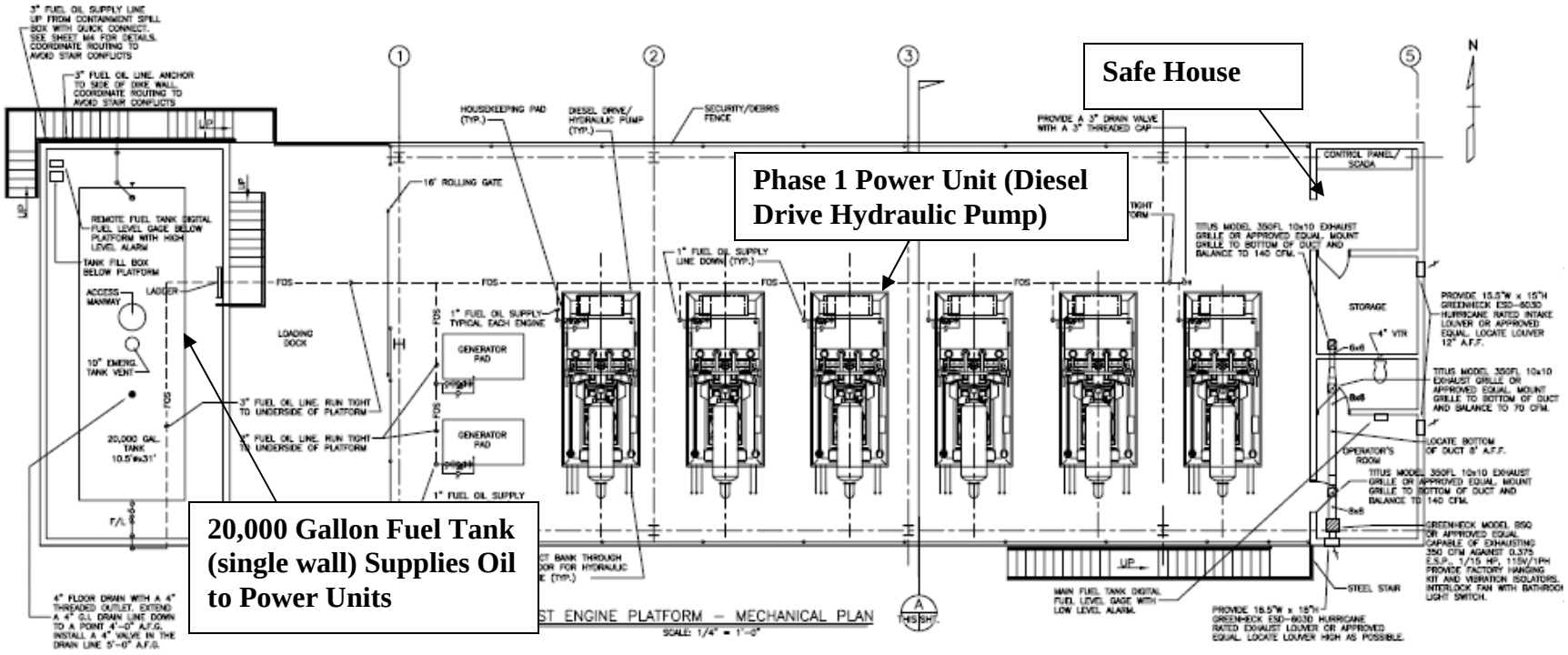

Figure 10 – 17th Street West Engineer Phase 1 Platform Plan

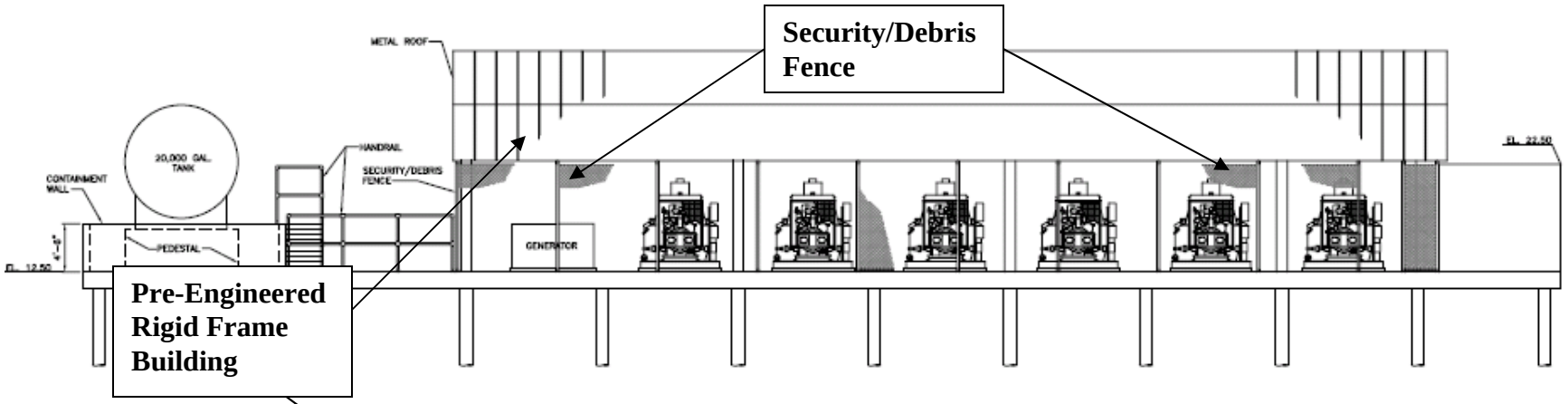

Figure 11 – 17th Street Phase 1 West Engine Platform Elevation

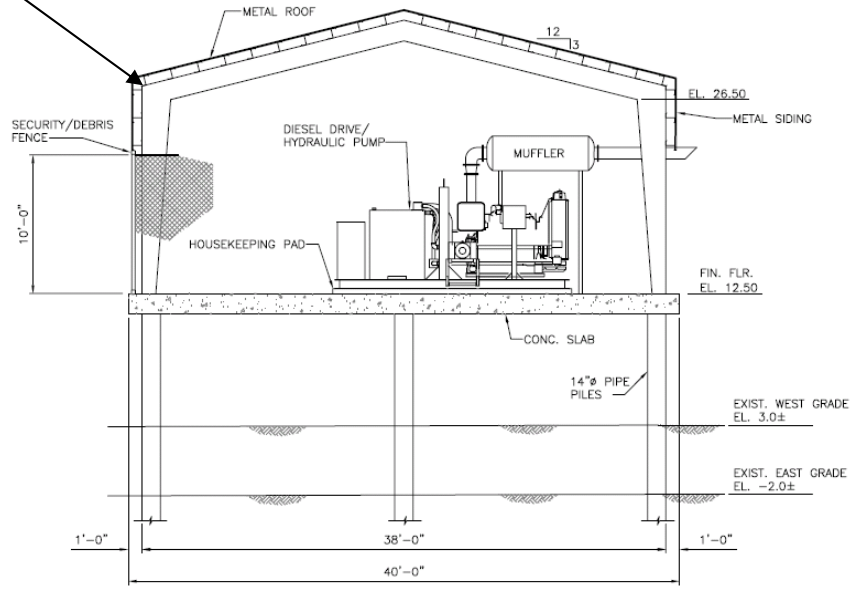

Figure 12 – 17th Street Phase 1 West Engine Platform Section

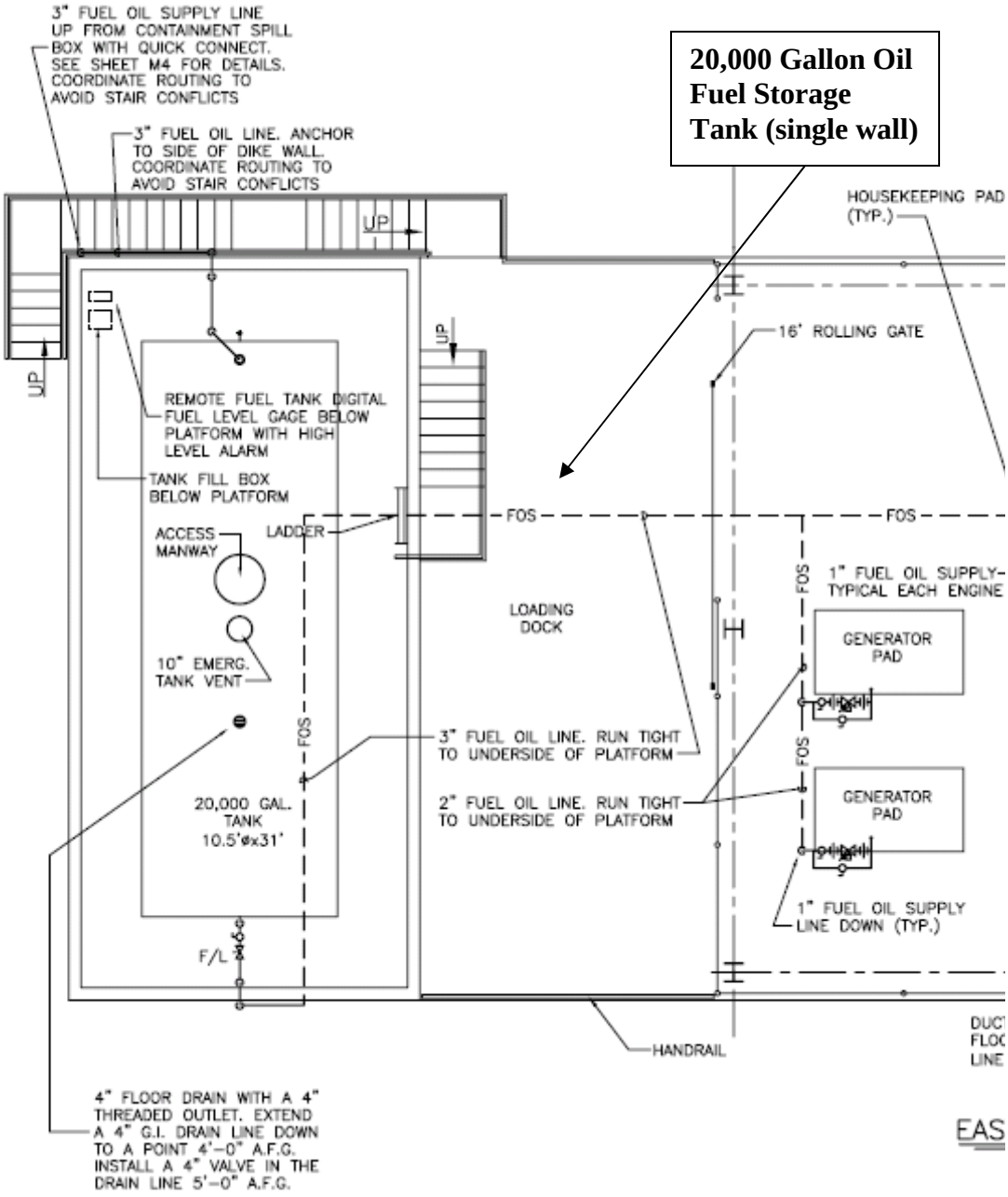

Figure 13 – 17th Street West Engine Platform Fuel Oil Storage Area

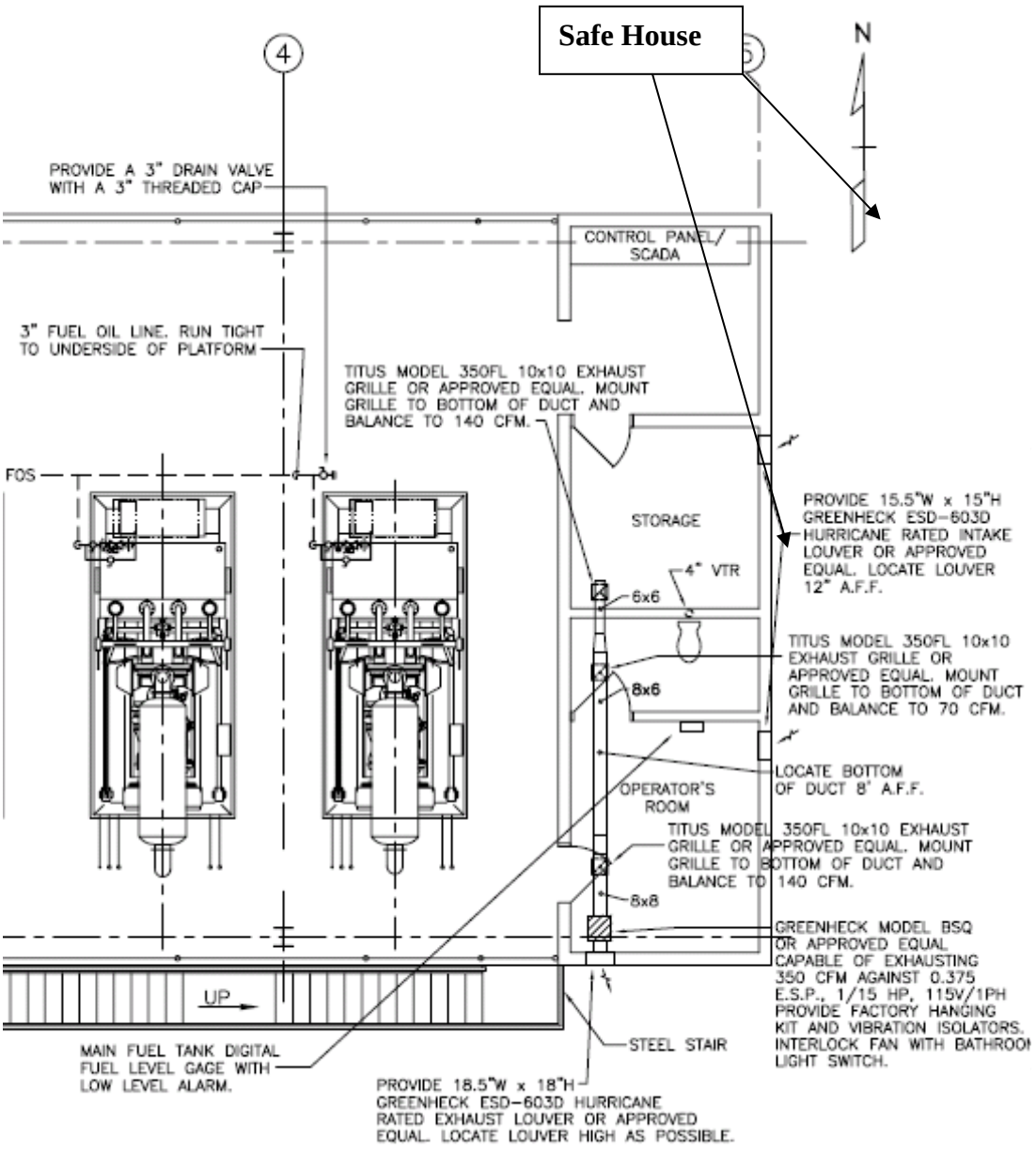

Figure 14 – 17th Street West Phase 1 Engine Platform Safe House Plan

Orleans Avenue ICS Facility Pump Systems.

The Orleans Avenue Phase 1 Pump Facilities includes 10 MWI pumps, 10 power units, two pump platforms, two safe house platforms, suction basins, and discharge piping. Figure 1 shows the overall plan of the Orleans Avenue ICS Pump Facilities.

There are no specific foundation soil improvements that were performed at the ICS facilities for the pump installation. The foundation substructure includes H-pile and sheet pile installation. This pile system supports a concrete slab and forms the suction basin for each pump.

The Orleans Avenue pump intakes are located at elevation -5.0 feet. This is just above top of the suction basin which is at elevation -8.0. The Orleans ICS phase 1 pump platform foundation substructure includes 24-HP14x73 piles with a tip elevation of -70.0 feet. PZ 27 and PZ 22 sheet piling is installed to form the perimeter of the suction basin. The top of the sheet pile is at elevation -8.0 which coincides with the top of the suction basin concrete slab. There appears to be a few locations where the top of the PZ 27 sheets extends up to elevation -5.0 to meet existing grade. The sheet pile tip elevation is -50.0 feet.

The suction basin reinforced concrete slab is 36" thick. The pump platform superstructure is comprised of structural steel W shapes and channels that are attached to the HP piles. The structural steel shapes support Borden RW-18A galvanized steel grating and the pumps. The top of steel elevation of the pump platforms is elevation +10.0 feet. Figures 2 through 4 show details of the pump platforms.

The phase 1 pumps discharge into 9' diameter steel pipes. Three pumps discharge into one 9' discharge pipe and the remaining two pipes discharge into the second 9' discharge pipe (similar for each side of the canal). Figures 2 and 3 show the discharge pipe manifold system at the pump platforms. The discharge pipes pass through the non-overflow cofferdam cells (two through the left non-overflow and two through the right non-overflow). The discharge pipe outlets are located just downstream of the gate closure monolith. Figures 2 and 3 show the layout of the discharge pipe outlets. There are an additional 48-HP14x73 piles with a tip elevation of -65.0 supporting the discharge pipes. Structural steel shapes are attached to the piles to form the pile bents, see Figures 4 and 5 for a typical discharge pipe support details.

The phase 1 pump power units are located on the engine platforms located on each bank. Each engine platform houses a 20,000 gallon single wall fuel tank that is 10.5 feet in diameter and 31 feet long. A 4 room safe house that includes a storage area, operator's room, control room and restroom is located on the same end of the platform. There are 5 power units on each engine platform located on under a pre-engineered rigid steel frame building. A security/debris fence is placed around the power units. The engine platform is a reinforced concrete slab that is 1'-4" thick and supported by 68-H14x73 piles with a tip elevation of -65.0 feet. Figures 6 through 10 show the various details of the engine platform.

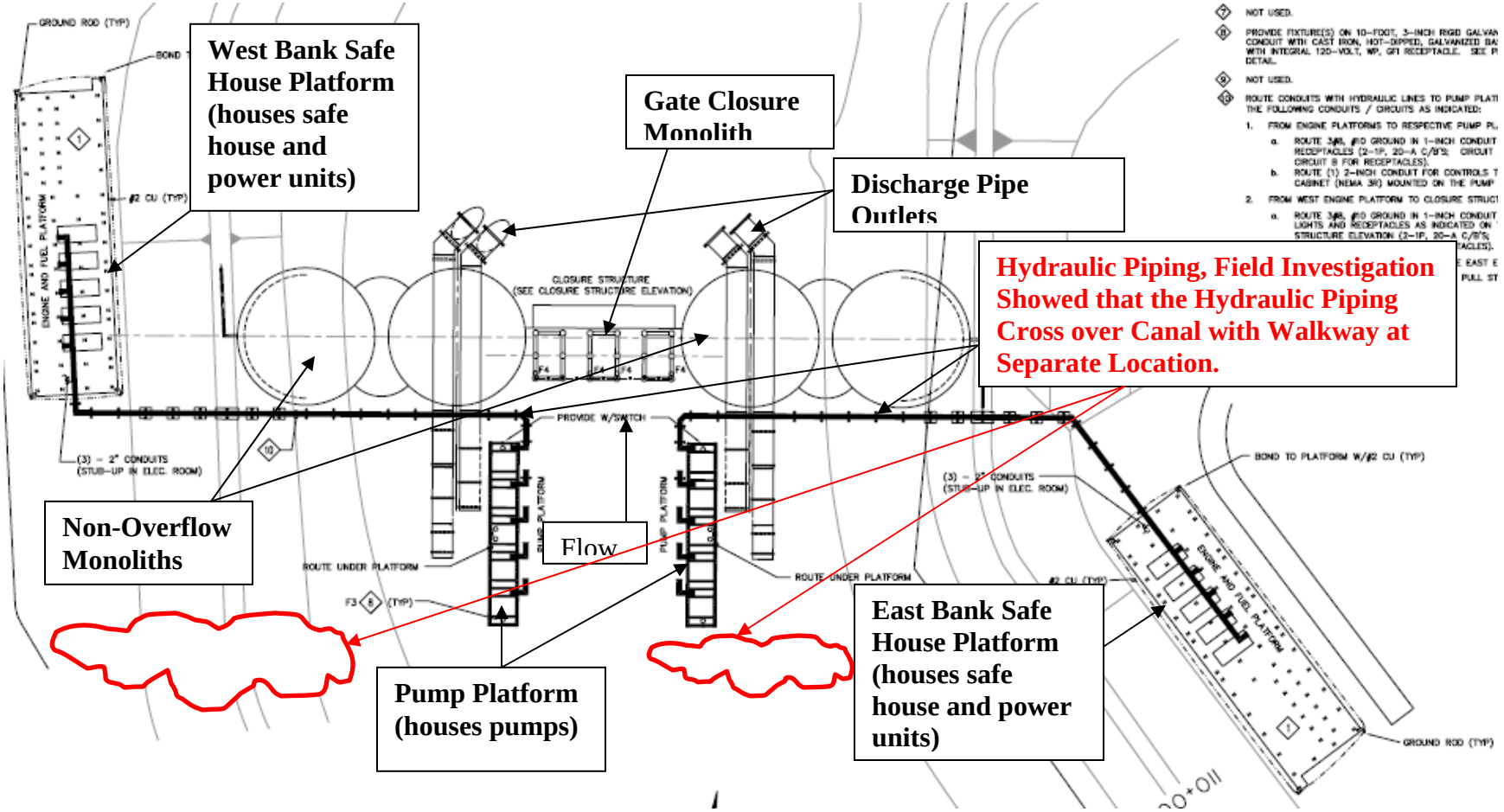

Figure 1 – Orleans Avenue ICS Facility Phase 1 Site Plan

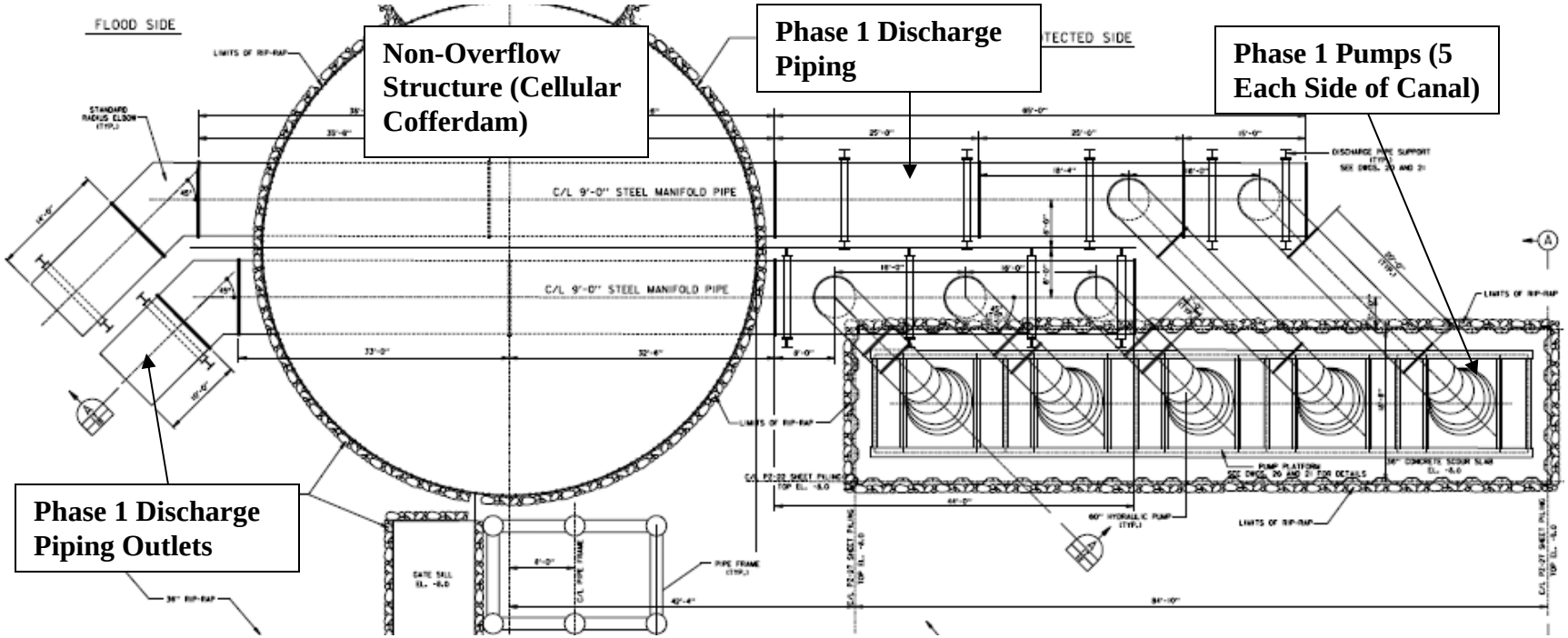

Figure 2 – Orleans Avenue West Bank Pump Platform and Discharge Pipe Location

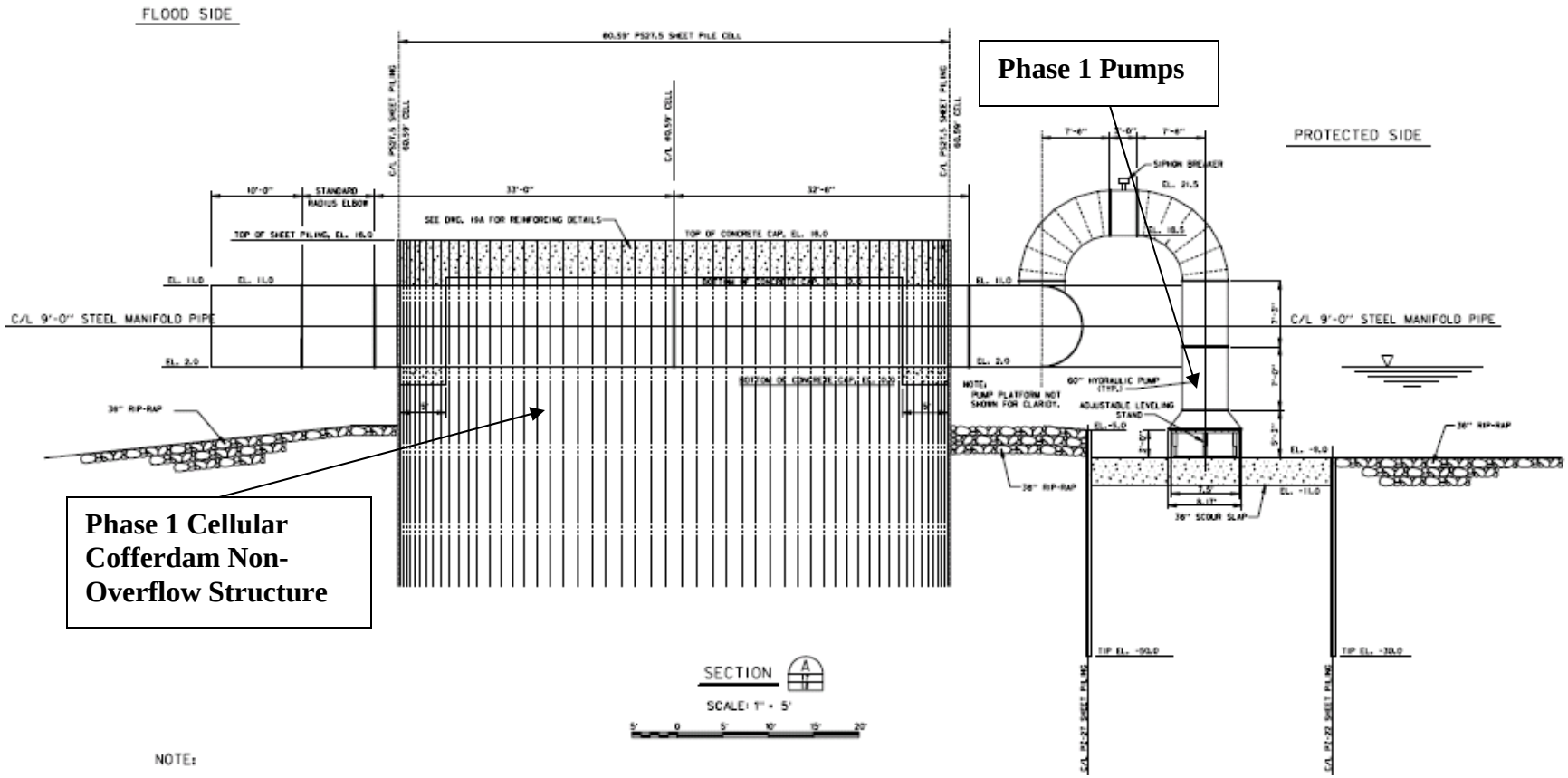

Figure 3 – Orleans Avenue West Bank Pump Platform and Discharge Pipe Section

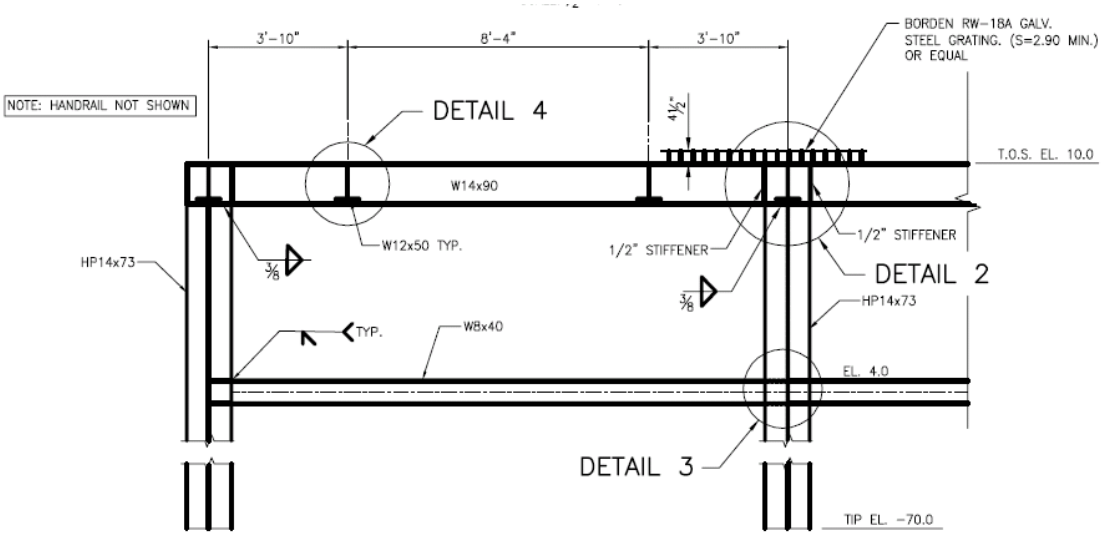

Figure 4 – Orleans Avenue Phase 1 Pump Platform Structural Section

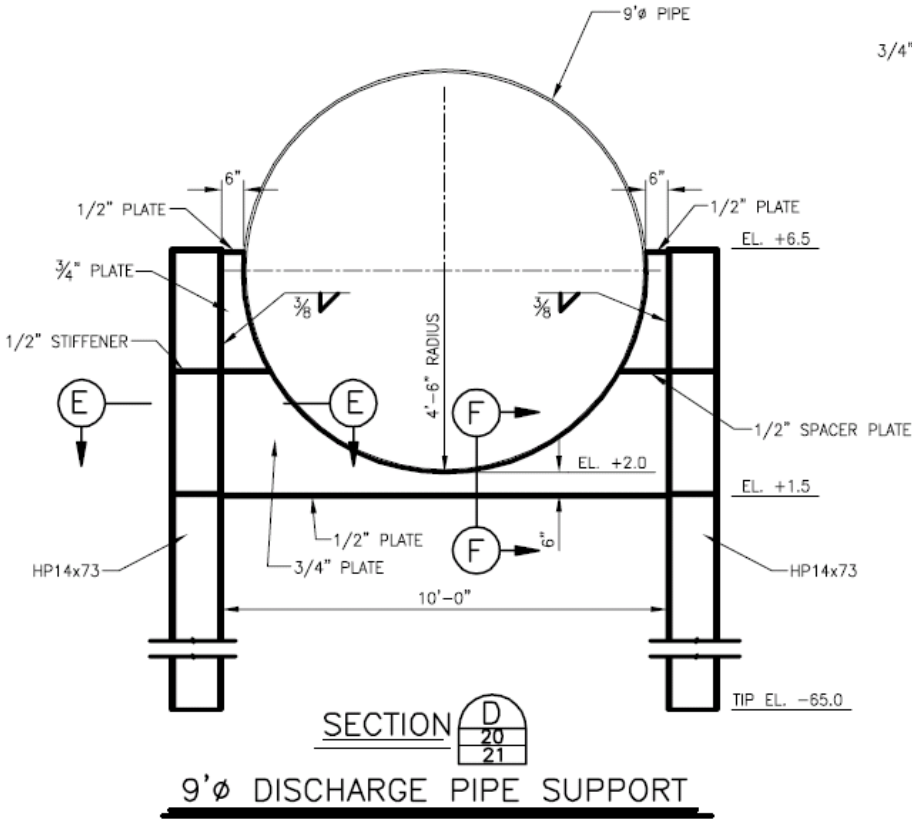

Figure 5 – Orleans Avenue Phase 1 Discharge Pipe Support Section

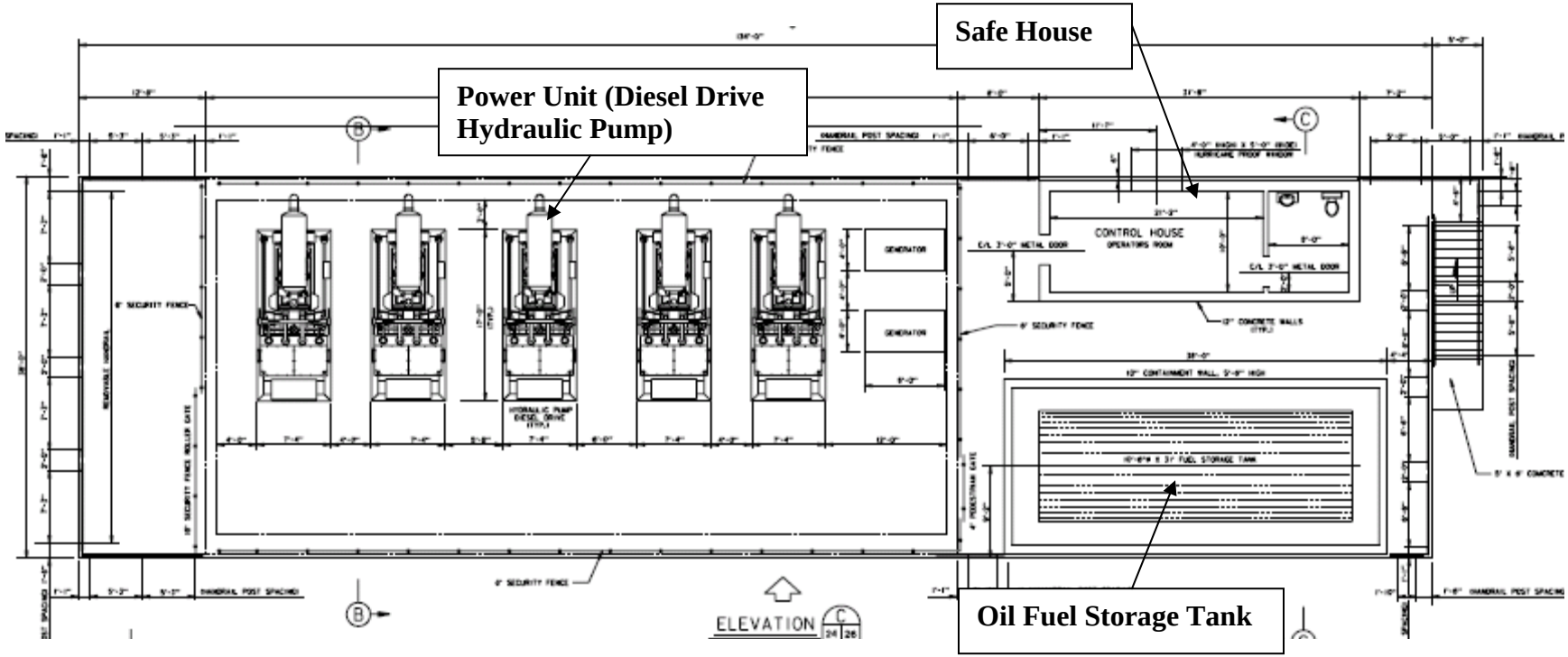

Figure 6 – Orleans Avenue Typical Phase 1 Engine Platform Plan

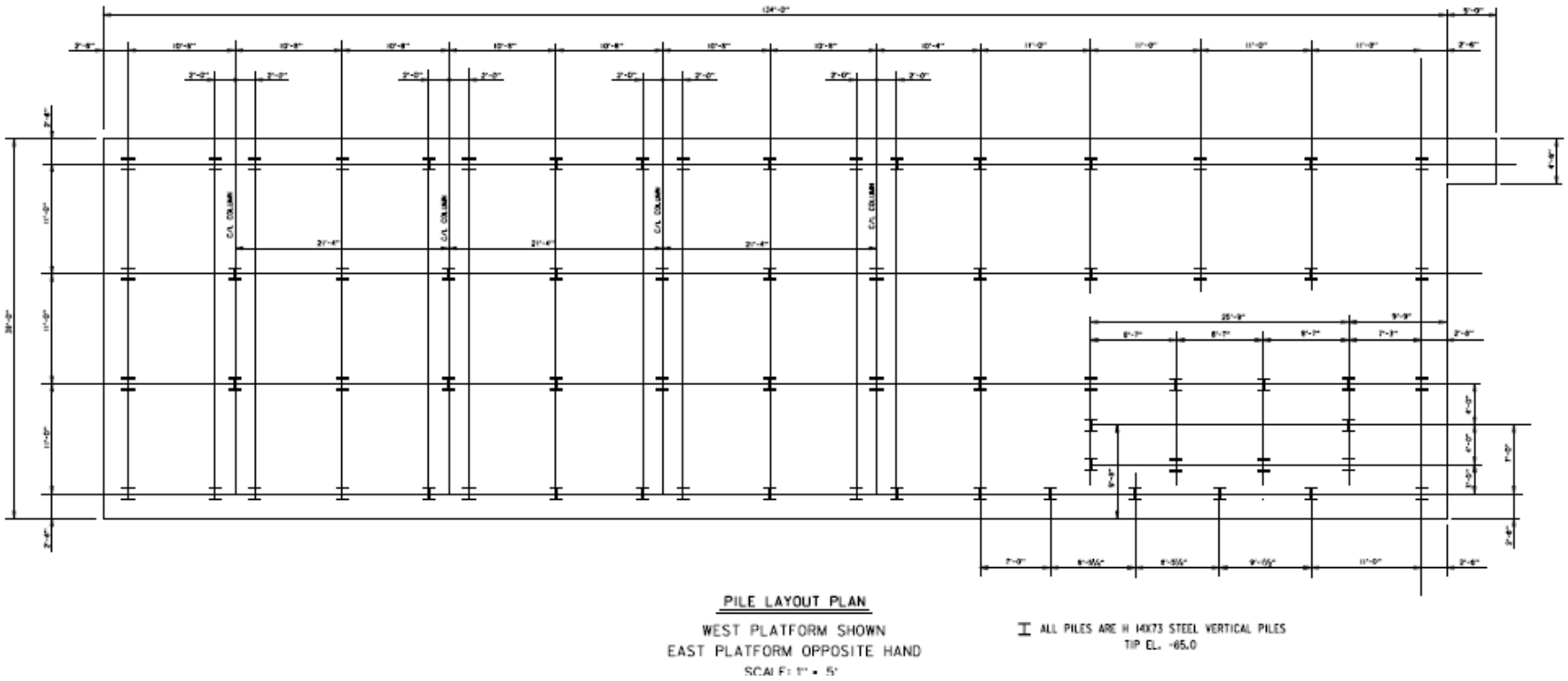

Figure 7 – Orleans Avenue Typical Phase 1 Engine Platform Pile Layout

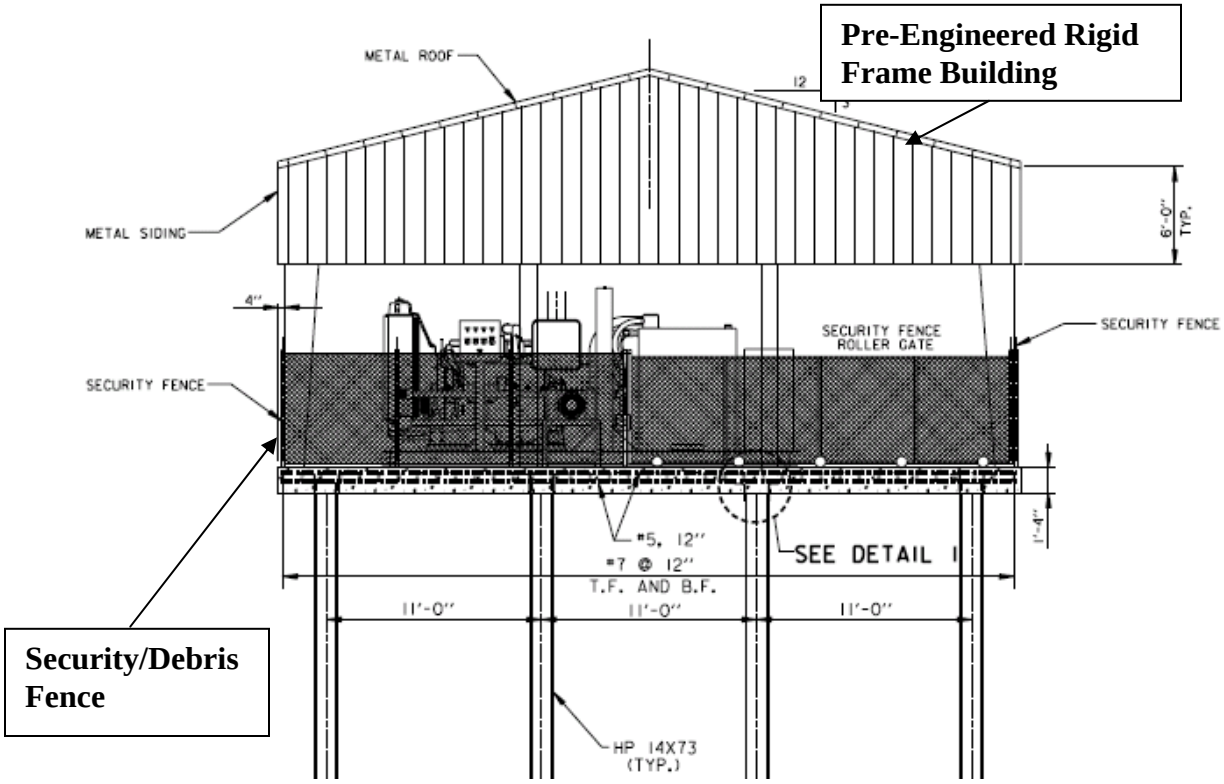

Figure 8 – Orleans Avenue Phase 1 Engine Platform End Elevation

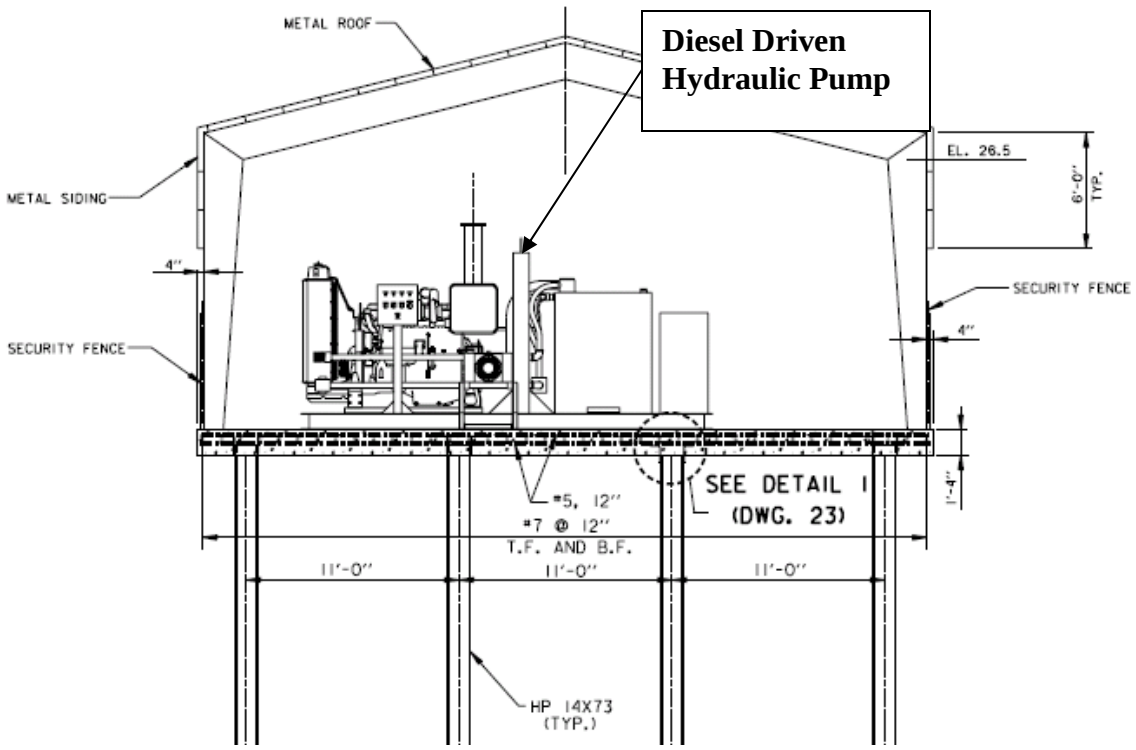

Figure 9 – Orleans Avenue Phase 1 Engine Platform Cross-Section

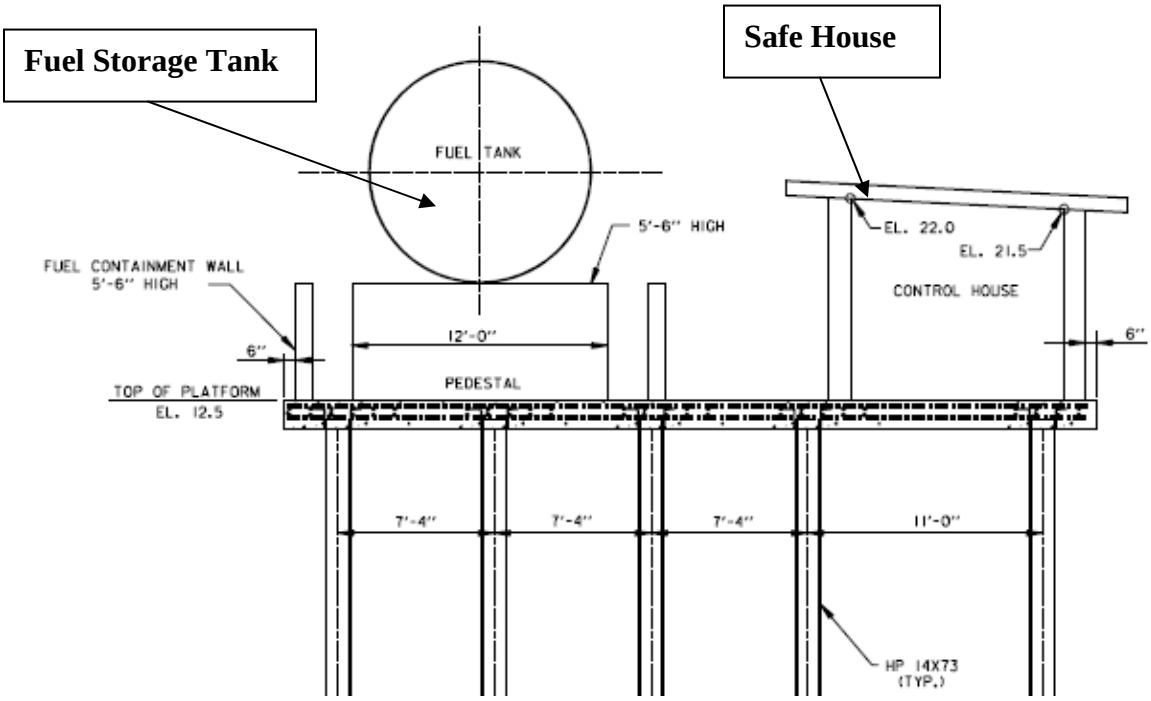

Figure 10 – Orleans Avenue Storage Tank and Safe House Cross Section

London Avenue ICS Facility Pump Systems.

The London Avenue Phase 1 Pump Facilities includes 12 MWI pumps, 12 power units, two pump platforms, two safe house platforms, suction basins, and discharge piping. Figure 1 and 2 shows the overall plan of the London Avenue ICS Pump Facilities.

There are no specific foundation soil improvements that were performed at the ICS facilities for the pump installation. The foundation substructure includes H-pile and sheet pile installation. This pile system supports a concrete slab and forms the suction basin for each pump.

The London Avenue pump intakes are located at elevation -5.0 feet. This is just above top of the suction basin which is at elevation -8.0. The London ICS phase 1 pump platform foundation substructure includes 24-HP14x73 piles with a tip elevation of -70.0 feet. PZ 27 and PZ 22 sheet piling is installed to form the perimeter of the suction basin. The top of the sheet pile is at elevation -8.0 which coincides with the top of the suction basin concrete slab. There appears to be a few locations where the top of the PZ 27 sheets extends up to elevation -2.0 to meet existing grade. The PZ 27 sheet pile tip elevation is -68.0 feet and the PZ 22 sheet pile tip elevation is -30.0 feet.

The suction basin reinforced concrete slab is 24" thick. The pump platform superstructure is comprised of structural steel W shapes and channels that are attached to the HP piles. The structural steel shapes support Borden RW-18A galvanized steel grating and the pumps. The top of steel elevation of the pump platforms is elevation +10.0 feet. Figures 3 and 4 show details of the pump platforms.

The Phase 1 pumps discharge into 9' diameter steel pipes. Three pumps discharge into one 9' discharge pipe (similar for each side of the canal). Figures 1, 2 and 3 show the discharge pipe manifold system at the pump platforms. The discharge pipes pass through the non-overflow cofferdam cells (two through the left non-overflow and two through the right non-overflow). The discharge pipe outlets are located just downstream of the gate closure monolith. Figures 1, 2 and 3 show the layout of the discharge pipe outlets. There are an additional 60-HP14x73 piles with a tip elevation of -65.0 supporting the discharge pipes. Structural steel shapes are attached to the piles to form the pile bents, see Figure 4 for a typical discharge pipe support detail.

The phase 1 pump power units are located on the engine platforms located on each bank. Each engine platform houses a 20,000 gallon single wall fuel tank that is 10.5 feet in diameter and 31 feet long. A 4 room safe house that includes a storage area, operator's room, control room and restroom is located on the same end of the platform. There are 6 power units on each engine platform located on under a pre-engineered rigid steel frame building. A security/debris fence is placed around the power units. The engine platform is a reinforced concrete slab that is 1'-4" thick and supported by 78-H14x73 piles with a tip elevation of -68.0 feet. Figures 5 through 9 show the various details of the engine platform.

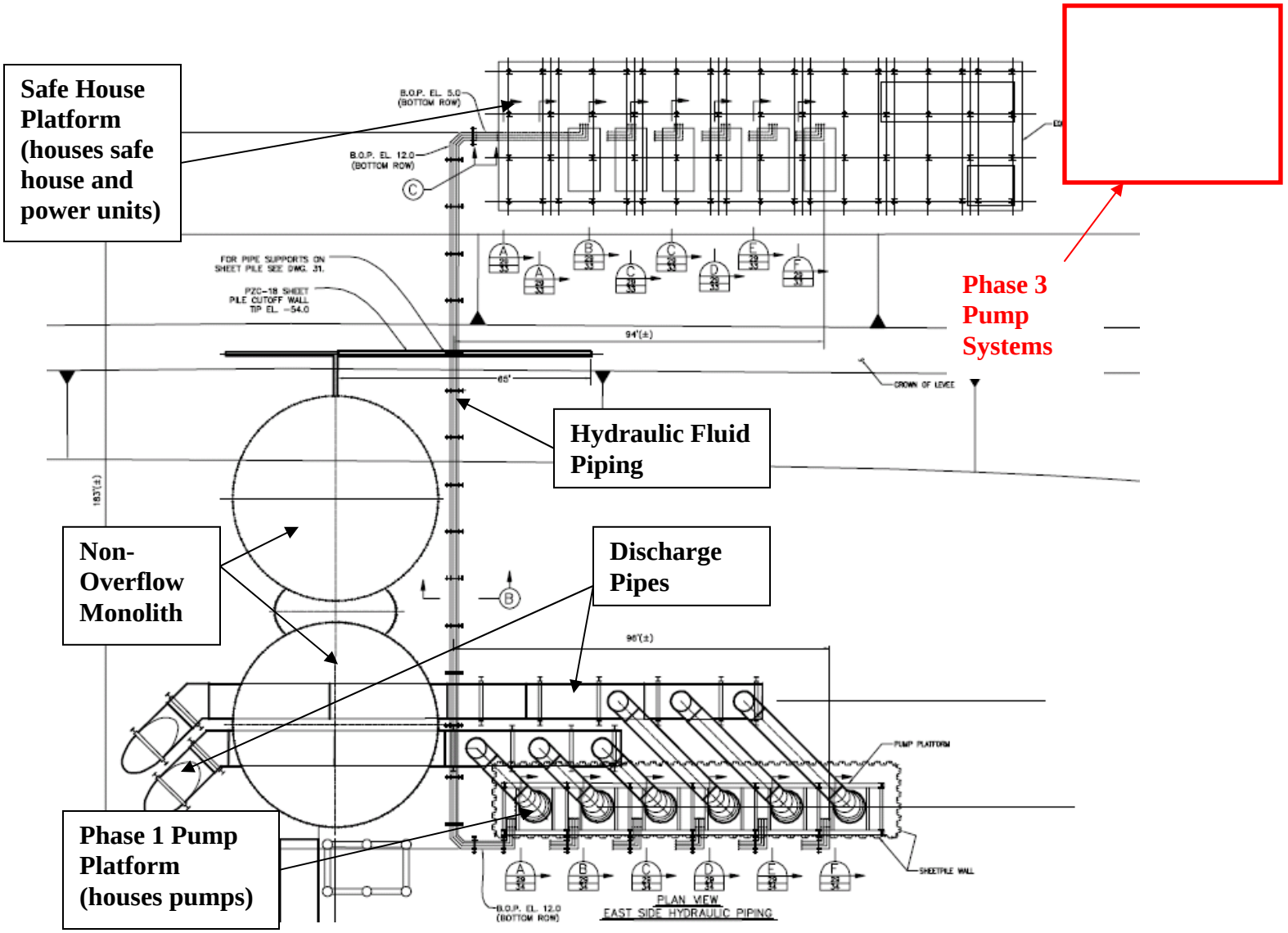

Figure 1 – London Avenue East Bank Pump Facility Site plan

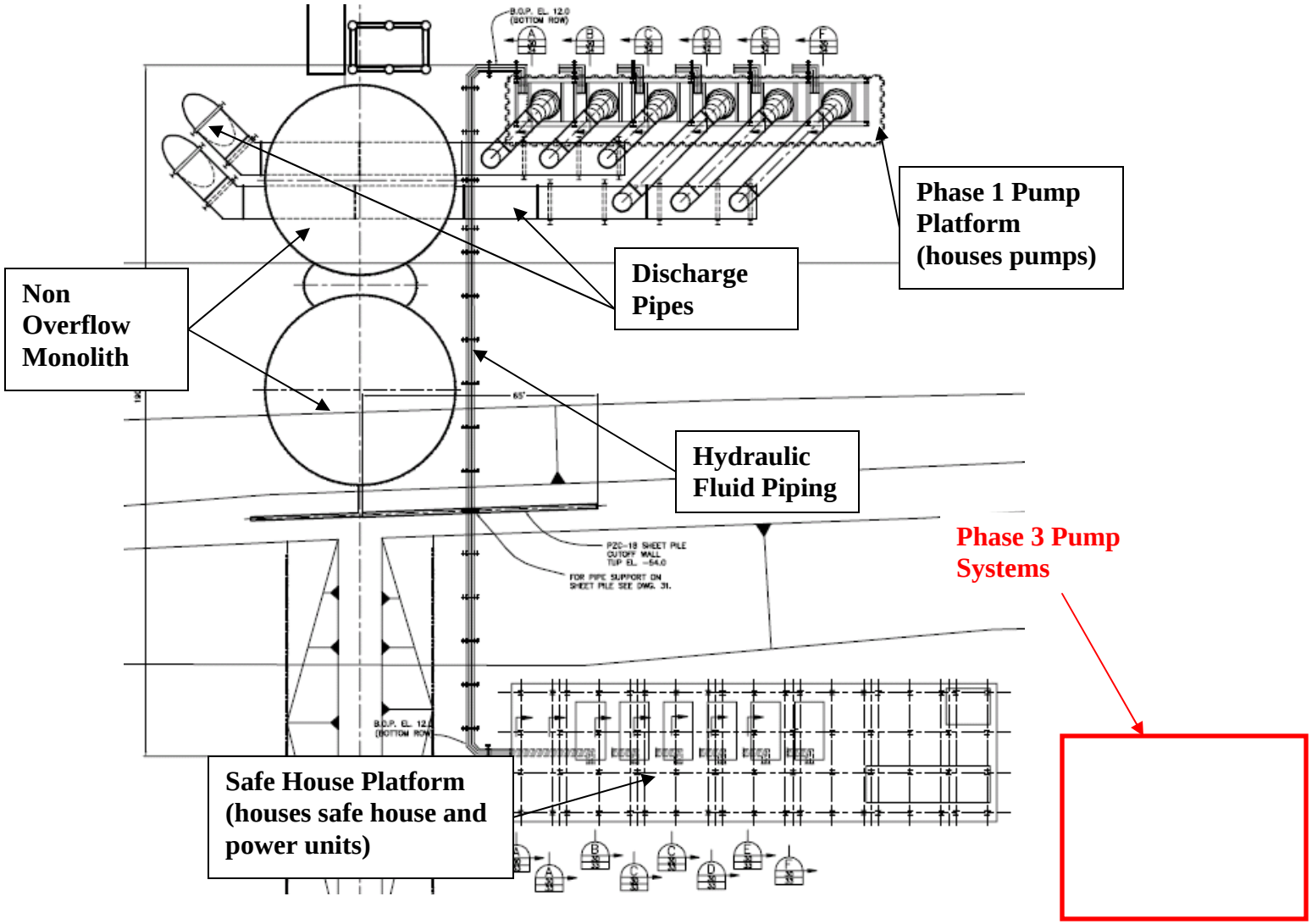

Figure 2 – London Avenue West Bank Pump Facility Site plan

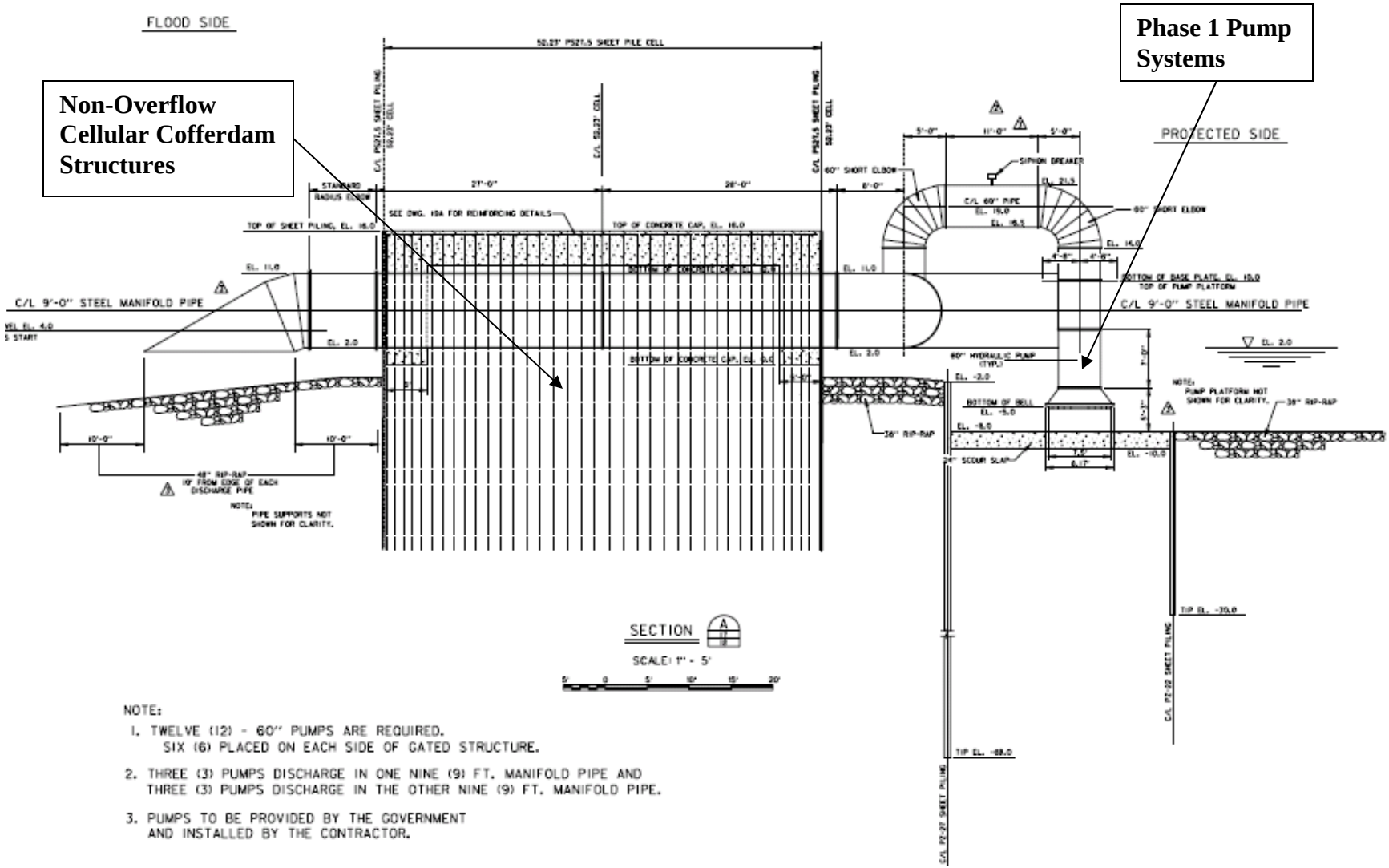

Figure 3 – London Avenue Pipe Discharge Section

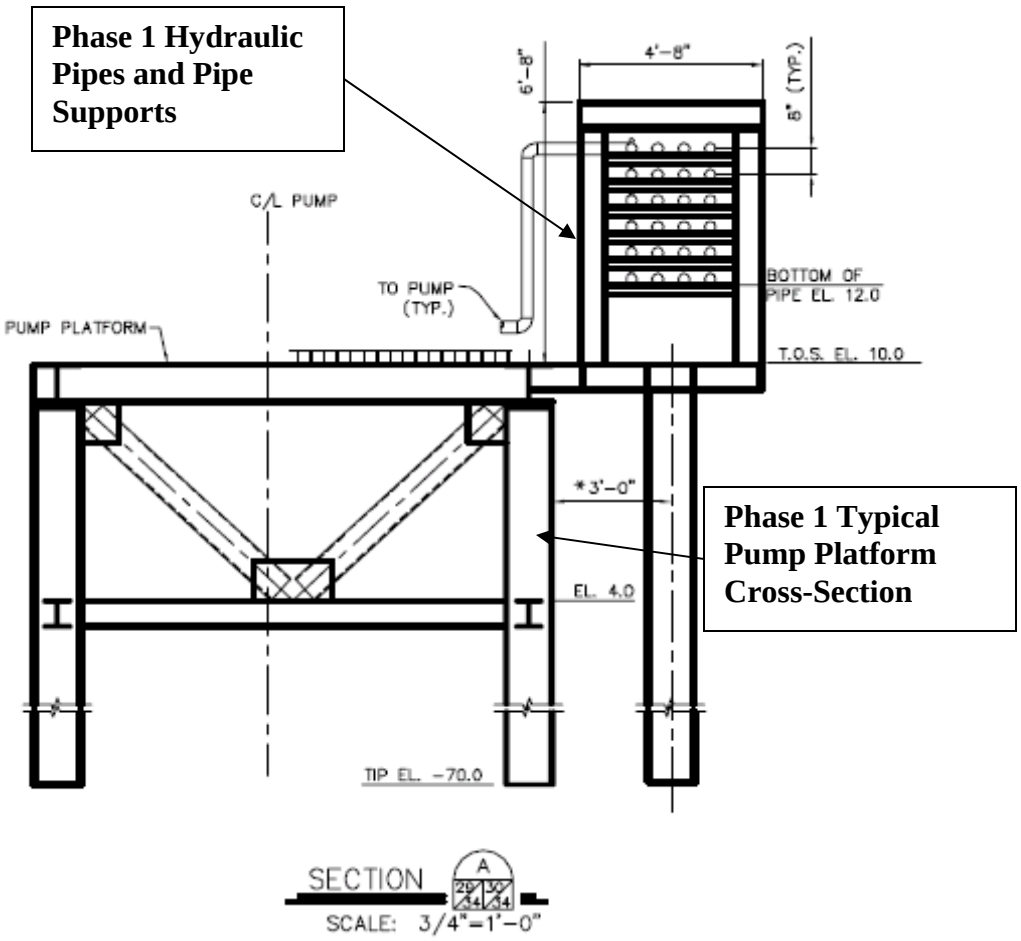

Figure 4 – London Avenue Pump Platform and Hydraulic Fluid Piping Support

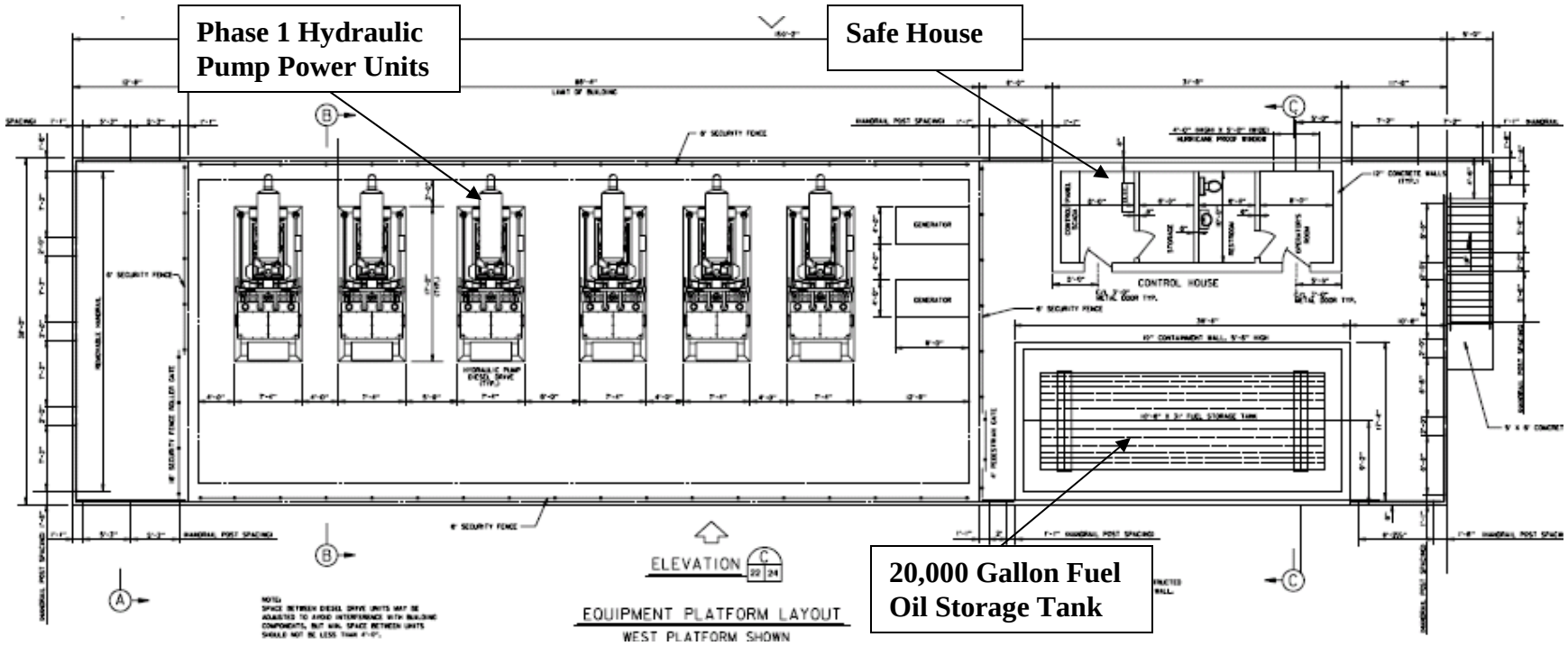

Figure 5 – London Avenue Phase 1 Engine Platform Typical Plan

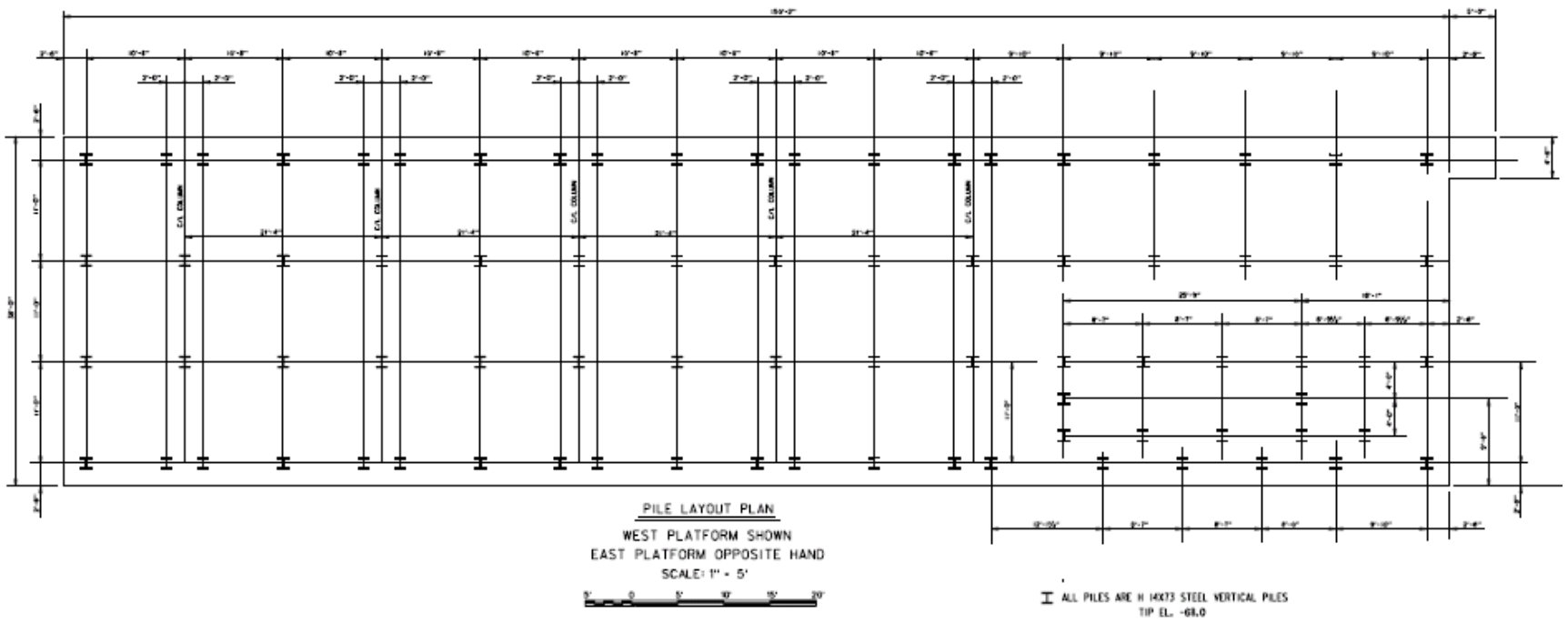

Figure 6 – London Avenue Phase 1 Engine Platform Pile Plan

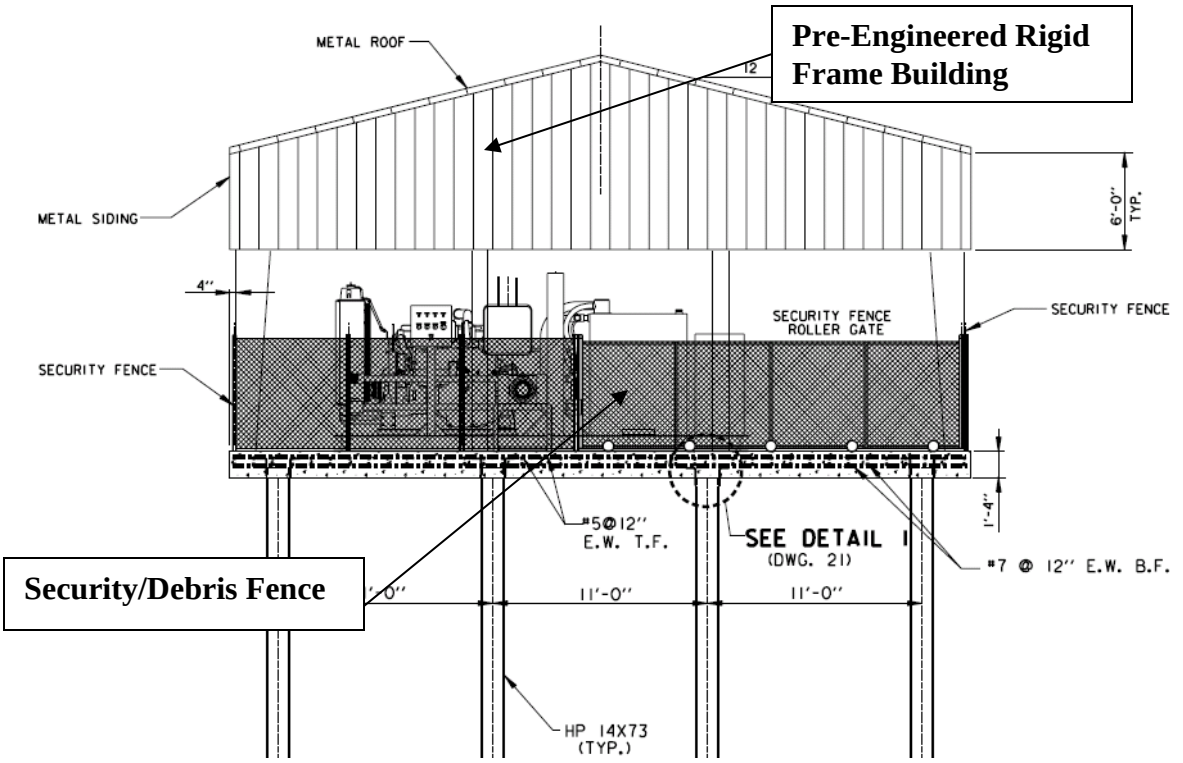

Figure 7 – London Avenue Phase 1 Engine Platform End Elevation

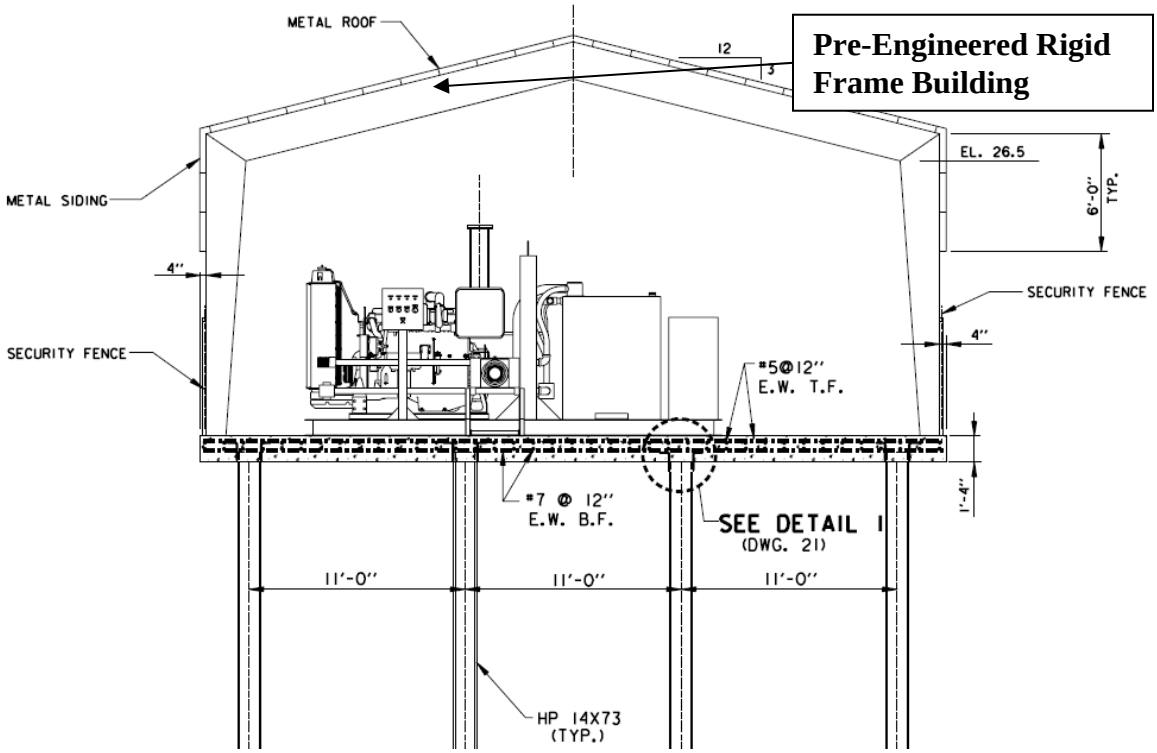

Figure 8 – London Avenue Engine Platform Typical Section

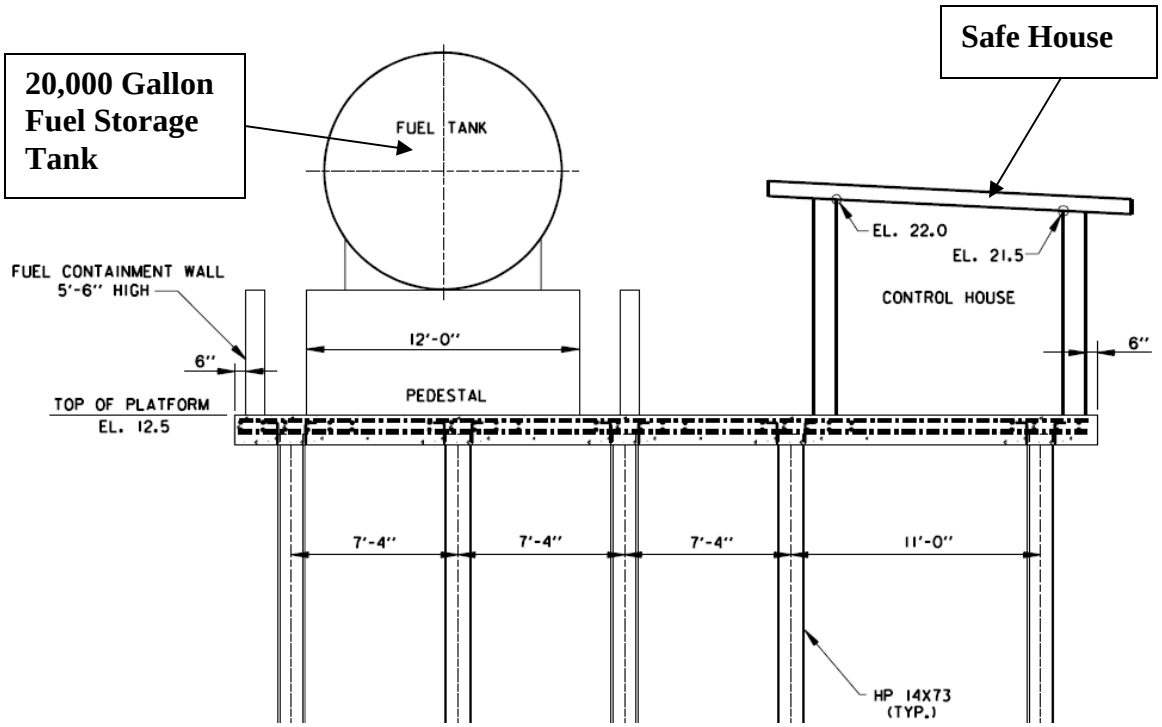

Figure 9 – London Avenue Phase 1 Fuel Tank and Safe House Typical Section

Appendix C

Corrosion Protection

BLACK & VEATCH CORPORATION

TECHNICAL MEMORANDUM
Corrosion Assessment

U.S. Army Engineer District, New Orleans
Corps of Engineers
17th Street, Orleans Avenue and London Avenue Canals
Interim Closure Structures (ICS)

B&V Project 041669
B&V File:
June 2007

Seal

To:

From: Mike Boehler, PE
Project Manager

Prepared By: Bryan Louque, PE
NACE Corrosion Specialist #5191

Reviewed By: Internal Review

BLACK & VEATCH
Building a world of difference.

Contents

TECHNICAL MEMORANDUM
Corrosion Assessment Memorandum

U.S. Army Engineer District, New Orleans
Corps of Engineers
17th Street Canal, Orleans Avenue and London Avenue
Interim Closure Structures (ICS)

B&V Project 041669
B&V File:
June 2007

Executive Summary

This technical memorandum (TM) identifies and evaluates the 17th Street, Orleans Avenue and London Avenue canal interim closure structure (ICS) project components that require corrosion risk assessment and supplemental corrosion protection. The ICS components discussed in this TM include Phase I construction at each location as follows:

Location	Structure	Type of Construction	Materials	Existing Corrosion Protection
17th Street Canal	Non-Overflow Section	Sheet Piling	Carbon Steel	None
	Gate Closure Monolith Substructure	Pipe Piling	Carbon Steel	Protective Coating
	Pumps	Vertical Turbine	Information Not Available	Protective Coating and Cathodic Protection
	Pump Platform Substructure	H Piling and Sheet Piling	Carbon Steel	None
	Power Unit Platform Substructure	Pipe Piling	Carbon Steel	None
Orleans Avenue Canal	Non-Overflow Section	Sheet Piling	Carbon Steel	None
	Gate Closure Monolith Substructure	Pipe Piling	Carbon Steel	Protective Coating
	Pumps	Vertical Turbine	Information Not Available	Protective Coating and Cathodic Protection
	Pump Platform Substructure	H Piling	Carbon Steel	None
	Power Unit Platform Substructure	H Piling	Carbon Steel	None
London Avenue Canal	Non-Overflow Section	Sheet Piling	Carbon Steel	None
	Gate Closure Monolith Substructure	Pipe Piling	Carbon Steel	Protective Coating
	Pumps	Vertical Turbine	Information Not Available	Protective Coating and Cathodic Protection
	Pump Platform Substructure	H Piling	Carbon Steel	None
	Power Unit Platform Substructure	H Piling	Carbon Steel	None

The remaining Phase II and Phase III components at each location will be evaluated as the design information becomes available.

U.S. Army Engineer District, New Orleans
Corps of Engineers
17th Street Canal, Orleans Avenue and London Avenue
Interim Closure Structures (ICS)

B&V Project 041669
B&V File:
June 2007

The primary objective of this TM is to assess conditions and recommend a corrosion protection system for the ICS. The intent is to develop a strategy to ensure that the proposed facilities achieve a service life of 50 years, while requiring minimal maintenance.

Evaluation Methods

An investigation was performed to determine the ICS materials of construction and to identify supplemental corrosion control measures where deemed necessary. The investigation included the following:

- Field investigation to identify ICS components that are subject to corrosion.
- Review of Phase I design drawings.
- Assumptions regarding soil resistivity and chemistry.
- Assumptions regarding water resistivity and chemistry.
- Assumptions regarding atmospheric corrosivity.
- Assumptions regarding the rate of corrosion at each site.

Results

Black & Veatch has assumed that the soils along each ICS installation vary widely in corrosive characteristics. Some areas are relatively noncorrosive, but many areas have the potential to be quite corrosive, especially when wet. The corrosive characteristics are low electrical resistivity and high concentrations of chloride and sulfate salts. Because of the potential for encountering corrosive soils, cathodic protection of the ICS structures will be necessary. Impressed current type cathodic protection is proposed for the structure.

Black & Veatch has assumed that the Lake Ponchartrain water around each ICS installation has the potential to be quite corrosive, especially when salinity levels increase. The corrosive characteristics of the lake water are low electrical resistivity and high concentrations of chloride and sulfate salts. Because of the potential for encountering corrosive waters in the splash, tidal and continuously submerged zones, a combination of protective coatings and cathodic protection of the ICS structures will be necessary. Coal tar epoxy, surface tolerant epoxies, epoxy mastics and polyurethane coating materials are proposed for the structure. Impressed current type cathodic protection is proposed for the structure.

The equations determining the allowable corrosion (sacrificial steel) at any point in the non-overflow structure sheet piling indicate there is a large safety factor in the cofferdam design. About 0.25 inches (250 mils) of corrosion can be tolerated without catastrophic results. Based

on the average (4.5 mils/year) and maximum (9.0 mils/year) submerged zone corrosion rates given in Table 1.4-1, the estimated service life of the non-overflow structure is in the range of 28 to 55 years. Note that the estimated service life is calculated based on corrosion rates taken from the literature. Actual corrosion rates at each ICS can differ from the estimated corrosion rate by as much as an order of magnitude. A method for determining the actual corrosion rate at each ICS location is presented in Section 6.0.

Due to the lack of actual and historical information relative to the site corrosivity, the effect of corrosion allowance on the structure life has not been considered. For the purpose of this analysis, supplemental corrosion protection has been proposed so that net metal loss due to corrosion is negligible over the 50 year structure life.

Recommendations

The results of the investigation led to several recommendations for corrosion protection of ICS structures.

- **Atmospheric Zone -** Steel structures exposed in the atmospheric zone should be protected against corrosion by application of a protective coating. ICS components that require coating include the: 1) engine platform substructures, 2) hydraulic piping and pipe supports, 3) pump platform substructures, 4) discharge piping supports, 5) discharge piping internal surfaces, 6) non-overflow substructures and 7) gate closure monoliths.

  Acceptable, alternative coating materials and methods of application are listed below:

Coating System	Number of Coats	DFT (mils)	Surface Preparation
Coal Tar Epoxy	2	16 - 20	Commercial Blast Cleaning (SP6)
Surface Tolerant Epoxy / Urethane	2	6 - 8	High Pressure Water Jetting (SP 12)
Epoxy Mastic (Aluminum Pigmented)	2	12-16	Power Tool Clean (SP 3)

- **Splash Zone** - Steel structures exposed in the splash zone should be protected against corrosion by application of a protective coating. ICS components that require coating include the: 1) hydraulic piping supports, 2) pump platform substructures, 3) discharge piping supports, 4) non-overflow substructures and 5) gate closure monoliths.

Acceptable, alternative coating materials and methods of application are listed below:

Coating System	Number of Coats	DFT (mils)	Surface Preparation
Coal Tar Epoxy	2	16 - 20	Commercial Blast Cleaning (SP6)
Surface Tolerant Epoxy / Surface Tolerant Epoxy	2	10 -12	High Pressure Water Jetting (SP 12)
Epoxy Mastic (Aluminum Pigmented)	2	12-16	Power Tool Clean (SP 3)

- **Tidal Zone** - Steel structures exposed in the tidal zone should be protected against corrosion by application of a protective coating and impressed current cathodic protection. ICS components that require coating and cathodic protection include the: 1) hydraulic piping supports, 2) pump platform substructures, 3) discharge piping supports, 4) non-overflow substructures and 5) gate closure monoliths.

  Acceptable, alternative coating materials and methods of application are listed below:

Coating System	Number of Coats	DFT (mils)	Surface Preparation
Coal Tar Epoxy	2	16 - 20	Near White Metal Blast Cleaning (SP 10)
Surface Tolerant Epoxy / Surface Tolerant Epoxy	2	10 -12	High Pressure Water Jetting (SP 12)
Elastomeric Polyurethane	1	30	Near White Metal Blast Cleaning (SP 10)

  Protective coatings should extend to elevation 3 feet below MLW. To accomplish this, dewatering of the structure on the protected side and flood site will be required.

- **Continuously Submerged Zone** - Steel structures exposed in the continuously submerged zone should be protected against corrosion by application of an impressed current cathodic protection system. ICS components that require cathodic protection include the: 1) hydraulic piping supports, 2) pump platform

substructures, 3) discharge piping supports, 4) non-overflow substructures and 5) gate closure monoliths.

- **Soil Zone** - Steel structures exposed in the soil zone should be protected against corrosion by application of an impressed current cathodic protection system. ICS components that require cathodic protection include the: 1) engine platform substructures, 2) hydraulic piping supports, 3) pump platform substructures, 4) discharge piping supports, 5) non-overflow sub structures and 6) gate closure monoliths.

CORROSION PROTECTION FOR STEEL PILE STRUCTURES IN MARINE ENVIRONMENTS

1.0 FUNDAMENTALS OF STEEL CORROSION

1.1 Corrosion Mechanism of Steel in Seawater

On steel piling in seawater, the more chemically active surface areas (anodes) are metallically coupled through the piling itself to the less chemically active surface areas (cathodes) resulting in corrosion of the anodic areas.

1.2 Corrosion Mechanism of Steel in Marine Atmospheres

The corrosion of steel in marine atmospheres proceeds by two mechanisms: electrolytic and direct chemical attack. The degree of wetting on the metal surface will greatly affect the corrosion rate.

A wet marine atmosphere, where condensed moisture is visible (corresponding to 100 percent relative humidity), is a very aggressive environment for steel. Under such conditions, the corrosion process is analogous to that of continuous seawater immersion.

In moist marine atmosphere (at relative humidity of less than 100 percent), the electrolytic films on the metal surfaces are invisible to the naked eye and extremely thin. Under these circumstances, dust, salt deposits and corrosion products enhance the corrosion process by entrapping moisture and allowing the electrolytic films to become continuous.

In industrial marine atmospheres, sulfur compounds that are present. under moist conditions the presence of sulfur compounds on the metal surface will greatly accelerate the corrosion rate of steel.

In general, the thickness of the moisture films, the cleanliness of the metal surface, atmospheric temperature and rates of evaporation all influence the corrosion rate of steel above the high waterline.

1.3 Zones of Corrosion of Steel Piles

Examination of corroded marine piles reveals several distinct areas of attack (refer to Figures 1.3-1 and 1.3-2). It is convenient to divide these areas into five zones, each having a characteristic corrosion rate:

- **Atmospheric Zone** - This is the area at the top of the piles which is continuously exposed to the atmosphere above the splash zone. This area is accessible for maintenance.

- **Splash Zone** - This is the area from mean high water level upward to the bottom of the atmospheric zone. In this area, moisture droplets and continuous water films are maintained on the pile surfaces exposed to the atmosphere. These areas are accessible for maintenance, with some inconvenience, at low tide.

- **Tidal Zone** - This is the area between mean low water level and high water level. This zone is subject to alternate periodic immersion owing to tide changes and is accessible for maintenance at low tide with difficulty.

- **Continuously Submerged Zone** - This is the area of the piles which is always submerged extending from the mud line upward to mean low water level. This area is not readily accessible for maintenance without recourse to cofferdamming techniques, structure dewatering, or specialized underwater painting techniques.

- **Soil Zone** - This is the area of total burial in mud or soil and generally does not require maintenance.

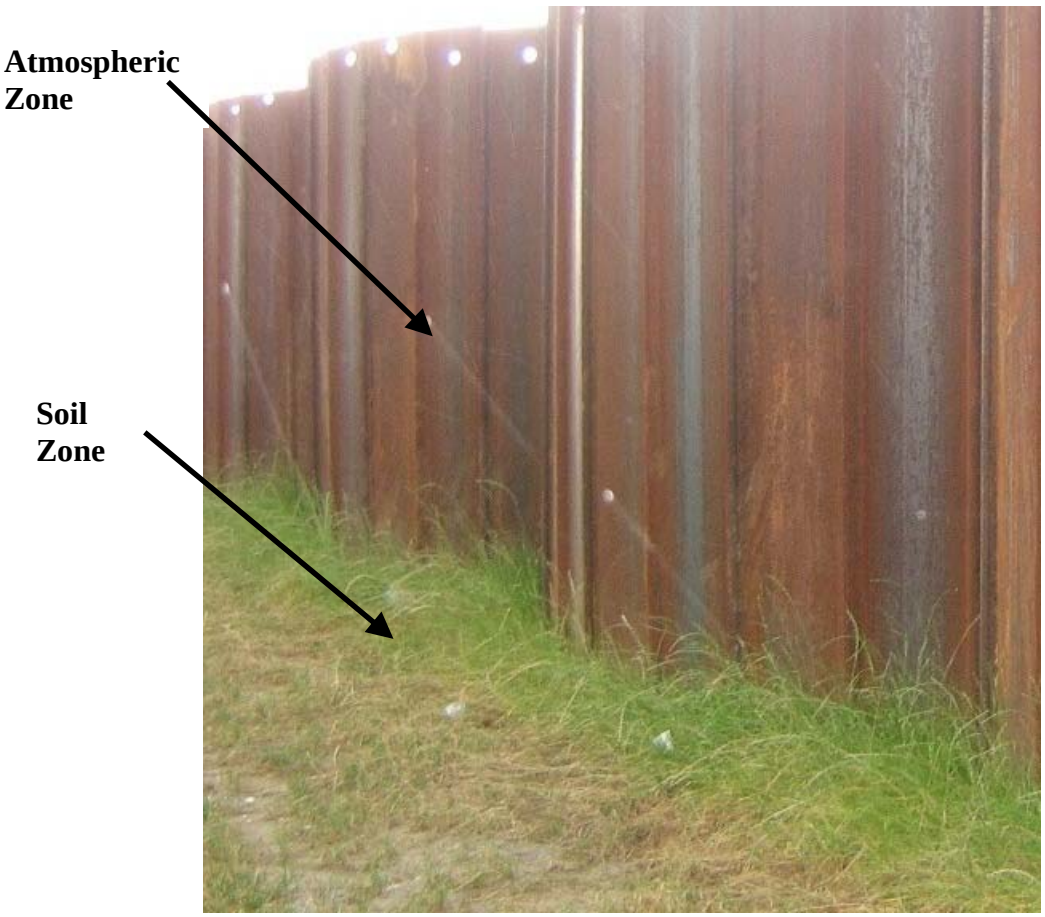

Figure 1.3-1. 17th Street Canal Sheet Piling – Typical Atmospheric and Soil Zones of Corrosion

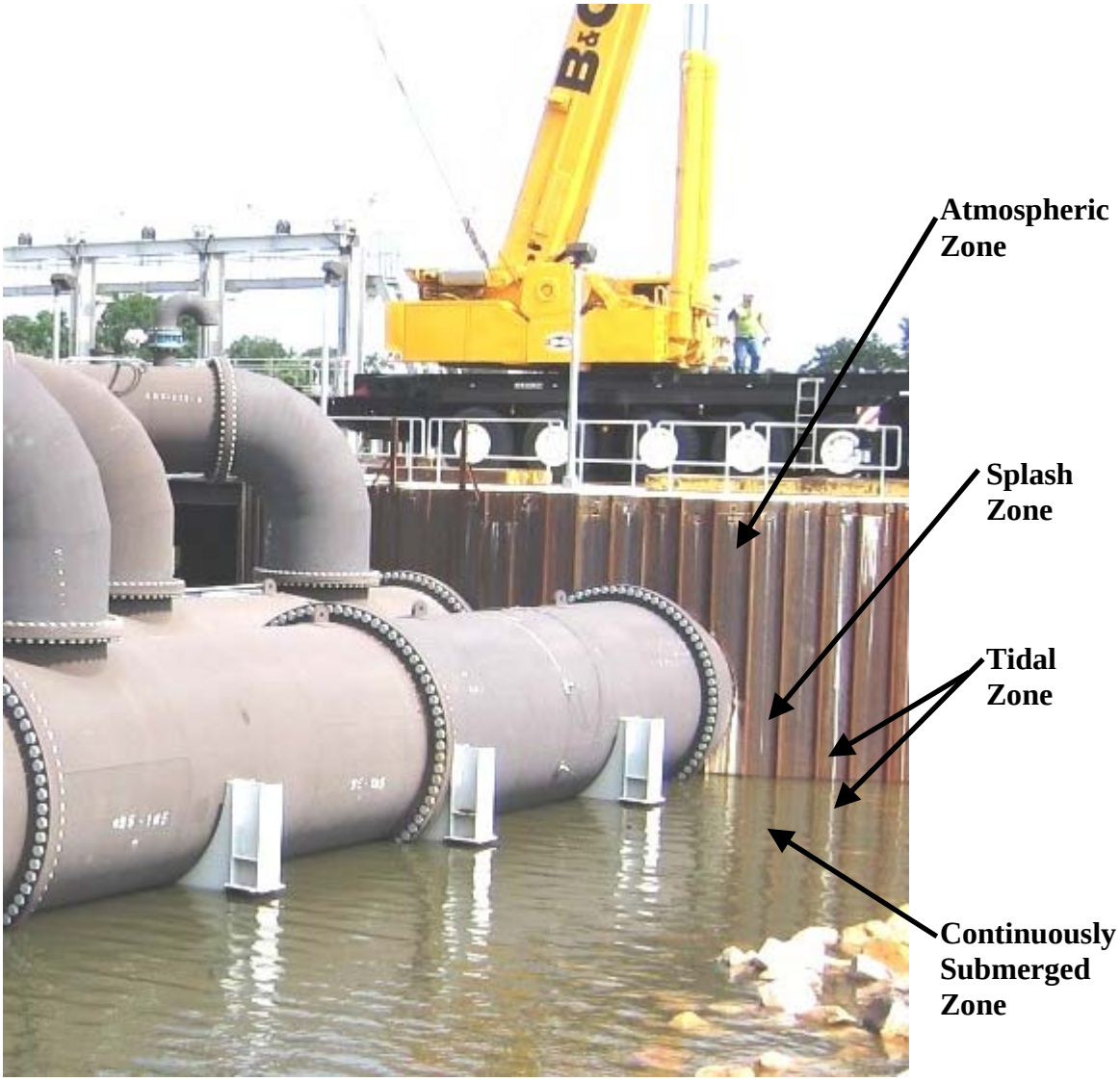

Figure 1.3-2. Orleans Avenue Canal Sheet Piling – Typical Splash, Tidal and Submerged Zones of Corrosion

1.4 Environmental Factors Affecting Marine Corrosion Rates of Steel Piling

Corrosion Rates by Zone - The corrosion rates on steel piling surfaces normally vary considerably by zone. The corrosion rate profile for steel sheet piling, averaged for several harbor installations, is shown on Figure 1.4-1. The varying corrosion loss indicated in each zone is the average of eight harbor installations after 19 years exposure. In general, the maximum reduction in metal thickness occurs in the splash zone immediately above mean high water level.

A significant loss usually occurs a short way below mean low water in the continuously submerged zone. Where steel sheet piling is exposed to water on both sides, the total rate of corrosion of the member is doubled.

The least affected zone is usually found below the mud line, with higher losses at the water-mud line interface. Another low loss area exists in the tidal zone about halfway between mean high water and mean low water levels. Corrosion loss is generally very low on areas of steel piling driven into undisturbed soils.

Erosion - Corrosion in the immersed zones in combination with erosion can produce severe localized attack. Steel in marine environments corrodes initially at a relatively high rate until protective films of corrosion reaction products form on the surface. In stagnant waters, the film is effective. The destruction of these protective films by the mechanical forces of severe wave action increases the corrosion rate in the splash zone.

Water Temperature - Seawater temperature is a complex variable in corrosion reactions. Chemical reactions, which include corrosion reactions, are accelerated in warmer water. However, this increase in corrosion rate is usually offset by an increase in marine fouling rate, which provides a protective covering over the metal surface. There is a decrease in oxygen solubility at higher temperatures which also exerts a retarding influence on the corrosion rate. Thus, contrary to expectations, corrosion rates in tropical seawaters (immersion zone) have not been found to differ significantly from those measured in the temperate and northern latitudes.

Oxygen Concentration - Oxygen is the principal corroding agent of steel in seawater. The rate and concentration at which oxygen arrives at the metal surface determines, to a large measure, the rate of corrosion. Variations in oxygen concentration on the surface of the steel, as a function of water depth, accelerate the corrosion reaction by formation of differential aeration cells along the length of the pile analogous to a galvanic cell. Areas of low concentrations of oxygen are anodic to areas of higher concentration.

The increased corrosion rate in the submerged zone just below mean low water as compared to the tidal zone is attributed to the action of such a differential aeration cell.

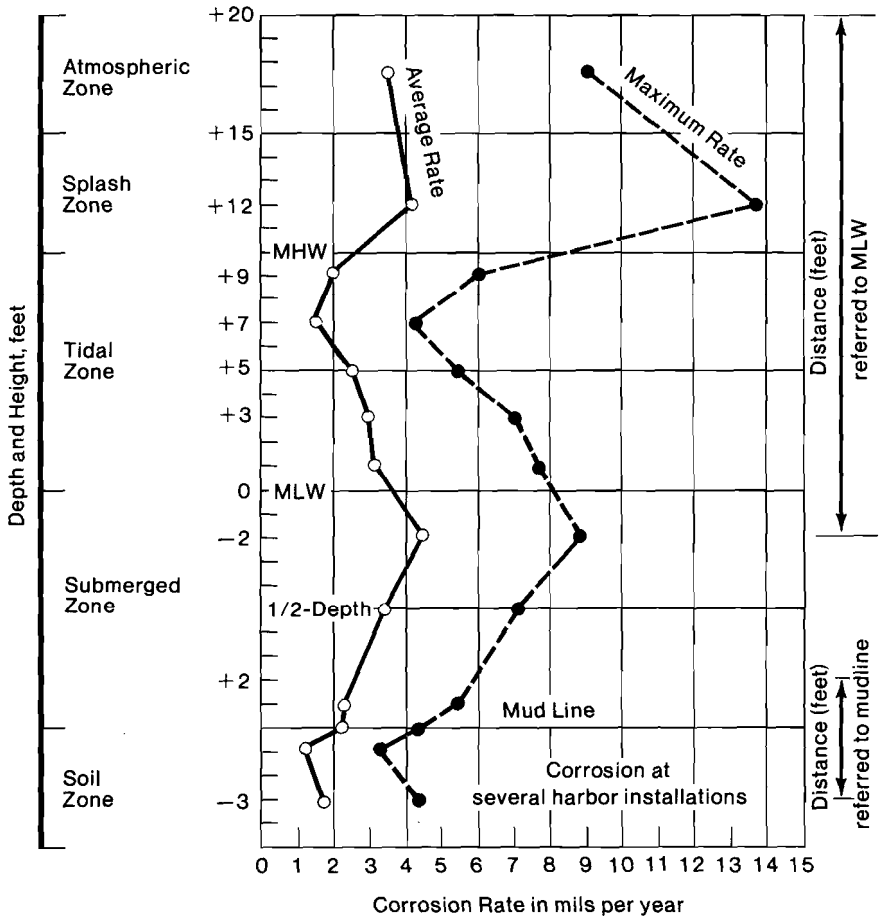

Figure 1.4-1. Corrosion Rate Profile of Steel Sheet Piling

Any mechanism that enhances the arrival of oxygen to the bare steel surface immersed in seawater, such as wave action, water velocity, abrasion by mud or sand, or increasing temperature, will generally increase the corrosion rate, provided the oxygen concentration remains the same and there are no barriers at the metal interface.

pH Value - The pH (degree of acidity or alkalinity) of seawater is almost a constant, ranging narrowly from 7.2 to 8.2. A pH value below 7 is acidic, and above 7 is alkaline. In polluted waters, the pH may vary somewhat, but over the mid-range the corrosion rate of steel is almost constant. The effect of pH changes within the expected norms is of little consequence in influencing the corrosion rate of steel piling.

Salinity - Water in the open sea has a salt content of about 3.5 percent. Dilution occurs with fresh water runoff in lakes and estuaries, but the proportions of the various salts relative to each

other remain virtually the same. Corrosion increases with increasing salinity until it reaches a peak at about one percent sodium chloride and then decreases with increasing salinity. Significantly, the amount of dissolved oxygen is constant up to the one percent sodium chloride concentration and then begins to drop off markedly with increasing salinities. Fresh water and seawater are not as aggressive as brackish waters containing over 0.1 percent chloride ion concentration.

Water Velocity - Increasing velocity of seawater results in an increase in the rate of corrosion of steel piling. With zero velocity (stagnant conditions), the overall corrosion rate of steel in seawater is lower. However, the incidence of pitting, with its higher localized corrosion rate, is greater.

Marine Organisms – Organic matter in natural waters has a marked effect on corrosion. A variety of marine plants and animals can attach themselves to marine structures. These organisms, such as barnacles and grasses, generally accelerate the corrosion rate in localized areas because of differential environmental conditions caused by their biologic processes. Dense, continuous marine growths can sometimes stifle general corrosion by impeding the diffusion of oxygen to the metal surface.

Pollution – Polluted waters may contain anything from domestic sewage to complex industrial wastes, oil well brines and spilled oil. Pollution generally causes harm to biological species by its toxic effect or by depletion of the dissolved oxygen. Contaminants that reduce pH or introduce sulfides locally at the site of the piles increase the corrosion rate of steel.

Wind - Wind is the major cause of wave action, which results in intermittent wetting in the splash zone. Wind also whips up the water surface and captures salt spray from breaking waves. The salt-laden air evaporates and the remaining salt dust is deposited on horizontal and inclined metal surfaces. These salt particles accelerate the corrosion of the steel surfaces to which they adhere because they attract and retain moisture and form aggressive local cells.

Rain - Rain leaves thin films of water which dissolves salt deposits on the surface of the metal. This promotes corrosion due to rapid oxygen diffusion through the thin film electrolyte. Heavy rains also serve to wash debris and salt from steel surfaces and, thereby, reduce the corrosion rate.

Humidity - Atmospheric corrosion, as described earlier, occurs when visible moisture films are present on the surface at 100 percent relative humidity. Under conditions of less than 100 percent humidity, corrosion proceeds under an extremely thin, invisible film of electrolyte formed on the surface. In dry atmospheres, in the complete absence of moisture, corrosion is relatively mild and proceeds by direct chemical attack, such as the oxidation of iron by air.

Sun - The sun causes an increase in temperature of the surrounding atmosphere and influences the relative humidity, the rate of evaporation and the temperature of the structure. This influences the corrosion rate in complex ways. The alternate drying and wetting of metal surfaces in salt-laden atmospheres causes localized acceleration of corrosion because of the disruption of natural protective films on steel. Long-term ultraviolet exposure from the sun has a damaging effect on the pigmentation and composition of many coating systems.

2.0 ECONOMICS OF CORROSION CONTROL

2.1 Economic Analysis of Corrosion Control Methods

To justify the application of any corrosion control method or combination of methods, an economic analysis has to be made. This is necessary to determine whether additional investment for corrosion control will result in a lower overall cost for the structure than the cost for repair or replacement of the structure periodically.

Several factors' have to be taken into account when making an economic analysis. These factors include the following:

- Corrosion will inevitably result in costs.
- Corrosion should be controlled in the most economical way possible.

2.2 Economic Factors Affecting Cost Estimates of Corrosion Control Methods

The following paragraphs discuss the separation of costs into those due to capital investment and those due to operation and maintenance of the system.

Initial Investments - These are the additional initial costs incurred due to the application of corrosion control to the structure. They include the following:

- The additional cost (or savings) in the structural design due to corrosion design considerations.
- The additional cost of corrosion control materials or methods including:
  - Cost of sacrificial steel.
  - Materials and procedures for providing electrical continuity.
  - Cathodic protection rectifier and associated hardware.
  - Anodes and associated hardware.
  - Cable.
  - Protective coatings.
- Additional labor costs include the following:
  - Electricians.
  - Welders.
  - Coating applicators.

Operating Costs - Additional costs incurred due to the operation and maintenance of the corrosion control system include the following:

- Power for rectifier operation.
- Anode replacement (materials and labor).
- Annual corrosion surveys.
- Bi-monthly checking of rectifier operation.
- Inventory and spare parts.
- Periodic coating maintenance (materials and labor).

3.0 DESIGN AND FABRICATION PRACTICES

3.1 Design Provisions

Provision for Corrosion Allowance - In the design of steel structures for marine use, if structural shapes can be increased in cross section to allow for loss of thickness by corrosion, factors of safety and structural integrity can be maintained without the further necessity of additional corrosion control measures.

It is not uncommon to apply excellent coatings at costs on new construction of $2.50 to $3.00 per square foot which will provide effective protection for periods up to ten years or more. Protective coatings can provide an economical alternative to a sacrificial steel corrosion allowance. However, renewal of coatings underwater, while feasible, is costly.

The cost of cathodic protection for bare steel also can be compared to the costs for a sacrificial steel corrosion allowance. Cathodic protection costs would normally not exceed $1.00 per square foot, and substantially lower costs could normally be anticipated. Thus, it appears that corrosion allowances are not necessarily the economic route for providing corrosion protection to fully submerged underwater structures. However, in the tidal zone, where cathodic protection is only partially effective, corrosion allowance costs may be justifiable when compared to other methods.

Provision for Cathodic Protection - Submerged portions of marine structures may require cathodic protection sometime during their service life. Installation during construction of wire ways, brackets and bonding cables, and bonding the structure together as an electrical unit are well justified against such costs of installation after erection of the structure.

3.2 Fabrication Practices

Protective Coating During Fabrication - Marine structures that will be exposed in the atmospheric and splash zones for which painting is specified would benefit from shop treatment of the steel, as it is usually more economical at that time to blast clean steel and apply the protective coating than after erection. Shop applied coatings also permit better quality control.

4.0 PROTECTIVE COATINGS

Protective coatings offer a means of providing additional life to piles in marine structures at moderate additional first cost. Coatings often need be applied only to those portions of the piles severely exposed to obtain a structure that will meet the service life requirements of the facility. Coatings combined with thicker steel shapes will often enable the designer to meet extra long-term life requirements.

Many coatings have been formulated and evaluated for marine service. The types of coatings commonly used for atmospheric and immersion (splash, tidal and submerged zones) service are coal tar epoxies, surface tolerant epoxies, epoxy mastics and polyurethanes.

Coal-Tar Epoxies - The coal-tar epoxies are believed to have the largest current use in coating steel marine structures for immersion service. This large usage is due to a combination of good service record, ease of application and economy. It is recommended that, for immersion service, a minimum of 16 mils dry film thickness be applied. This system is suitable for structures exposed to immersion. It is also suitable for underground exposure. The system exhibits excellent adhesion when applied over blast cleaned surfaces.

Epoxies - Epoxies form hard coatings with good chemical and water permeation resistance. They offer good corrosion protection in all zones of a marine structure. However, they tend to discolor and look unattractive in atmospheric exposure. Surface tolerant variations can be applied up to 10 mils dry film thickness over marginally prepared steel surfaces and in the presence of moisture. Aluminum pigmented epoxy mastics are suitable for atmospheric exposure as well as areas that are frequently wet (excluding immersion). This system exhibits excellent adhesion when applied over blast cleaned surfaces or hand tool / power tool cleaned surfaces.

Urethanes – Urethane painting systems are intended principally for steel exposed to the atmosphere where excellent weathering, color retention and chemical resistance is desired. One hundred percent solids elastomeric urethanes are suitable for structures in immersion service. This high film build, flexible system offers outstanding abrasion and impact resistance as well as extremely quick cure capabilities for fast turnaround applications. Elastomeric urethanes exhibit excellent adhesion when applied over a blast cleaned surface.

4.1 Surface Preparation

The ultimate life of a protective system is dependent upon substrate cleanliness and proper anchor profile.

Blast cleaning is commonly used in the surface preparation of steel piling when protective coatings are indicated. Although varying degrees of surface blast cleaning are used, a surface

blasted to a near-white (SSPC-SP 10) condition is expected to give best results and is deemed a necessity for long-term service of coatings immersed in seawater. Blast cleaning to this extent is not economical for many structures and, therefore, for less corrosive environments such as atmospheric exposure, a quality commercial blasting (SSPC-SP 6) is considered adequate.

Other cleaning methods available for preparing steel piling surfaces for coating are solvent cleaning (SSPC-SP 1) hand tool and power tool cleaning (SSPC-SP 2 and SP 3), and high pressure water jetting (SSPC-SP 12). These methods are considered to be more limited in use and effectiveness than blast cleaning and are generally employed on localized areas needing touch up and coating repair.

4.2 Coating Application

For coating application on existing structures within the splash or tidal zone, drying time or curing of the coating system must be considered, since the time interval between low and high tide is relatively short.

Most coatings can be applied by airless spray, conventional spray, brush or roller methods. For specific details on mixing, thinning, application techniques, thickness of coats and drying or curing times, the recommendations of the manufacturer should be followed.

As the purpose of the coating is to isolate the steel substrate physically and electrically from its environment, it is most important that the coating system be free of pinholes and voids (holidays).

4.3 Inspection

The proper application of a coating to a marine structure is vital to achieving the desired service life. This requires close attention and adherence to specifications by the applicator. It is most important that inspection of the coating be performed during and after completion of the application.

5.0 CATHODIC PROTECTION

Cathodic protection is an electrochemical method of corrosion control. It is frequently used to protect submerged and buried structures from corrosion. Cathodic protection transfers uncontrolled corrosion of the structure to controlled corrosion of external anodes, which are easily replaced after being consumed. It is an effective method of protecting both bare and coated steel pilings under total immersion conditions; it is also partially effective in providing protection in the tidal zone under alternate conditions of immersion.

5.1 Types of Cathodic Protection Systems

Underground or submerged metallic structures can be protected by two types of cathodic protection systems:

- Galvanic anode systems.
- Impressed current systems.

A galvanic anode system consists of a sacrificial anode which is electrically connected to the structure and immersed in an electrolyte (seawater). The anode is consumed to produce the required current to maintain the structure in a cathodic condition. Certain metals, such as zinc, magnesium and aluminum, make effective galvanic anodes if the proper alloys are used.

An impressed current system utilizes dc power from an external source to drive current to the protected structure. Anodes are consumed slowly under the action of the impressed current.

An impressed current system normally consists of the following:

- Anodes and associated dc positive wiring.
- Dc power supply and means of current regulation.
- Negative return circuit from protected structure to dc power supply, including tying the structure together (bonding).
- Reference electrode and means for measuring structure potential (optionally, portable test equipment can be used).

5.2 Design of Cathodic Protection Systems

The general design practice that is followed in selecting and sizing a cathodic protection system is the same for galvanic anode or impressed current systems. The objective is to provide a

system capable of delivering and distributing sufficient direct current to maintain the buried or submerged structure in a passive (non-corroding) condition for a specified period of time. To achieve this objective, the following steps are considered:

- Determine the initial and nominal protective current requirements for the structure.
- Select appropriate anode materials and determine size and number of anodes required for a given service life requirement.
- Locate and space anodes to obtain uniform and efficient current distribution to the structure taking account of such factors as anode repair and replacement.
- Provide suitable mounting methods for mechanically and electrically securing anodes to the structure.
- Provide suitable wiring circuits for impressed current systems.
- Provide suitable bonding means for the structure.
- Determine rectifier requirements for impressed current systems.

Protective Current Requirements - To obtain corrosion protection of the structure, it is necessary to provide sufficient external current from the cathodic protection system protect the structure against corrosion.

Once the current density requirement is identified, it is simply multiplied by the total submerged surface area (up to MHW) to determine the current requirement for the bare structure in the submerged and tidal zone. Additional current must be added for the surface area in the submerged zone (front and backside on sheet piling). This requirement will depend on soil conditions. If the structure is coated in some or all of the tidal, submerged and soil zones, a factor must be applied to the current density for bare steel to compute the current density for coated steel.

6.0 PRACTICAL APPROACHES TO THE DESIGN OF CORROSION CONTROL SYSTEMS

The design procedures outlined below are intended to provide a guide for the engineer to select and design the most cost-effective corrosion control system for a steel structure in a marine environment.

6.1 Collection of Design Data

Complete information on the steel pile structure (installation and design details) and the surrounding environment are the most important factors in evaluating the corrosion hazard and selecting the proper corrosion control system.

Steel Pile Structure to be Protected - Complete knowledge of the structure under consideration should be obtained and the construction specifications and drawings should be reviewed for the following:

- Description of materials used.
- Welding procedures (grounding connections, welding materials, etc.).
- Design details for calculating the steel areas in the atmospheric, splash, tidal, submerged and soil zones.

Environmental Data - As steel piles in a marine environment are exposed to different type of corrosion attack in the atmospheric, splash, tidal, submerged and soil zones, it is important that detailed data on the surrounding environment be collected. This will allow design of the most suitable and economical method or combination of methods for corrosion control. These data should include the following:

- Information on atmospheric and water pollution.
- Water resistivity and pH.
- Range of relative humidity.
- Range of water temperatures.
- Range of oxygen concentration.
- Salinity.

- Range of water velocity.
- Marine organisms.
- Tidal range.
- Any other pertinent data.

These factors will determine the severity of corrosion attack to be expected in the respective exposure zones of the piles.

6.2 Assessment of the Corrosion Hazards

When all the pertinent data related to the material description and design of the steel pile structure and the corrosivity of the environment have been collected, an evaluation of the corrosion hazards of the steel piles can be made. This evaluation has to be made by zones as, in all probability, different corrosion control methods or combination of methods will be required.

The information obtained should be divided in accordance with the zones affected by it, as follows:

- Atmospheric
- Splash
- Tidal
- Submerged
- Soil

Atmospheric Corrosion - The top portion of the pile that is exposed to atmospheric conditions is susceptible to electrolytic and/or chemical attack. The rate of atmospheric corrosion varies according to the following factors:

- Range of relative humidities.
- Degree of pollution of the atmosphere.
- Chemical composition of the steel.

Corrosion in the Splash and Tidal Zones - The most serious form of corrosion attack in the splash and tidal zones is pitting. Pitting is a form of localized galvanic cell corrosion and its rate is considered to be much higher than the corrosion rates encountered in the form of general corrosion. Some of the most important information required to evaluate fully the corrosion hazards in these zones are:

- Corrosivity of water (resistivity, pollutants, pH, etc.).
- Atmospheric conditions.
- Extent of tidal and splash zones.

This information is important for the selection of the appropriate corrosion control system.

Corrosion in the Submerged Zone - Two types of corrosion may be encountered in this zone: general and localized pitting types. Uniform corrosion occurs over the entire exposed metal surface of the pile, while localized pitting is confined to a discrete area of the pile.

Information required to evaluate the corrosion hazards in the submerged zone includes the following:

- Water pollution, velocity and temperature.
- Salinity and pH.
- Oxygen concentration and marine organisms.
- Sulfate-reducing bacteria.

Corrosion in the Soil Zone - Generally, the corrosion rates in the soil zone have been found to be much less than the average corrosion rates in the submerged zone.

Information, in addition to that already collected, which may be useful in evaluating the corrosion hazards in this area, includes the soil characteristics. Corrosion control methods used to reduce corrosion in this area are similar to those for the submerged area.

6.3 Corrosion Control Measures

There are four basic corrosion control methods:

- Good design and fabricating practices.

- Steel selection by composition.
- Coating (isolation of steel surface from the surrounding environment).
- Cathodic protection (mitigation of corrosion in the submerged/soil zones and partially in the tidal zone).

Coatings - Coatings provide corrosion protection to the steel piling by isolating the steel surfaces from the surrounding environment. There are certain types of coatings that may be used to provide corrosion protection to one or more zones (atmospheric, splash, tidal, submerged, and soil). The type of coating to be used depends on the following:

- Economics.
- Degree of performance desired in the particular environment.
- Whether supplementary corrosion protective measures are used, such as cathodic protection.

Cathodic Protection - Cathodic protection is an electrochemical method that can provide corrosion protection to the tidal, submerged and soil zones of any steel structure.

There are two basic types of cathodic protection systems: the galvanic and the impressed current. The selection of the system to be used will depend mainly on design parameters and economics.

Galvanic Anode System - This system is a simple application of a dissimilar metal corrosion cell. When the steel piling is electrically connected to a metal (zinc, magnesium or aluminum anodes) higher in the electromotive series (more negative galvanic potential) and both are in a common electrolyte (sea water), the more active metal (anode) is consumed to protect the steel cathode.

Impressed Current System - An impressed current system is similar to a galvanic system with the exception that a source of direct current (usually rectifiers) is introduced into the circuit to increase the driving voltage between the anode and the cathode.

With this system, the materials most frequently used for anodes are as follows:

- High silicon content cast iron.
- Graphite.

- Mixed metal oxide.

The selection would depend on availability and economics. The source of direct current is usually a rectifier that converts ac current into dc current.

Appendix D

Deficiencies
(By ICS Facility)

London Canal ICS - List of Deficiencies

Structure	Deficiency	Description
Non-overflow	Coating	Closed cell sheet piling, atmospheric zone.
	Coating	Closed cell sheet piling, splash zone.
	Coating	Closed cell sheet piling, intertidal zone.
	Coating	Closed cell sheet piling, permanent immersion zone.
	Coating	Closed cell sheet piling, underground exposure zone.
	Sheet pile Embedment Depth	Maybe not deep enough to prevent global failure
Gate Closure Monolith	Cathodic Protection	Steel jacket substructure.
	Cathodic Protection	Needle gate.
	Cathodic Protection	Needle gate guide beam.
	Sedimentation in Bulkhead Closure Slots	No bubbler system
	No Wheels on Bulkheads	No ability to close or open gates with adverse head present
	Exposed Bulkhead Hoisting Equipment	May be damaged during storm event
	Gate Closure Monolith Grating	Requires cribbing to support cranes
	Gate Operation	Location of Controls
Pumps	Coating	Platform framing, intertidal zone.
	Coating	Discharge header internal surfaces.
	Coating	Discharge header pile bents, intertidal zone.
	Cathodic Protection	Vertical turbine pumps, external surfaces.
	Material Selection	Discharge piping flange nuts and bolts.
	Exposed Hydraulic Lines	Potential to breakdown due to weather exposure & spill into canal
	Pump Supports at Platform Level	Poor mounting may increase vibrations and maintenance issues
	Pump Maintenance Access	Requires large crane capacity
	Hydraulic Line Connection Location	Reduces ability to perform adequate maintenance
	Hydraulic Cooling Unit Location Underwater	Biological growth may compromise cooling unit reducing capacity
	Number of Pumps	Requires full time maintenance, may require maintenance facility
	Pump Maintenance Access	During event the access is limited, non hurricane operation issues

London Canal ICS - List of Deficiencies Continued

Structure	Deficiency	Description
Power Units	Coating	Hydraulic conduit supports, atmospheric zone.
	Coating	Hydraulic conduit supports, splash zone.
	Coating	Hydraulic conduit supports, intertidal zone.
	Coating	Hydraulic conduit supports, underground exposure zone.
	Coating	Engine platform pilings, atmospheric zone.
	Coating	Engine platform pilings, underground exposure zone.
	Coating	Fuel oil supply piping.
	Coating	Hydraulic oil vent piping.
	Coating	Hydraulic oil vent piping hangers.
	Fuel Storage Unit Single Wall Container	Needs to be double wall for hurricane zone
	Lack of Spill Containment below units	Holes in floor and no curbs
	Open Platform Work Surface	Potential for hydraulic fuel spills and tool loss into canal
	Lack of Storage Space for Spare Parts	No storage space available to support high maintenance equipment
	Lack of facilities for makeup and waste oil	No storage space for makeup and waste oil
	Power Units are partially and fully exposed	Rain water and weather may impact engine performance
	Widely Dispersed Equipment	Impacts quality and ability to perform adequate maintenance
	Hydraulic Line Pressures	Operate near or above 3000 psig which is capacity
	Interconnected Diesel Fuel Day Tank Vents	Failure of the day tank inlet valve on one unit will fill the vent system higher than the vent header result surcharged condition.
	Congestion on Exposed Platforms	No room to move around units, may be dangerous
	Unit Vibration on Platforms	May result in stress and fatigue problems on structure
	Exposed Electrical Components on Diesel Drives	May be damage during storm
	Length of Hydraulic Fluid Lines	Exceed recommended length of run per manufacturer
Miscellaneous	Safe Houses	Not large enough to house required information to support O&M
	No Ability to Move Heavy Parts on Site	Reduces ability to perform adequate maintenance
	Cyclone Fencing	May not stop hard projectiles
	No facility lightning protection	May result in equipment damage or personnel safety issues
	No facility grounding	May result in equipment damage or personnel safety issues
	Lighting Support	Not adequate to survive hurricane event
	Equipment is not protected	No acceptable level of anti-terrorism or vandalism protection

Appendix E

Cost Estimate

E.1 Basis of Estimate

This submittal reflects a draft level of the cost estimate, in MCACES for Windows format (Micro Computer Aided Cost Engineering System), provided within the scope of the Permanent Enhancement of the ICS Facilities in the 17th Street, Orleans Avenue and London Avenue Canals. The cost evaluation is based on the work described in this study.

Costs for various features are based on professional judgment coupled with construction experience; cost data resources; and detailed quantity estimates to the extent possible. The cost estimate is developed to a level of detail that reflects the level of detail provided for the various concepts presented in the report. Where the level of design detail was insufficient to support a detailed breakdown of costs in estimate, lump sum allowances were used based on historical experience for similar tasks.

The cost estimate assumes construction efforts by a self-performing general prime contractor and supporting subcontractors.

Cost impacts to existing features and appurtenances generally apply to modifications of the existing ICS features or new facilities required for ICS permanent enhancements. The estimate reflects the three primary construction locations (17th Street, Orleans Avenue and London Avenue Canals); separate construction costs for a common Maintenance Facility; capacity enhancements to the modified ICS pumping systems; and separate Life Cycle Operations and Maintenance (O&M). Costs for Primary systems structured in the estimate as follows :

A. 17th Street Avenue Canal ICS

B. Orleans Avenue Canal ICS

C. London Avenue Canals ICS

D. Maintenance Facility

E. Capacity Enhancements

F. Life Cycle Operations and Maintenance (O&M)

E.2 Methodology

This cost estimate reflects a work breakdown structure (WBS) of the primary systems, subsystems, and significant components associated with the construction of permanent enhancements, and impacts to existing site conditions at each ICS facility. The WBS format provides for the development of enhancement construction costs independent from costs of improvements in capacity, and separate from Life Cycle O&M costs. Costs such as design fees, and construction contingencies are likewise applied accordingly. Contractor markups costs such as for profit, field and home office overheads and bonds are applied to the estimate.

E.3 Assumptions

This section lists those items which fundamentally serve as a basis for assumptions and inclusion for cost determination within the estimate. (note: items considered for exclusion from basis of cost are listed later in this appendix). The assumptions may be direct and indirect items and considered to provide cost impacts to the project.

E.3.1 Basic Assumptions

Costs are base lined to 2007 Dollars.

Costs are escalated to a hypothetical mid-point of construction. (see Escalation discussion below)

Costs are primarily derived or abstracted from MCACES price guides and “RS MEANS" cost data; and pricing data abstracted from B&V historical data.

Costs of labor are adjusted to reflect "area cost factor" based on Davis-Bacon wage rates as applied to the Jefferson Parrish, Louisiana region, although contractors may mobilize from outside the region. Labor costs would include base rates and fringes. Incentive pay is factored as a percentage markup to the prime, and not distributed across various task items.

Construction will be with a self-performing prime contractor and supporting subcontractors.

Evaluation assumes prime contractor and subcontractors are "local" to the Jefferson Parrish region, and shall have minimum mobilization and demobilization costs, and as stated above.

Contractors may be required to offer labor incentives for an effective work force due to the demand for skilled labor by significant projects in the southeast region of the U.S.

Assumed project to be 100% funded, not impacting schedule and project costs.

E.4 Discussion of contingencies

E.4.1 Engineering and Design

A 12 percent *Engineering and Design* factor is applied to the estimate as an "Owner Cost". This factor allows for engineering fees, investigations, studies, etc. which would support the design process for the permanent enhancements of the ICS facilities. This factor is not considered a design contingency.

(Note: For the purpose of this study NO specific design contingency is applied to the estimate. A design contingency is incorporated into and becomes an integral part of the estimated construction cost to accommodate those features of the work that cannot be adequately assessed due to the partially developed design. The amount of contingency reflects both the degree of risk associated with uncertainties, particularly with respect to geotechnical conditions, and the completeness of the design detail for the major elements of work. The design contingency is based on and applied as an "Owner" cost to the subtotal of construction costs, because it represents an unknown portion of the total estimated construction cost. The contingency decreases as the project moves forward into final design as more information becomes available, project requirements become better defined, and more of the design detail is captured in the subtotal of construction costs.

E.4.2 Construction Contingency

A construction growth contingency should be planned to pay for the costs of owner-directed changes after the project is under contract, changed conditions that occur or are encountered during construction, and other unforeseen conditions or changes. The contingency allows for unexpected costs in labor, material, site condition impacts, etc., which may result in additional costs specific to the project. The contingency is applied to the estimated construction value of the project.

(Note: A 30% contingency was applied to the cost estimate for Option 1 and Option 2 of the Final Conceptual Design Report for Permanent Flood Gate and Pump Stations. This

contingency was in consideration of new construction which was not impacted heavily by existing site features and facilities.)

A 35% contingency was applied to this ICS cost estimate due the nature of the existing conditions at each ICS following the construction of Phase 1, Phase 2, and Phase 3 ICS facility modifications. Phase 2 and Phase 3 detailed drawings were not available to effectively evaluate complete site conditions at each facility. An extensive array of existing pumping equipment, support platforming, and appurtenances are found at each ICS facility. Demolition and facility modifications are inherent at each ICS location, the details of which are not fully determined. The unknowns relating to demolition and existing facility modifications are considerations not otherwise applied to the cost estimate for Option 1 and Option 2 of the Final Conceptual Design Report for Permanent Flood Gate and Pump Stations.

E.4.3 Escalation

Costs are escalated to a hypothetical mid-point of construction of March 2010 using 2.5% costs inflation per annum. To determine mid-point of construction, the following phases of design development and construction are assumed:

Design Phase:	9 months	(08/2007 to 05/2008)
Bid Phase:	4 months	(05/2008 to 09/2008)
Construction Phase:	24 months	(09/2008 to 09/2010)

An escalation factor of 5.75% is applied to the estimate.

E.4.4 Item breakdown description

Following is a listing of primary systems associated with the ICS enhancements by canal location, forming the basic structure of the cost estimate:

A. 17th Street Avenue Canal ICS

- Exist Engine Platform Enclosures
- New Engine Platform & Enclosures
- Phase 3 Pump Platform Enclosure

- Gate Operations
- Mechanical Systems
- Electrical Systems
- Miscellaneous Items

B. Orleans Avenue Canal ICS

- Exist Engine Platform Enclosures
- New Engine Platform & Enclosures (N/A)
- Phase 3 Pump Platform Enclosure (N/A)
- Gate Operations
- Mechanical Systems
- Electrical Systems
- Miscellaneous Items

C. London Avenue Canals ICS

- Exist Engine Platform Enclosures
- New Engine Platform & Enclosures (N/A)
- Phase 3 Pump Platform Enclosure
- Gate Operations
- Mechanical Systems
- Electrical Systems
- Miscellaneous Items

E. Maintenance Facility

- Land Acquisition
- Maintenance & Storage Facility (Off-Site)

F. Capacity Enhancements

- 17th Street Avenue Canal ICS
- Orleans Avenue Canal ICS
- London Avenue Canal ICS

E.4.5. ICS Facility Tasks

Facility tasks associated within the Primary Systems are described as a subsystem or significant component to the ICS enhancements. The following breakdown of the tasks describes the significant subsystem components associated within each primary task:

Primary System	Subsystem
Exist. Engine Platform Enclosures:	Demolition and structure modifications required to enclosure the existing Engine Platform
New Engine Platform & Enclosures:	Expanded Engine Platforming (17th St. Canal only)
Phase 3 Pump Platform Enclosure:	Enclosure of exist. Phase 3 platform (17th Street and London Ave. Canals only)
Gate Operations:	Installation of new roller gates and guides, replacing existing needle gates
Mechanical Systems:	Replacement of existing Phase 1 and Phase 2pumps and appurtenances with new pumps and electric drivers Requires demo and platform modifications

Electrical Systems:	Lightning Protection and grounding, Lighting, SCADA
Miscellaneous Items:	Corrosion Protection; On-site Fluid Storage; Installation of Addt'l Fuel Farm

Maintenance Facility:

The estimate reflects the cost for a recommended common Maintenance Facility intended to support heavy maintenance, parts and records storage. The cost is separated from the construction costs for enhancements to 17th Street, Orleans Avenue and London Avenue Canal locations. The location for such a facility is undetermined, and it is assumed land acquisition is required for construction of the facility. As discussed in the report a 25,000 SF facility is assumed.

Capacity Improvements:

Capacity Improvements costs include new Engine Platform(s) & Enclosure(s); new mechanical systems including pumps, drivers, and piping; new electrical systems to provide power supply to the pumps; lighting and grounding protection; and SCADA capability. Additionally the estimate provides for costs of corrosion protection of the new platforming. Capacity Improvements construction costs are separated by the 17th Street, Orleans Avenue and London Avenue Canal locations.

Life Cycle Operations & Maintenance (O&M) Costs:

Life Cycle Operations & Maintenance (O&M) costs are developed independent from the construction costs of ICS enhancements. The MCACES formatted cost estimate does not include O&M costs. See Section 5 of the report for discussion and cost development of the O&M costs.

MCACES
Cost Estimate

BLACK & VEATCH

DATE: June 29, 2007

DRAFT

CLIENT: UCACE - NASHVILLE
PROJECT: Permanent Enhancements of ICS
LOCATION: New Orleans, Louisiana

Prepared By: G. Hicks
Checked By: M. Ledbetter
Approved By: L. Schieber

SHEET 1 OF 1

TOTAL PROJECT COST SUMMARY #1 :

ICS Facility Location	Permanent Enhancements of ICS			
	ICS Enhancement Costs	Maint. Facility Costs	Capacity improvement Costs	
A. 17th STREET CANAL	$ 125,039,826	X	X	
B. ORLEANS AVE. CANAL	$ 68,487,729	X	X	
C. LONDON AVE. CANAL	$ 82,598,997	X	X	
D. MAINTENANCE FACILITY	X	$ 41,556,365	X	
E. CAPACITY IMPROVEMENTS	----------	----------	----------	
17th Street Canal:	X	X	$ 56,188,253	
Orleans Ave Canal:	X	X	$ 15,015,699	
London Ave Canal:	X	X	$ 42,903,197	
				PROJECT TOTAL
TOTALS =	$ 276,126,552	$ 41,556,365	$ 114,107,149	$ 431,790,066

BLACK & VEATCH

DATE: June 29, 2007

DRAFT

CLIENT: UCACE - NASHVILLE
PROJECT: Permanent Enhancements of ICS
LOCATION: New Orleans, Louisiana

Prepared By: G. Hicks
Checked By: M. Ledbetter
Approved By: L. Schieber

SHEET 1 OF 1

TOTAL PROJECT COST SUMMARY #2 :

Permanent Enhancements of ICS	Permanent Enhancements of ICS			
	ICS Enhancement Costs	Maint. Facility Costs	Capacity improvement Costs	TOTALS
A. 17th STREET CANAL	$ 125,039,826	X	$ 56,188,253	$ 181,228,079
B. ORLEANS AVE. CANAL	$ 68,487,729	X	$ 15,015,699	$ 83,503,428
C. LONDON AVE. CANAL	$ 82,598,997	X	$ 42,903,197	$ 125,502,194
D. MAINTENANCE FACILITY	X	$ 41,556,365	X	$ 41,556,365
TOTALS =	$ 276,126,552	$ 41,556,365	$ 114,107,149	$ 431,790,066

Permanent Enhancement of ICS
New Orleans Hurricane Prot Proj
Enhancement of ICS Facilities
New Orleans, Louisiana

Designed By: Black & Veatch
Estimated By: Mike Ledbetter

Prepared By: Fred Pratt, Gary L. Hicks

Preparation Date: 06/28/07
Effective Date of Pricing: 06/28/07
Est Construction Time: 1092 Days

Sales Tax: 0.0%

This MCACES Estimate, as provided within the general scope of the Hurricane Protection Project provides cost information pertaining to the permanent enhancement of the Interim Control Structures (ICS). The estimate reflects investigation of construction costs for modifications required to make the ICS a permanent faciltiy, allowing for a 50 year life.

The Estimate reflects a general work breakdown of primary systems, subsystems, and significant components of the existing ICS facilities, formatted to correspond to the main deficiencies developed for the facility.

Life Life Cycle Operation & Maintenance costs are not included in this MCACES formatted construction cost estimate. See Section 5 of the report for O&M Costs.

SUMMARY REPORTS — SUMMARY PAGE

DETAILED ESTIMATE — DETAIL PAGE

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

** PROJECT OWNER SUMMARY - Scope **

	QUANTITY UOM	CONTRACT	ESCALATN	ENG&DES	CON CONT	TOTAL COST	UNIT COST
A_ 17th Street Canal ICS		78,201,700	4,496,598	9,923,796	32,417,733	125,039,826	
B_ Orleans Avenue Canal ICS		42,833,208	2,462,909	5,435,534	17,756,078	68,487,729	
C_ London Avenue Canal ICS		51,658,597	2,970,369	6,555,476	21,414,555	82,598,997	
D_ Maintenance Facility		25,989,946	1,494,422	3,298,124	10,773,872	41,556,365	
E_ Capacity Improvements		71,364,247	4,103,444	9,056,123	29,583,335	114,107,150	
TOTAL Permanent Enhancement of ICS		270,047,698	15,527,743	34,269,053	111,945,573	431,790,066	

** PROJECT INDIRECT SUMMARY - Scope **

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
A_ 17th Street Canal ICS		67,447,601	3,372,380	2,832,799	3,774,645	774,274	78,201,700	
B_ Orleans Avenue Canal ICS		36,920,679	1,846,034	1,550,669	2,091,735	424,091	42,833,208	
C_ London Avenue Canal ICS		44,528,876	2,226,444	1,870,213	2,521,593	511,471	51,658,597	
D_ Maintenance Facility		23,125,000	906,250	761,250	989,625	207,821	25,989,946	
E_ Capacity Improvements		61,557,164	3,077,858	2,585,401	3,437,248	706,577	71,364,247	
TOTAL Permanent Enhancement of ICS		233,579,320	11,428,966	9,600,331	12,814,846	2,624,235	270,047,698	
OTHER							15,527,743	
SUBTOTAL							285,575,440	
ESCALATN							34,269,053	
SUBTOTAL							319,844,493	
OWN FURN							111,945,573	
TOTAL INCL OWNER COSTS							431,790,066	

** PROJECT DIRECT SUMMARY - Scope **

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_ 17th Street Canal ICS	16,665		656,644	50,751	789993058840276			67,447,601	
B_ Orleans Avenue Canal ICS	10,713		423,874	30,510	446661231999683			36,920,679	
C_ London Avenue Canal ICS	13,187		521,727	41,948	557743138387770			44,528,876	
D_ Maintenance Facility	0		0	0	023125000			23,125,000	
E_ Capacity Improvements	11,993		474,817	29,683	686562854167035			61,557,164	
TOTAL Permanent Enhancement of ICS	52,558		2077063	152,893	24829602*******			233,579,320	
OVERHEAD								11,428,966	
SUBTOTAL								245,008,286	
HOME OFC								9,600,331	
SUBTOTAL								254,608,618	
PROFIT								12,814,846	
SUBTOTAL								267,423,463	
BOND								2,624,235	
TOTAL INCL INDIRECTS								270,047,698	
OTHER								15,527,743	
SUBTOTAL								285,575,440	
ESCALATN								34,269,053	
SUBTOTAL								319,844,493	
OWN FURN								111,945,573	
TOTAL INCL OWNER COSTS								431,790,066	

Project Distributed Costs

0. 5. General Prime Contract	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

0. 5. General Prime Contract
Contractor Quality Control includes costs for 1 field testing lab+1lab tech+1 field technician to perform req'd project material testing for 36 mo. period

A_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_. 17th Street Canal ICS									
A_.01. Exist Engine Platform Enclosures									
Notes:									
1. Phase 1, 2, 3 Power Units are exposed to hurricane wind blown debris.									
2. Hoisting equipment needs some level of protection from flying debris.									
3. Quantities reflect total for both east / west side platforms.									
A_.01.01 . Demolition									
A_.01.01 . 01. Chain Link Fencing									
L RSM SS < > Site dml, chain link, remove			0.00	0.00	0.00	0.00	3.00	3.00	
	450.00	LF	0	0	0	0	1,350	1,350	3.00
TOTAL Chain Link Fencing	450.00	LF	0	0	0	0	1,350	1,350	3.00
A_.01.01 . 02. Metal Roof-Siding Panels									
L RSM SS < > Remove metal roof and metal			0.00	0.00	0.00	0.00	1.00	1.00	
	11300	SF	0	0	0	0	11,300	11,300	1.00
TOTAL Metal Roof-Siding Panels	11300	SF	0	0	0	0	11,300	11,300	1.00
A_.01.01 . 03. Misc Steel - Roof Purlins									
L RSM SS < > Remove metal purlins supporting			0.00	0.00	0.00	0.00	0.25	0.25	
	23400	LBS	0	0	0	0	5,850	5,850	0.25
TOTAL Misc Steel - Roof Purlins	23400	LBS	0	0	0	0	5,850	5,850	0.25
TOTAL Demolition			0	0	0	0	18,500	18,500	
A_.01.02 . Structure Modifications									
A_.01.02 . 01. Add Misc Steel Framing									
A_.01.02 . 01.01. Add Welded Structural Frame									
Note:									
1. Allow 5500 LBS each Welded Frame (say 58 LF x 100 = 5800 lbs).									
2. 6 ea. x 5800 = 34,800 lbs.									
3. 34,800 / 2000 = 17.4 tons									

A_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
4. Cost based on $1.50/LB for material, labor, equip. incl dwelivery and handling.									
B MIL SS < > Add Welded Steel Frame			0.00	0.00	0.00	0.00	3000.00	3000.00	
	17.40	TON	0	0	0	0	52,200	52,200	3000.00
TOTAL Add Welded Structural Frame	6.00	EA	0	0	0	0	52,200	52,200	8700.00
A_.01.02 . 01.02. Add W10 Col's at Eaves of Bldg									
Notes:									
1. Allow for the addition of (4)- new W10x30 columns (at 16-ft length) at east and west enclosures.									
B MIL SS < > Add W10 Wide-Flange Columns at			0.00	0.00	0.00	0.00	2100.00	2100.00	
	2.40	TON	0	0	0	0	5,040	5,040	2100.00
TOTAL Add W10 Col's at Eaves of Bldg	4800.00	LB	0	0	0	0	5,040	5,040	1.05
A_.01.02 . 01.03. Add New Roof Purlins									
B MIL SS < > Add new purlins to support			0.00	0.00	0.00	0.00	1.10	1.10	
	47520	LB	0	0	0	0	52,272	52,272	1.10
TOTAL Add New Roof Purlins	38400	LB	0	0	0	0	52,272	52,272	1.36
A_.01.02 . 01.04. Add MC6 Girts at Bldg Perimeter									
B MIL SS < > Add new MC6x8.2 Girts btwn			0.00	0.00	0.00	0.00	3.00	3.00	
	22000	LB	0	0	0	0	66,000	66,000	3.00
TOTAL Add MC6 Girts at Bldg Perimeter	9600.00	LB	0	0	0	0	66,000	66,000	6.88
TOTAL Add Misc Steel Framing			0	0	0	0	175,512	175,512	
A_.01.02 . 02. Add Precast Wall & Roof Panels									
Note:									
1. Estimates assumes 6" +/- thick precast panels. 2. Cost incl materils, labor, equip, etc for installation onto existing bldg.									
B MIL SS < > Add new perimeter wall panels			0.00	0.00	0.00	0.00	10.00	10.00	
	16000	SF	0	0	0	0	160,000	160,000	10.00

A_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Add Precast Wall & Roof Panels	16000	SF	0	0	0	0	160,000	160,000	10.00
A_.01.02 . 03. Add Overhead & Personnel Doors									
Notes:									
1. Allow (2)- commercial grade hollow metal doors at each enclosure.									
2. Allow (1)-commercial grade, sectional, steel, heavy duty, overhead door at each enclosure. Assume 10-ft x 10-ft size.									
B MIL SS < > Overhead coml, no frame, manual,			0.00	0.00	0.00	0.00	1200.00	1200.00	
	2.00	EA	0	0	0	0	2,400	2,400	1200.00
B MIL SS < > Coml stl dr, fl, 3'-4" x 7'-0",			0.00	0.00	0.00	0.00	500.00	500.00	
	4.00	EA	0	0	0	0	2,000	2,000	500.00
TOTAL Add Overhead & Personnel Doors			0	0	0	0	4,400	4,400	
A_.01.02 . 04. Add Louvers & Ventilators									
Notes: 1. Install louvers for air intake each side of enclosure. Provide at East and West enclosures									
2. Assume (14) ea side , at 4-ft x 4-ft size.									
3. Total louver area = (14 ea x 2 sides x 4 x 4) x 2 enclosures = 896 SF. (SAY 1000 SF total)									
4.Provide a protective aluminum shroud over top & sides of louver.									
5. Provide (2)- powered wall exhausters at ea enclosure; with shroud protection.									
B MIL JJ < > Wall louvers, aluminum, with			0.00	0.00	0.00	0.00	40.00	40.00	
	1000.00	SF	0	0	0	0	40,000	40,000	40.00
B MIL JJ < > Protective aluminum shroud over			0.00	0.00	0.00	0.00	250.00	250.00	
	56.00	EA	0	0	0	0	14,000	14,000	250.00
B AF JJ < > Fan, wall exhers, 1 HP, cntfgl,			0.00	0.00	0.00	0.00	1500.00	1500.00	
	4.00	EA	0	0	0	0	6,000	6,000	1500.00
TOTAL Add Louvers & Ventilators			0	0	0	0	60,000	60,000	
A_.01.02 . 05. Modify Exist Gen Exhaust Vents									
B MIL JJ < > Allowance to modify exist			0.00	0.00	0.00	0.00	500.00	500.00	
	12.00	EA	0	0	0	0	6,000	6,000	500.00

A_.01. Exist Engine Platform Enclosures		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Modify Exist Gen Exhaust Vents				0	0	0	0	6,000	6,000	
A_.01.02 . 06. Modify Exist Utility Runs										
B MIL JJ <	> Allowance to modify utility runs			0.00	0.00	0.00	0.00	10000	10000.00	
		1.00	LS	0	0	0	0	10,000	10,000	10000.00
TOTAL Modify Exist Utility Runs				0	0	0	0	10,000	10,000	
TOTAL Structure Modifications				0	0	0	0	415,912	415,912	
A_.01.03 . Allowance for Misc Modifications										
L RSM SS <	> Allowance for misc modifications			0.00	0.00	0.00	0.00	10000	10000.00	
		1.00	LS	0	0	0	0	10,000	10,000	10000.00
TOTAL Allowance for Misc Modifications				0	0	0	0	10,000	10,000	
TOTAL Exist Engine Platform Enclosures		2.00	EA	0	0	0	0	444,412	444,412	222206.00

A_.02. New Engine Platform & Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

A_.02. New Engine Platform & Enclosures

Notes:

1. At 17th St. canal ICS only, a new expanded Engine Platform is required on both east and west side to house (3) additional pumps and power units each.

2. The estimate provides for a free-standing structure, adjacent to the existing Engine Platform Structure, constructed upon a pile-supported elevated concrete slab similar to the existing structure. The new structure to be framed with rigid welded frames, with a superstructure of precast concrete wall and roof panels.

3. Overhead door and personnel door access provided, in addition to louver and ventilation system appurtenances.

4. The size of the new expanded Engine Platform is assumed to be 50-ft x 50-ft in area:

50 x 50 = 2500 SF x 2 = 5000 SF

5. Cost per SF allows for misc eletrical (i.e., lighting, recepticles) and misc mechanical appurtenances for new enclosed platform.

L RSM SS <	> Allowance for (2) ~2500 SF		0.00	0.00	0.00	0.00	785.00	785.00	
		5000.00	SF 0	0	0	0	3925000	3,925,000	785.00
	TOTAL New Engine Platform & Enclosures	2.00	EA 0	0	0	0	3925000	3,925,000	1962500

A_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.03. Phase 3 Pump Platform Enclosure									
Notes:									
1. Phase 3 Power Units are exposed to hurricane wind blown debris.									
2. For purpose of cost development, estimate assumes enclosure similar in size and framing to London Ave. Generator Platform.									
3. Quantities reflect total for one platform.									
A_.03.01 . Demolition									
A_.03.01 . 01. Chain Link Fencing									
L RSM SS < > Site dml, chain link, remove			0.00	0.00	0.00	0.00	3.00	3.00	
	265.00	LF	0	0	0	0	795	795	3.00
TOTAL Chain Link Fencing	265.00	LF	0	0	0	0	795	795	3.00
A_.03.01 . 02. Metal Roof-Siding Panels									
L RSM SS < > Remove metal roof and metal			0.00	0.00	0.00	0.00	1.00	1.00	
	5150.00	SF	0	0	0	0	5,150	5,150	1.00
TOTAL Metal Roof-Siding Panels	5150.00	SF	0	0	0	0	5,150	5,150	1.00
A_.03.01 . 03. Misc Steel - Roof Purlins									
L RSM SS < > Remove metal purlins supporting			0.00	0.00	0.00	0.00	0.25	0.25	
	10750	LBS	0	0	0	0	2,688	2,688	0.25
TOTAL Misc Steel - Roof Purlins	10750	LBS	0	0	0	0	2,688	2,688	0.25
TOTAL Demolition			0	0	0	0	8,633	8,633	
A_.03.02 . Structure Modifications									
A_.03.02 . 01. Add Misc Steel Framing									
A_.03.02 . 01.01. Add Welded Structural Frame									
Note:									
1. Allow 5500 LBS each Welded Frame (say 55 LF x 100 = 5500 lbs).									
2. 8 ea. x 5500 = 44,000 lbs.									
3. 44,000 / 2000 = 22 tons									
4. Cost based on $1.50/LB for material, labor, equip. incl dwelivery and handling.									

A_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B MIL SS < > Add Welded Steel Frame			0.00	0.00	0.00	0.00	3000.00	3000.00	
	11.00	TON	0	0	0	0	33,000	33,000	3000.00
TOTAL Add Welded Structural Frame	4.00	EA	0	0	0	0	33,000	33,000	8250.00
A_.03.02 . 01.02. Add W10 Col's at Eaves of Bldg									
B MIL SS < > Add W10 Wide-Flange Columns at			0.00	0.00	0.00	0.00	2100.00	2100.00	
	0.96	TON	0	0	0	0	2,016	2,016	2100.00
TOTAL Add W10 Col's at Eaves of Bldg	1920.00	LB	0	0	0	0	2,016	2,016	1.05
A_.03.02 . 01.03. Add New Roof Purlins									
B MIL SS < > Add new purlins to support			0.00	0.00	0.00	0.00	1.10	1.10	
	21600	LB	0	0	0	0	23,760	23,760	1.10
TOTAL Add New Roof Purlins	21600	LB	0	0	0	0	23,760	23,760	1.10
A_.03.02 . 01.04. Add MC6 Girts at Bldg Perimeter									
B MIL SS < > Add new MC6x8.2 Girts btwn			0.00	0.00	0.00	0.00	3.00	3.00	
	11000	LB	0	0	0	0	33,000	33,000	3.00
TOTAL Add MC6 Girts at Bldg Perimeter	11000	LB	0	0	0	0	33,000	33,000	3.00
TOTAL Add Misc Steel Framing			0	0	0	0	91,776	91,776	

A_.03.02 . 02. Add Precast Wall & Roof Panels

Note:

1. Estimates assumes 6" +/- thick precast panels.

2. Cost incl materils, labor, equip, etc for installation onto existing bldg.

B MIL SS < > Add new perimeter wall panels			0.00	0.00	0.00	0.00	10.00	10.00	
	7920.00	SF	0	0	0	0	79,200	79,200	10.00
TOTAL Add Precast Wall & Roof Panels	7920.00	SF	0	0	0	0	79,200	79,200	10.00

A_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.03.02 . 03. Add Overhead & Personnel Doors									
Notes:									
1. Allow (2)- commercial grade hollow metal doors at each enclosure.									
2. Allow (1)-commercial grade, sectional, steel, heavy duty, overhead door at each enclosure. Assume 10-ft x 10-ft size.									
B MIL SS < > Overhead coml, no frame, manual,			0.00	0.00	0.00	0.00	1200.00	1200.00	
	1.00	EA	0	0	0	0	1,200	1,200	1200.00
B MIL SS < > Coml stl dr, fl, 3'-4" x 7'-0",			0.00	0.00	0.00	0.00	500.00	500.00	
	2.00	EA	0	0	0	0	1,000	1,000	500.00
TOTAL Add Overhead & Personnel Doors			0	0	0	0	2,200	2,200	
A_.03.02 . 04. Add Louvers & Ventilators									
Notes:									
1. Install louvers for air intake each side of enclosure. Provide at East and West enclosures									
2. Assume (14) ea side , at 4-ft x 4-ft size.									
3. Total louver area = (14 ea x 2 sides x 4 x 4) x 2 enclosures = 896 SF. (SAY 1000 SF total)									
4. Provide a protective aluminum shroud over top & sides of louver.									
5. Provide (2)- powered wall exhausters at ea enclosure; with shroud protection.									
B MIL JJ < > Wall louvers, aluminum, with			0.00	0.00	0.00	0.00	40.00	40.00	
	500.00	SF	0	0	0	0	20,000	20,000	40.00
B MIL JJ < > Protective aluminum shroud over			0.00	0.00	0.00	0.00	250.00	250.00	
	28.00	EA	0	0	0	0	7,000	7,000	250.00
B AF JJ < > Fan, wall exhers, 1 HP, cntfgl,			0.00	0.00	0.00	0.00	1500.00	1500.00	
	2.00	EA	0	0	0	0	3,000	3,000	1500.00
TOTAL Add Louvers & Ventilators			0	0	0	0	30,000	30,000	

A_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.03.02 . 05. Modify Exist Gen Exhaust Vents									
Notes:									
1. Existing exhaust vents pentrate the metal siding of the bldg.									
2. Vents need to be modified to function with the new exterior precast concrete panel system.									
3. Includes adapting exterior shrouds on vent penetration thru new precast concrte panels.									
B MIL JJ < > Allowance to modify exist			0.00	0.00	0.00	0.00	500.00	500.00	
	6.00	EA	0	0	0	0	3,000	3,000	500.00
TOTAL Modify Exist Gen Exhaust Vents			0	0	0	0	3,000	3,000	
A_.03.02 . 06. Modify Exist Utility Runs									
B MIL JJ < > Allowance to modify utility runs			0.00	0.00	0.00	0.00	5000.00	5000.00	
	1.00	LS	0	0	0	0	5,000	5,000	5000.00
TOTAL Modify Exist Utility Runs			0	0	0	0	5,000	5,000	
TOTAL Structure Modifications			0	0	0	0	211,176	211,176	
A_.03.03 . Allow for Misc Enclosure Mods									
L RSM SS < > Allowance for misc modifications			0.00	0.00	0.00	0.00	25000	25000.00	
	1.00	LS	0	0	0	0	25,000	25,000	25000.00
TOTAL Allow for Misc Enclosure Mods			0	0	0	0	25,000	25,000	
TOTAL Phase 3 Pump Platform Enclosure	1.00	EA	0	0	0	0	244,809	244,809	244808.50

A_.04. Gate Operations	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

A_.04. Gate Operations
Note:

1. Allow for removal and disposal of existing (11) needle gates, and replacement with (11) roller gates and associated framing.

2. Provide gates with rollers to allow response to emergency closures during differential head conditions, and need for quicker repsponse time for placement of gates.

A_.04. 01. Roller Gates and Guides

A_.04. 01. 01. Roller Gates

L RSM SS <	> Allowance for fabrication and			0.00	0.00	0.00	0.00	1700.00	1700.00	
		128.00	TON	0	0	0	0	217,600	217,600	1700.00
L RSM SS <	> Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
		13000	SF	0	0	0	0	39,000	39,000	3.00
L RSM SS <	> Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
		128.00	TON	0	0	0	0	128,000	128,000	1000.00
	TOTAL Roller Gates	11.00	EA	0	0	0	0	384,600	384,600	34963.64

A_.04. 01. 02. Gate Guide Columns

L RSM SS <	> Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
		55.00	TON	0	0	0	0	93,500	93,500	1700.00
L RSM SS <	> Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
		7000.00	SF	0	0	0	0	21,000	21,000	3.00
L RSM SS <	> Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
		55.00	TON	0	0	0	0	55,000	55,000	1000.00
	TOTAL Gate Guide Columns			0	0	0	0	169,500	169,500	

A_.04. 01. 03. Add Platform Expansion & Ladders

L RSM SS <	> Allowance for fabrication and			0.00	0.00	0.00	0.00	1700.00	1700.00	
		10.00	TON	0	0	0	0	17,000	17,000	1700.00
L RSM SS <	> Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
		10.00	TON	0	0	0	0	10,000	10,000	1000.00

A_.04. Gate Operations	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Add Platform Expansion & Ladders			0	0	0	0	27,000	27,000	
A_.04. 01. 04. Removal / Dispose of Exist Gates									
L RSM SS < > Allowance for gate removal from			0.00	0.00	0.00	0.00	1000.00	1000.00	
	128.00	TON	0	0	0	0	128,000	128,000	1000.00
L RSM SS < > Allowance for off-site removal			0.00	0.00	0.00	0.00	0.02	0.02	
	256000	LBS	0	0	0	0	5,120	5,120	0.02
TOTAL Removal / Dispose of Exist Gates	11.00	EA	0	0	0	0	133,120	133,120	12101.82
A_.04. 01. 05. Fill Void of Needle Gate Seat									
Notes:									
1. Allow 12-ft / gate x 11 gates = 132 LF									
L RSM SS < > Fill void of Needle Gate Seats			0.00	0.00	0.00	0.00	100.00	100.00	
	132.00	LF	0	0	0	0	13,200	13,200	100.00
TOTAL Fill Void of Needle Gate Seat	11.00	EA	0	0	0	0	13,200	13,200	1200.00
A_.04. 01. 06. Install Gate Operator / Motor									
L RSM SS < > Install gate operator; reuse			0.00	0.00	0.00	0.00	2500.00	2500.00	
	11.00	EA	0	0	0	0	27,500	27,500	2500.00
TOTAL Install Gate Operator / Motor	11.00	EA	0	0	0	0	27,500	27,500	2500.00
TOTAL Roller Gates and Guides			0	0	0	0	754,920	754,920	
TOTAL Gate Operations			0	0	0	0	754,920	754,920	

A_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.05. Mechanical Systems									
A_.05. 01. Phase 1 Pumps Sys Modifications									
Notes:									
1. Replace existing Phase 1 pumps (12 ea) with new 350 cfs pumps (12 ea) - FSI type.									
2. See "Item E_Capacity Modifications" for alternative of providing additional pumping equipment and expanded facilities to accommodate enhanced capacity.									
A_.05. 01. 01. Demo Exist Phase 1 Pumps									
L RSM JJ < > Allowance for disconnect & prep			0.00	0.00	0.00	0.00	7100.00	7100.00	
	12.00	EA	0	0	0	0	85,200	85,200	7100.00
L RSM JJ < > Allowance for removal and			0.00	0.00	0.00	0.00	3750.00	3750.00	
	12.00	EA	0	0	0	0	45,000	45,000	3750.00
TOTAL Demo Exist Phase 1 Pumps	12.00	EA	0	0	0	0	130,200	130,200	10850.00
A_.05. 01. 02. Demo Exist Hydraulic Piping Sys									
A_.05. 01. 02.01. Install Valves & drain Hyd Fluid									
L RSM JJ < > Purchase (8)-3" gate valves ---1			0.00	0.00	0.00	0.00	500.00	500.00	
	8.00	EA	0	0	0	0	4,000	4,000	500.00
L RSM JJ < > Purchase (2)-1" gate valves ---1			0.00	0.00	0.00	0.00	200.00	200.00	
	2.00	EA	0	0	0	0	400	400	200.00
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	11880	LF	0	0	0	0	38,610	38,610	3.25
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	2970.00	LF	0	0	0	0	9,653	9,653	3.25
L RSM JJ < > Fluid Containment and Disposal			0.00	0.00	0.00	0.00	10.00	10.00	
	4883.00	GAL	0	0	0	0	48,830	48,830	10.00
TOTAL Install Valves & drain Hyd Fluid			0	0	0	0	101,493	101,493	
A_.05. 01. 02.02. Clean interior of piping									
L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	2.00	2.00	
	11880	LF	0	0	0	0	23,760	23,760	2.00

A_.05. Mechanical Systems			QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM JJ <	> Allowance for flushing &				0.00	0.00	0.00	0.00	0.50	0.50	
			2970.00	LF	0	0	0	0	1,485	1,485	0.50
	TOTAL Clean interior of piping				0	0	0	0	25,245	25,245	
A_.05. 01. 02.03. Demo exist hyd fluid piping											
L RSM JJ <	> Demo existing 3" hydraulic				0.00	0.00	0.00	0.00	10.50	10.50	
			11880	LF	0	0	0	0	124,740	124,740	10.50
L RSM JJ <	> Demo existing 1" hydraulic				0.00	0.00	0.00	0.00	10.50	10.50	
			2970.00	LF	0	0	0	0	31,185	31,185	10.50
	TOTAL Demo exist hyd fluid piping				0	0	0	0	155,925	155,925	
	TOTAL Demo Exist Hydraulic Piping Sys				0	0	0	0	282,663	282,663	
A_.05. 01. 03. Demo Exist Power Units											
L RSM JJ <	> Allowance for disconnect & prep				0.00	0.00	0.00	0.00	3600.00	3600.00	
			12.00	EA	0	0	0	0	43,200	43,200	3600.00
L RSM JJ <	> Allowance for removal and				0.00	0.00	0.00	0.00	1800.00	1800.00	
			12.00	EA	0	0	0	0	21,600	21,600	1800.00
	TOTAL Demo Exist Power Units		12.00	EA	0	0	0	0	64,800	64,800	5400.00
A_.05. 01. 04. Miscellaneous Demo											
L RSM JJ <	> Allowance for Misc Pump Sys				0.00	0.00	0.00	0.00	50000	50000.00	
			1.00	LS	0	0	0	0	50,000	50,000	50000.00
	TOTAL Miscellaneous Demo				0	0	0	0	50,000	50,000	
A_.05. 01. 05. Modify Exist Pump Supt Platforms											
A_.05. 01. 05.01. Demo Exist Stl & Grating (E-W)											
L RSM SS <	> Allowance for demo of exist				0.00	0.00	0.00	0.00	250.00	250.00	
			13.00	TON	0	0	0	0	3,250	3,250	250.00
L RSM SS <	> Allowance for demo of exist				0.00	0.00	0.00	0.00	5.00	5.00	
			2640.00	SF	0	0	0	0	13,200	13,200	5.00
L RSM SS <	> Allowance for disposal of demo				0.00	0.00	0.00	0.00	50.00	50.00	
			35.00	TON	0	0	0	0	1,750	1,750	50.00

A_.05. Mechanical Systems

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Demo Exist Stl & Grating (E-W)			0	0	0	0	18,200	18,200	
A_.05. 01. 05.02. Install New Stl & Grating (E-W)									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	13.00	TON	0	0	0	0	22,100	22,100	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	3300.00	SF	0	0	0	0	9,900	9,900	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	13.00	TON	0	0	0	0	13,000	13,000	1000.00
L RSM SS < > Allowance for new Grating			0.00	0.00	0.00	0.00	25.00	25.00	
	2640.00	SF	0	0	0	0	66,000	66,000	25.00
TOTAL Install New Stl & Grating (E-W)			0	0	0	0	111,000	111,000	
TOTAL Modify Exist Pump Supt Platforms			0	0	0	0	129,200	129,200	
A_.05. 01. 06. Install New Pumps w/ Elec Driver									
L RSM JJ < > New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
	12.00	EA	0	0	0		020400000	20,400,000	1700000
L RSM JJ < > Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
	12.00	EA	0	0	0	0	4980000	4,980,000	415000.00
TOTAL Install New Pumps w/ Elec Driver	12.00	EA	0	0	0		025380000	25,380,000	2115000
A_.05. 01. 07. Install New Motor Power Units									
L RSM JJ < > Motors for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
	12.00	EA	0	0	0	0	6000000	6,000,000	500000.00
TOTAL Install New Motor Power Units	12.00	EA	0	0	0	0	6000000	6,000,000	500000.00

A_.05. 01. 08. Replace Storage Tks w/ Dbl Wall

A_.05. 01. 08.01. Disconnect-Clean Exist Fuel Tank

Notes:

1. Assume tank 5% full
20,000 gal x .05 = 100 gal

A_.05. Mechanical Systems			QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM JJ <	> Disconnect existing fuel oil				0.00	0.00	0.00	0.00	500.00	500.00	
		1.00	LS		0	0	0	0	500	500	500.00
L RSM JJ <	> Transfer re-usable fuel, incl				0.00	0.00	0.00	0.00	1.00	1.00	
		100.00	GAL		0	0	0	0	100	100	1.00
L RSM JJ <	> Clean and Flush tank prior to				0.00	0.00	0.00	0.00	500.00	500.00	
		1.00	LS		0	0	0	0	500	500	500.00
	TOTAL Disconnect-Clean Exist Fuel Tank	2.00	EA		0	0	0	0	1,100	1,100	550.00
A_.05. 01. 08.02. Removal and Disposal of Exist Tk											
L RSM JJ <	> Removal and disposal of existing				0.00	0.00	0.00	0.00	2000.00	2000.00	
		2.00	EA		0	0	0	0	4,000	4,000	2000.00
	TOTAL Removal and Disposal of Exist Tk	2.00	EA		0	0	0	0	4,000	4,000	2000.00
A_.05. 01. 08.03. Install Double-Wall Storage Tank											
L RSM JJ <	> New Dbl Wall Storage Tank(s) ;				0.00	0.00	0.00	0.00	22500	22500.00	
		2.00	EA		0	0	0	0	45,000	45,000	22500.00
L RSM JJ <	> Install new Dbl Wall Storage				0.00	0.00	0.00	0.00	2000.00	2000.00	
		2.00	EA		0	0	0	0	4,000	4,000	2000.00
L RSM JJ <	> Reconnect fuel piping; allow				0.00	0.00	0.00	0.00	1000.00	1000.00	
		2.00	EA		0	0	0	0	2,000	2,000	1000.00
	TOTAL Install Double-Wall Storage Tank	2.00	EA		0	0	0	0	51,000	51,000	25500.00
	TOTAL Replace Storage Tks w/ Dbl Wall	2.00	EA		0	0	0	0	56,100	56,100	28050.00
	TOTAL Phase 1 Pumps Sys Modifications				0	0	0	032092963		32,092,963	

A_.05. 02. Phase 2 Pumps Sys Modifications

Notes:

1. Replace existing Phase 1 pumps (12 ea) with new 350 cfs pumps (6 ea) - FSI type.

2. Assume fuel supply from existing 20,000 gal fuel storage tank located in Phase 1 Engine Platform (east & west).

3. See "Item E_Capacity Modifications" for alternative of providing additional pumping equipment and expanded facilities to accommodate

A_.05. Mechanical Systems		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
enhanced capacity.										
A_.05. 02. 01. Demo Exist Phase 1 Pumps										
	L RSM JJ < > Allowance for disconnect & prep			0.00	0.00	0.00	0.00	7100.00	7100.00	
		6.00	EA	0	0	0	0	42,600	42,600	7100.00
	L RSM JJ < > Allowance for removal and			0.00	0.00	0.00	0.00	3750.00	3750.00	
		6.00	EA	0	0	0	0	22,500	22,500	3750.00
	TOTAL Demo Exist Phase 1 Pumps	6.00	EA	0	0	0	0	65,100	65,100	10850.00
A_.05. 02. 02. Demo Exist Hydraulic Piping Sys										
A_.05. 02. 02.01. Install Valves & drain Hyd Fluid										
	L RSM JJ < > Purchase (8)-3" gate valves ---1			0.00	0.00	0.00	0.00	500.00	500.00	
		8.00	EA	0	0	0	0	4,000	4,000	500.00
	L RSM JJ < > Purchase (2)-1" gate valves ---1			0.00	0.00	0.00	0.00	200.00	200.00	
		2.00	EA	0	0	0	0	400	400	200.00
	L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
		594.00	LF	0	0	0	0	1,931	1,931	3.25
	L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
		594.00	LF	0	0	0	0	1,931	1,931	3.25
	L RSM JJ < > Fluid Containment and Disposal			0.00	0.00	0.00	0.00	10.00	10.00	
		225.00	GAL	0	0	0	0	2,250	2,250	10.00
	TOTAL Install Valves & drain Hyd Fluid			0	0	0	0	10,511	10,511	
A_.05. 02. 02.02. Clean interior of piping										
	L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	2.00	2.00	
		594.00	LF	0	0	0	0	1,188	1,188	2.00
	L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	0.50	0.50	
		149.00	LF	0	0	0	0	75	75	0.50
	TOTAL Clean interior of piping			0	0	0	0	1,263	1,263	
A_.05. 02. 02.03. Demo exist hyd fluid piping										
	L RSM JJ < > Demo existing 3" hydraulic			0.00	0.00	0.00	0.00	10.50	10.50	
		594.00	LF	0	0	0	0	6,237	6,237	10.50

A_.05. Mechanical Systems			QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM JJ <	> Demo existing 1" hydraulic				0.00	0.00	0.00	0.00	10.50	10.50	
			149.00	LF	0	0	0	0	1,565	1,565	10.50
	TOTAL Demo exist hyd fluid piping				0	0	0	0	7,802	7,802	
	TOTAL Demo Exist Hydraulic Piping Sys				0	0	0	0	19,575	19,575	
A_.05. 02. 03. Demo Exist Power Units											
L RSM JJ <	> Allowance for disconnect & prep				0.00	0.00	0.00	0.00	3600.00	3600.00	
			6.00	EA	0	0	0	0	21,600	21,600	3600.00
L RSM JJ <	> Allowance for removal and				0.00	0.00	0.00	0.00	1800.00	1800.00	
			6.00	EA	0	0	0	0	10,800	10,800	1800.00
	TOTAL Demo Exist Power Units		6.00	EA	0	0	0	0	32,400	32,400	5400.00
A_.05. 02. 04. Miscellaneous Demo											
L RSM JJ <	> Allowance for Misc Pump Sys				0.00	0.00	0.00	0.00	25000	25000.00	
			1.00	LS	0	0	0	0	25,000	25,000	25000.00
	TOTAL Miscellaneous Demo				0	0	0	0	25,000	25,000	

A_.05. 02. 05. Modify Exist Pump Supt Platforms

Notes:

1. Costs for Phase 2 platforming abstracted from Phase 1 quantities and costs for modifications of existing pump support platforms.

2. Abstracted costs based on replacement of (6)-Phase 2 pumps in lieu of replacement of (12)-Phase 1 pumps.

A_.05. 02. 05.01. Demo Exist Stl & Grating (E-W)											
L RSM SS <	> Allowance for demo of exist				0.00	0.00	0.00	0.00	250.00	250.00	
			6.50	TON	0	0	0	0	1,625	1,625	250.00
L RSM SS <	> Allowance for demo of exist				0.00	0.00	0.00	0.00	5.00	5.00	
			1320.00	SF	0	0	0	0	6,600	6,600	5.00
L RSM SS <	> Allowance for disposal of demo				0.00	0.00	0.00	0.00	50.00	50.00	
			17.50	TON	0	0	0	0	875	875	50.00
	TOTAL Demo Exist Stl & Grating (E-W)				0	0	0	0	9,100	9,100	

A_.05. Mechanical Systems			QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.05. 02. 05.02. Install New Stl & Grating (E-W)											
	L RSM SS <	> Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
			6.50	TON	0	0	0	0	11,050	11,050	1700.00
	L RSM SS <	> Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
			1650.00	SF	0	0	0	0	4,950	4,950	3.00
	L RSM SS <	> Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
			6.50	TON	0	0	0	0	6,500	6,500	1000.00
	L RSM SS <	> Allowance for new Grating			0.00	0.00	0.00	0.00	25.00	25.00	
			1320.00	SF	0	0	0	0	33,000	33,000	25.00
		TOTAL Install New Stl & Grating (E-W)			0	0	0	0	55,500	55,500	
		TOTAL Modify Exist Pump Supt Platforms			0	0	0	0	64,600	64,600	
A_.05. 02. 06. Install New Pumps w/ Elec Driver											
	L RSM JJ <	> New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
			6.00	EA	0	0	0		010200000	10,200,000	1700000
	L RSM JJ <	> Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
			6.00	EA	0	0	0	0	2490000	2,490,000	415000.00
		TOTAL Install New Pumps w/ Elec Driver	6.00	EA	0	0	0		012690000	12,690,000	2115000
A_.05. 02. 07. Install New Motor Power Units											
	L RSM JJ <	> Motoros for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
			6.00	EA	0	0	0	0	3000000	3,000,000	500000.00
		TOTAL Install New Motor Power Units	6.00	EA	0	0	0	0	3000000	3,000,000	500000.00
		TOTAL Phase 2 Pumps Sys Modifications			0	0	0		015896675	15,896,675	

A_.05. 03. Gate Closure Pump System Mods

Notes:

1. Allows for demo of the existing hydraulic pumping system and modifications to the existing platform.

A_.05. 03. 01. Demo Exist Gate Closure Pumps											
	L RSM JJ <	> Allowance for disconnect & prep			0.00	0.00	0.00	0.00	7100.00	7100.00	
			14.00	EA	0	0	0	0	99,400	99,400	7100.00

A_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM JJ < > Allowance for removal and			0.00	0.00	0.00	0.00	3750.00	3750.00	
	14.00	EA	0	0	0	0	52,500	52,500	3750.00
TOTAL Demo Exist Gate Closure Pumps	14.00	EA	0	0	0	0	151,900	151,900	10850.00
A_.05. 03. 02. Demo Exist Hydraulic Piping Sys									
A_.05. 03. 02.01. Install Valves & drain Hyd Fluid									
L RSM JJ < > Purchase (8)-3" gate valves ---1			0.00	0.00	0.00	0.00	500.00	500.00	
	8.00	EA	0	0	0	0	4,000	4,000	500.00
L RSM JJ < > Purchase (2)-1" gate valves ---1			0.00	0.00	0.00	0.00	200.00	200.00	
	2.00	EA	0	0	0	0	400	400	200.00
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	1400.00	LF	0	0	0	0	4,550	4,550	3.25
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	1400.00	LF	0	0	0	0	4,550	4,550	3.25
L RSM JJ < > Fluid Containment and Disposal			0.00	0.00	0.00	0.00	10.00	10.00	
	528.00	GAL	0	0	0	0	5,280	5,280	10.00
TOTAL Install Valves & drain Hyd Fluid			0	0	0	0	18,780	18,780	
A_.05. 03. 02.02. Clean interior of piping									
L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	2.00	2.00	
	1400.00	LF	0	0	0	0	2,800	2,800	2.00
L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	0.50	0.50	
	350.00	LF	0	0	0	0	175	175	0.50
TOTAL Clean interior of piping			0	0	0	0	2,975	2,975	
A_.05. 03. 02.03. Demo exist hyd fluid piping									
L RSM JJ < > Demo existing 3" hydraulic			0.00	0.00	0.00	0.00	10.50	10.50	
	1400.00	LF	0	0	0	0	14,700	14,700	10.50
L RSM JJ < > Demo existing 1" hydraulic			0.00	0.00	0.00	0.00	10.50	10.50	
	350.00	LF	0	0	0	0	3,675	3,675	10.50
TOTAL Demo exist hyd fluid piping			0	0	0	0	18,375	18,375	

A_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Demo Exist Hydraulic Piping Sys			0	0	0	0	40,130	40,130	
A_.05. 03. 03. Demo Exist Power Units									
L RSM JJ < > Allowance for disconnect & prep			0.00	0.00	0.00	0.00	3600.00	3600.00	
	14.00	EA	0	0	0	0	50,400	50,400	3600.00
L RSM JJ < > Allowance for removal and			0.00	0.00	0.00	0.00	1800.00	1800.00	
	14.00	EA	0	0	0	0	25,200	25,200	1800.00
TOTAL Demo Exist Power Units	14.00	EA	0	0	0	0	75,600	75,600	5400.00

A_.05. 03. 04. Demo Exist Disch Pipe+Misc Demo

Notes:

1. Assume discharge pipes are 3-ft diameter. x 30-ft length each pipe.

2. 30-ft ea x 14 pipes = 420 LF.

3. Say $75 per LF for demo and disposal.

L RSM JJ < > Allowance for demo & disposal of			0.00	0.00	0.00	0.00	75.00	75.00	
	420.00	LF	0	0	0	0	31,500	31,500	75.00
L RSM JJ < > Allowance for Misc Pump Sys			0.00	0.00	0.00	0.00	25000	25000.00	
	1.00	LS	0	0	0	0	25,000	25,000	25000.00
TOTAL Demo Exist Disch Pipe+Misc Demo			0	0	0	0	56,500	56,500	

A_.05. 03. 05. Modify Exist Pump Supt Platforms

Notes:

1. Say Platform approx 30-ft wide x 140-ft lg. = 4200 SF

2. Allow 25lbs / SF for existing platform framing at $5.00 per SF. (No salvage value incl) .

3. Allow $50 lbs / SF for new platform framing, including fabrication, delivery, corrsion protection, and installation.

L RSM JJ < > Allowance for demo & disposal of			0.00	0.00	0.00	0.00	5.00	5.00	
	4200.00	SF	0	0	0	0	21,000	21,000	5.00
L RSM JJ < > Allowance for new replacement			0.00	0.00	0.00	0.00	50.00	50.00	
	4200.00	SF	0	0	0	0	210,000	210,000	50.00

A_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Modify Exist Pump Supt Platforms			0	0	0	0	231,000	231,000	
TOTAL Gate Closure Pump System Mods			0	0	0	0	555,130	555,130	
TOTAL Mechanical Systems			0	0	0	048544768		48,544,768	

A_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.06. Electrical Systems									
A_.06. 01. Lightning and Grounding System									
A_.06. 01. 01. Lightning Protection									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 5999 Wire, laid in trench									
16181 5999 Copper, bare stranded									
MIL GG <16181 6010 > Grounding, laid in trench,			6.86	221.53	0.00	545.00	0.00	766.53	
	0.40	MLF	3	89	0	218	0	307	766.53
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16840 0010 Lightning protection									
16840 4000 Air terminals, copper									
L MIL GG <16840 4040 > Lightning protection, air			0.48	19.28	0.00	14.67	0.00	33.95	
	29.00	EA	14	559	0	425	0	984	33.95
16840 0010 Lightning protection									
16840 4200 Air terminal bases, copper									
M MIL GG <16840 4220 > Lightning protection, air term			0.89	35.72	0.00	21.50	0.00	57.22	
	29.00	EA	26	1,036	0	624	0	1,659	57.22
TOTAL Lightning Protection			42	1,683	0	1,267	0	2,950	
A_.06. 01. 02. Grounding									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 0029 Rod									
MIL GG <16181 0100 > Grounding, rod, copper clad, 10'			1.82	73.05	0.00	29.40	0.00	102.45	
	20.00	EA	36	1,461	0	588	0	2,049	102.45
MIL GG <16181 6020 > Grounding, laid in trench,			9.43	304.60	0.00	1060.00	0.00	1364.60	
	1.00	MLF	9	305	0	1,060	0	1,365	1364.60
16181 0010 Grounding devices									
16181 6299 Ground conductor bonding, cadweld									

A_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
MIL GG <16181 6350 > Grounding, gnd conductor bond,			1.82	73.42	0.00	19.89	0.00	93.31	
	20.00	EA	36	1,468	0	398	0	1,866	93.31
MIL GG <16181 6380 > Grounding, gnd conductor bond,			2.08	84.12	0.00	17.29	0.00	101.41	
	50.00	EA	104	4,206	0	865	0	5,071	101.41
TOTAL Grounding			186	7,440	0	2,910	0	10,350	
TOTAL Lightning and Grounding System			229	9,123	0	4,177	0	13,301	

A_.06. 02. Electrical Power

A_.06. 02. 01. Power

16000 0000 Electrical, Generally excludes crane services
16000 0000 Raceways, Generally excludes crane services
16016 0000 Conduits
16017 0010 Conduit, to 15', incl. terminations & elbows
16017 9889 Rental, hydraulic bender

L MIL GG <16018 0000 > Remove generator power and			24.00	964.80	0.00	9.58	206868	207842.38	
	1.00	LS	24	965	0	10	206,868	207,842	207842.38

16016 0000 Conduits
16018 0010 Conduit, to 15', includes couplings only
16018 0499 Steel, rigid galvanized (RGS)

MIL GG <16018 0640 > Conduit to 15' H, 3" dia, incl			0.25	10.05	0.00	9.58	0.00	19.63	
	20350	LF	5,088	204,518	0	194,953	0	399,471	19.63

16000 0000 Electrical, Generally excludes crane services
16100 0000 Conductors & Grounding
16108 0000 Conductors
16115 0010 Shielded cable
16115 0039 Copper, XLP shielding, 5 KV

M MIL GG <16115 0400 > Shielded cable, 5kV, 1/0, no			42.11	1691.79	0.00	2184.00	0.00	3875.79	
	32.00	MLF	1,347	54,137	0	69,888	0	124,025	3875.79

16108 0000 Conductors
16119 0010 Wire
16119 0919 600 volt, type THWN-THHN
16119 0999 Copper, stranded

MIL GG <16119 1350 > Wire, 600 volt, type THWN-THHN,			12.31	494.52	0.00	274.50	0.00	769.02	
	11.30	MLF	139	5,588	0	3,102	0	8,690	769.02

16000 0000 Electrical, Generally excludes crane services

A_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16300 0000 Motors, Starters, Boards & Switches									
16330 0000 Switches									
16330 0010 Distribution section									
16330 0100 Aluminum bus bars, not including breakers									
B AF GG <16331 0000 > Medium voltyage soft start			40.00	1615.20	0.00	39600.00	0.00	41215.20	
	18.00	EA	720	29,074	0	712,800	0	741,874	41215.20
16000 0000 Electrical, Generally excludes crane services									
16500 0000 Power Systems & Capacitors									
16510 0000 Power Systems									
16513 0010 Generator set									
16513 2000 Diesel engine									
M MIL GG <16513 3270 > Remove generator set			177.78	6787.85	778.37	0.00	0.00	7566.22	
	18.00	EA	3,200	122,181	14,011	0	0	136,192	7566.22
B MIL GG <16513 3270 > Generator set, dsl eng, xfr			250.00	9545.41	1094.58	350000	0.00	360640.00	
	18.00	EA	4,500	171,817	19,702	6300000	0	6,491,520	360640.00
TOTAL Power			15,018	588,280	33,713	7280752	206,868	8,109,614	

A_.06. 02. 03. Gate Motor Operators

16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16350 0000 Motors									
B MIL GG <16353 0000 > Gate motor operator			0.00	76.53	0.00	5000.00	0.00	5076.53	
	11.00	EA	0	842	0	55,000	0	55,842	5076.53
TOTAL Gate Motor Operators			0	842	0	55,000	0	55,842	

A_.06. 02. 08. Control

Notes:

1. The report considers that incremental SCADA (Supervisory Control And Data Acquisition) interface will be required in considerations of ICS enhancements.

2. Estimate provides for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system.

3. Allowance includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system.

4. Allowance based on cost of SCADA upgrades per pump.

A_.06. Electrical Systems

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

Total allowance of $3000 as follows:
$1000 - Pump House SCADA upgrade cost per pump
$2000 - SCADA routing cost to remote pump motors, etc
---------- $3000 - Total estimated SCADA upgrade cost per pump

5. Estimate assumes existing SCADA system is adequate for all Phase 3 monitoring.

16000 0000 Electrical, Generally excludes crane services
16800 0000 Special Systems
16801 0000 Special Systems
16862 0010 Closed circuit TV system
16862 6999 Microprocessor, matrix switcher/controller

M CIV GG <16865 0000 > Scada control system for canal			1.00	40.38	0.00	0.00	3000.00	3040.38	
	18.00	EA	18	727	0	0	54,000	54,727	3040.38
TOTAL Control			18	727	0	0	54,000	54,727	
TOTAL Electrical Power			15,036	589,849	33,713	7335752	260,868	8,220,182	
TOTAL Electrical Systems			15,265	598,972	33,713	7339930	260,868	8,233,483	

A_.07. Miscellaneous Items

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
A_.07. Miscellaneous Items									
A_.07. 01. Corrosion Protection									
Note:									
1. Provide coating on all major elements of the facility.									
2. Soil excavation and backfill required at all platform columns and structure supports in order to provided corrosion protection below grade.									
3. A cofferdam is required on the Flood side to enable drawdown of water to adequate depth to provide corrosion protection at a nominal depth below water line on Flood side.									
4. On Protected side, it is assumed the pump station pumps can be used for draw-down of canal for purpose of applying corrosion protection at a nominal depth below water line on Protected side.									
A_.07. 01. 01. Protective Coatings									
A_.07. 01. 01.01. Soil Excavation / Backfill									
L MIL AA < > Excav / Backfill around existing			0.00	0.00	0.00	0.00	60000	60000.00	
	1.00	LS	0	0	0	0	60,000	60,000	60000.00
TOTAL Soil Excavation / Backfill			0	0	0	0	60,000	60,000	
A_.07. 01. 01.02. Construct Temp Cofferdam									
L MIL AA < > Construct Temp Cofferdam on			0.00	0.00	0.00	0.00	1912500	1912500.00	
	1.00	LS	0	0	0	0	1912500	1,912,500	1912500
TOTAL Construct Temp Cofferdam			0	0	0	0	1912500	1,912,500	
A_.07. 01. 01.03. Dewater Protected Side									
L MIL AA < > Allowance for dewatering of			0.00	0.00	0.00	0.00	300000	300000.00	
	1.00	LS	0	0	0	0	300,000	300,000	300000.00
TOTAL Dewater Protected Side			0	0	0	0	300,000	300,000	
A_.07. 01. 01.04. Apply Protective Coating									
L MIL AA < > Apply protective coating to			0.00	0.00	0.00	0.00	425000	425000.00	
	1.00	LS	0	0	0	0	425,000	425,000	425000.00
TOTAL Apply Protective Coating			0	0	0	0	425,000	425,000	

A_.07. Miscellaneous Items	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Protective Coatings			0	0	0	0	2697500	2,697,500	
A_.07. 01. 02. Cathodic Protection									
L MIL AA < > Allowance to install cathodic			0.00	0.00	0.00	0.00	425000	425000.00	
	1.00	LS	0	0	0	0	425,000	425,000	425000.00
TOTAL Cathodic Protection			0	0	0	0	425,000	425,000	
TOTAL Corrosion Protection			0	0	0	0	3122500	3,122,500	

A_.07. 02. Fluid Storage Facility (On-Site)

Note:

1. The estimate assumes The Fluid Storage Facility shall contain a 200 SF area for stockpile of waste fluids; an 1800 Sf area for new fluid storage and fluid changing of equipment.

L RSM SS < > Allow for (1)- onsite stor &			0.00	0.00	0.00	0.00	725.00	725.00	
	1500.00	SF	0	0	0	0	1087500	1,087,500	725.00
TOTAL Fluid Storage Facility (On-Site)			0	0	0	0	1087500	1,087,500	

A_.07. 03. Addt'l Fuel Farm Installed

Notes:

1. Additional Fuel Tanks are provided to enhance fuel reserves at to ICS facility. The additional of these tanks align reserve capacity with OPTION 1 & OPTION 2 Conceptual Designs for New Pump Station Facilities.

2. The added tanks are in addition to the existing single wall tanks to be replaced by double wall tanks as shown elewhere in the estimate.

L MIL AA < > Install Fuel Farm Tanks and			0.00	0.00	0.00	0.00	54000	54000.00	
	5.00	EA	0	0	0	0	270,000	270,000	54000.00
TOTAL Addt'l Fuel Farm Installed	5.00	EA	0	0	0	0	270,000	270,000	54000.00

A_.07. 04. 96-in Butterfly Valves

02000 0000 Site Work
02100 0000 Site Preparation & Excavation Support
02160 0000 Sheet Piling
02161 0009 Sheet piling
02161 3900 Wood, including wales, braces and spacers

A_.07. Miscellaneous Items	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L MIL AA <02200 0000 > Allowance for delivery of Valves			0.00	0.00	0.00	0.00	1500.00	1500.00	
	7.00	EA	0	0	0	0	10,500	10,500	1500.00
11000 0000 Equipment									
11000 0000 Equipment									
B MIL AA <11000 0001 > Allowance for modifying and			0.00	0.00	0.00	0.00	25000	25000.00	
	7.00	EA	0	0	0	0	175,000	175,000	25000.00
15000 0000 Mechanical, Generally excludes crane services									
15100 0000 Pipe & Fittings									
15191 0000 Valves									
15193 0010 Valves, bronze									
15193 8350 Tempering water									
15193 8650 Threaded connections									
B MIL AA <15194 0000 > 96" dia Butterfly Valve			200.00	8238.90	2434.02	80000.00	0.00	90672.92	
	7.00	EA	1,400	57,672	17,038	560,000	0	634,710	90672.92
TOTAL 96-in Butterfly Valves	7.00	EA	1,400	57,672	17,038	560,000	185,500	820,210	117172.92
TOTAL Miscellaneous Items			1,400	57,672	17,038	560,000	4665500	5,300,210	
TOTAL 17th Street Canal ICS			16,665	656,644	50,751	789993058840276		67,447,601	

B_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_. Orleans Avenue Canal ICS									
B_.01. Exist Engine Platform Enclosures									
Notes:									
1. Phase 1, 2, 3 Power Units are exposed to hurricane wind blown debris.									
2. Hoisting equipment needs some level of protection from flying debris.									
3. For purpose of cost development, estimate assumes enclosure similar in size and framing to London Ave. Generator Platform.									
4. Quantities reflect total for both east / west side platforms.									
B_.01.01 . Demolition									
B_.01.01 . 01. Chain Link Fencing									
L RSM SS < > Site dml, chain link, remove			0.00	0.00	0.00	0.00	3.00	3.00	
	530.00	LF	0	0	0	0	1,590	1,590	3.00
TOTAL Chain Link Fencing	530.00	LF	0	0	0	0	1,590	1,590	3.00
B_.01.01 . 02. Metal Roof-Siding Panels									
L RSM SS < > Remove metal roof and metal			0.00	0.00	0.00	0.00	1.00	1.00	
	10300	SF	0	0	0	0	10,300	10,300	1.00
TOTAL Metal Roof-Siding Panels	10300	SF	0	0	0	0	10,300	10,300	1.00
B_.01.01 . 03. Misc Steel - Roof Purlins									
L RSM SS < > Remove metal purlins supporting			0.00	0.00	0.00	0.00	0.25	0.25	
	21500	LBS	0	0	0	0	5,375	5,375	0.25
TOTAL Misc Steel - Roof Purlins	21500	LBS	0	0	0	0	5,375	5,375	0.25
TOTAL Demolition			0	0	0	0	17,265	17,265	
B_.01.02 . Structure Modifications									
B_.01.02 . 01. Add Misc Steel Framing									

B_.01. Exist Engine Platform Enclosures	QUANTY UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.01.02 . 01.01. Add Welded Structural Frame								
Note:								
1. Allow 5500 LBS each Welded Frame (say 55 LF x 100 = 5500 lbs).								
2. 8 ea. x 5500 = 44,000 lbs.								
3. 44,000 / 2000 = 22 tons								
4. Cost based on $1.50/LB for material, labor, equip. incl dwelivery and handling.								
MIL SS < > Add Welded Steel Frame		9.14	398.12	92.94	1220.00	0.00	1711.06	
	22.00 TON	201	8,759	2,045	26,840	0	37,643	1711.06
TOTAL Add Welded Structural Frame	8.00 EA	201	8,759	2,045	26,840	0	37,643	4705.42
B_.01.02 . 01.02. Add W10 Col's at Eaves of Bldg								
B MIL SS < > Add W10 Wide-Flange Columns at		0.00	0.00	0.00	0.00	2100.00	2100.00	
	1.92 TON	0	0	0	0	4,032	4,032	2100.00
TOTAL Add W10 Col's at Eaves of Bldg	3840.00 LBS	0	0	0	0	4,032	4,032	1.05
B_.01.02 . 01.03. Add New Roof Purlins								
B MIL SS < > Add new purlins to support		0.00	0.00	0.00	0.00	1.10	1.10	
	43200 LB	0	0	0	0	47,520	47,520	1.10
TOTAL Add New Roof Purlins	43200 LB	0	0	0	0	47,520	47,520	1.10
B_.01.02 . 01.04. Add MC6 Girts at Bldg Perimeter								
B MIL SS < > Add new MC6x8.2 Girts btwn		0.00	0.00	0.00	0.00	3.00	3.00	
	22000 LB	0	0	0	0	66,000	66,000	3.00
TOTAL Add MC6 Girts at Bldg Perimeter	22000 LB	0	0	0	0	66,000	66,000	3.00
TOTAL Add Misc Steel Framing		201	8,759	2,045	26,840	117,552	155,195	
B_.01.02 . 02. Add Precast Wall & Roof Panels								
Note:								
1. Estimates assumes 6" +/- thick precast panels.								
2. Cost incl materils, labor, equip, etc for installation onto existing bldg.								
B MIL SS < > Add new perimeter wall panels		0.00	0.00	0.00	0.00	10.00	10.00	
	15840 SF	0	0	0	0	158,400	158,400	10.00
TOTAL Add Precast Wall & Roof Panels	15840 SF	0	0	0	0	158,400	158,400	10.00

B_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.01.02 . 03. Add Overhead & Personnel Doors									
Notes:									
1. Allow (2)- commercial grade hollow metal doors at each enclosure.									
2. Allow (1)-commercial grade, sectional, steel, heavy duty, overhead door at each enclosure. Assume 10-ft x 10-ft size.									
B MIL SS < > Coml stl dr, fl, 3'-4" x 7'-0",			0.00	0.00	0.00	0.00	500.00	500.00	
	4.00	EA	0	0	0	0	2,000	2,000	500.00
08000 0000 Doors & Windows									
08300 0000 Special Doors									
08360 0000 Sectional Overhead Doors									
08361 0010 Overhead, commercial									
08361 2599 Steel, sectional									
B MIL SS <08361 2650 > Overhead coml, no frame, manual,			0.00	0.00	0.00	0.00	1200.00	1200.00	
	2.00	EA	0	0	0	0	2,400	2,400	1200.00
TOTAL Add Overhead & Personnel Doors			0	0	0	0	4,400	4,400	
B_.01.02 . 04. Add Louvers & Ventilators									
Notes:									
1. Install louvers for air intake each side of enclosure. Provide at East and West enclosures									
2. Assume (14) ea side , at 4-ft x 4-ft size.									
3. Total louver area = [14 ea x 2 sides x 4 x 4] x 2 enclosures = 896 SF. (SAY 1000 SF total)									
4. Provide a protective aluminum shroud over top & sides of louver.									
5. Provide (2)- powered wall exhausters at ea enclosure; with shroud protection.									
B MIL SS < > Wall louvers, aluminum, with			0.00	0.00	0.00	0.00	40.00	40.00	
	1000.00	SF	0	0	0	0	40,000	40,000	40.00
B MIL SS < > Protective aluminum shroud over			0.00	0.00	0.00	0.00	250.00	250.00	
	56.00	EA	0	0	0	0	14,000	14,000	250.00
B AF JJ < > Fan, wall exhers, 1 HP, cntfgl,			0.00	0.00	0.00	0.00	1500.00	1500.00	
	4.00	EA	0	0	0	0	6,000	6,000	1500.00
TOTAL Add Louvers & Ventilators			0	0	0	0	60,000	60,000	

B_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.01.02 . 05. Modify Exist Gen Exhaust Vents									
Notes:									
1. Existing exhaust vents pentrate the metal siding of the bldg.									
2. Vents need to be modified to function with the new exterior precast concrete panel system.									
3. Includes adapting exterior shrouds on vent penetration thru new precast concrte panels.									
B MIL JJ < > Allowance to modify exist			0.00	0.00	0.00	0.00	500.00	500.00	
	10.00	EA	0	0	0	0	5,000	5,000	500.00
TOTAL Modify Exist Gen Exhaust Vents			0	0	0	0	5,000	5,000	
B_.01.02 . 06. Modify Exist Utility Runs									
B MIL JJ < > Allowance to modify utility runs			0.00	0.00	0.00	0.00	10000	10000.00	
	1.00	LS	0	0	0	0	10,000	10,000	10000.00
TOTAL Modify Exist Utility Runs			0	0	0	0	10,000	10,000	
TOTAL Structure Modifications			201	8,759	2,045	26,840	355,352	392,995	
B_.01.03 . Allow for Misc Enclosure Mods									
L RSM SS < > Allowance for misc modifications			0.00	0.00	0.00	0.00	25000	25000.00	
	1.00	LS	0	0	0	0	25,000	25,000	25000.00
TOTAL Allow for Misc Enclosure Mods			0	0	0	0	25,000	25,000	
TOTAL Exist Engine Platform Enclosures			201	8,759	2,045	26,840	397,617	435,260	

B_.02. New Engine Platform & Encl (N/A)	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.02. New Engine Platform & Encl (N/A)									
Notes:									
New Engine Platforms with Enclosures are not required at Orleans Avenue Pump Station.									
TOTAL New Engine Platform & Encl (N/A)			0	0	0	0	0	0	
B_.03. Phase 3 Pump Platform Encl (N/A)									
Notes:									
1. Phase 1, 2, 3 Power Units are exposed to hurricane wind blown debris.									
2. Hoisting equipment needs some level of protection from flying debris.									
3. Quantities reflect total for both east / west side platforms.									
TOTAL Phase 3 Pump Platform Encl (N/A)			0	0	0	0	0	0	
B_.04. Gate Operations									
Note:									
1. Allow for removal and disposal of existing (5) needle gates, and replacement with (5) roller gates and associated framing.									
2. Provide gates with rollers to allow response to emergency closures during differential head conditions, and need for quicker repsponse time for placement of gates.									
B_.04. 01. Roller Gates and Guides									
B_.04. 01. 01. Roller Gates									
L RSM SS < > Allowance for fabrication and			0.00	0.00	0.00	0.00	1700.00	1700.00	
	60.00	TON	0	0	0	0	102,000	102,000	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	6000.00	SF	0	0	0	0	18,000	18,000	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	60.00	TON	0	0	0	0	60,000	60,000	1000.00
TOTAL Roller Gates	5.00	EA	0	0	0	0	180,000	180,000	36000.00
B_.04. 01. 02. Gate Guide Columns									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	28.00	TON	0	0	0	0	47,600	47,600	1700.00

B_.04. Gate Operations	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	2800.00	SF	0	0	0	0	8,400	8,400	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	28.00	TON	0	0	0	0	28,000	28,000	1000.00
TOTAL Gate Guide Columns			0	0	0	0	84,000	84,000	
B_.04. 01. 03. Add Platform Expansion & Ladders									
L RSM SS < > Allowance for fabrication and			0.00	0.00	0.00	0.00	1700.00	1700.00	
	4.50	TON	0	0	0	0	7,650	7,650	1700.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	4.50	TON	0	0	0	0	4,500	4,500	1000.00
TOTAL Add Platform Expansion & Ladders			0	0	0	0	12,150	12,150	
B_.04. 01. 04. Removal / Dispose of Exist Gates									
L RSM SS < > Allowance for gate removal from			0.00	0.00	0.00	0.00	1000.00	1000.00	
	60.00	TON	0	0	0	0	60,000	60,000	1000.00
L RSM SS < > Allowance for off-site removal			0.00	0.00	0.00	0.00	0.02	0.02	
	120000	LBS	0	0	0	0	2,400	2,400	0.02
TOTAL Removal / Dispose of Exist Gates	5.00	EA	0	0	0	0	62,400	62,400	12480.00
B_.04. 01. 05. Fill Void of Needle Gate Seat									
Notes:									
1. Allow 12-ft / gate x 5 gates = 60 LF									
L RSM SS < > Fill void of Needle Gate Seats			0.00	0.00	0.00	0.00	100.00	100.00	
	60.00	LF	0	0	0	0	6,000	6,000	100.00
TOTAL Fill Void of Needle Gate Seat	5.00	EA	0	0	0	0	6,000	6,000	1200.00
B_.04. 01. 06. Install Gate Operator / Motor									
L RSM SS < > Install gate operator; reuse			0.00	0.00	0.00	0.00	2500.00	2500.00	
	5.00	EA	0	0	0	0	12,500	12,500	2500.00
TOTAL Install Gate Operator / Motor	11.00	EA	0	0	0	0	12,500	12,500	1136.36

B_.04. Gate Operations	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Roller Gates and Guides	0		0	0	0	0	357,050	357,050	
TOTAL Gate Operations	0		0	0	0	0	357,050	357,050	

B_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.05. Mechanical Systems									
B_.05. 01. Phase 1 Pumps Sys Modifications									
Notes:									
1. Replace existing Phase 1 pumps (12 ea) with new 350 cfs pumps (12 ea) - PSI type.									
2. See "Item E_Capacity Modifications" for alternative of providing additional pumping equipment and expanded facilities to accommodate enhanced capacity.									
B_.05. 01. 01. Demo Exist Phase 1 Pumps									
L RSM JJ < > Allowance for disconnect & prep			0.00	0.00	0.00	0.00	7100.00	7100.00	
	10.00	EA	0	0	0	0	71,000	71,000	7100.00
L RSM JJ < > Allowance for removal and			0.00	0.00	0.00	0.00	3750.00	3750.00	
	10.00	EA	0	0	0	0	37,500	37,500	3750.00
TOTAL Demo Exist Phase 1 Pumps	10.00	EA	0	0	0	0	108,500	108,500	10850.00
B_.05. 01. 02. Demo Exist Hydraulic Piping Sys									
B_.05. 01. 02.01. Install Valves & drain Hyd Fluid									
L RSM JJ < > Purchase (8)-3"gate valves ---1			0.00	0.00	0.00	0.00	500.00	500.00	
	8.00	EA	0	0	0	0	4,000	4,000	500.00
L RSM JJ < > Purchase (2)-1" gate valves ---1			0.00	0.00	0.00	0.00	200.00	200.00	
	2.00	EA	0	0	0	0	400	400	200.00
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	12600	LF	0	0	0	0	40,950	40,950	3.25
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	3150.00	LF	0	0	0	0	10,238	10,238	3.25
L RSM JJ < > Fluid Containment and Disposal			0.00	0.00	0.00	0.00	10.00	10.00	
	4755.00	GAL	0	0	0	0	47,550	47,550	10.00
TOTAL Install Valves & drain Hyd Fluid			0	0	0	0	103,138	103,138	
B_.05. 01. 02.02. Clean interior of piping									
L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	2.00	2.00	
	12600	LF	0	0	0	0	25,200	25,200	2.00

B_.05. Mechanical Systems		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM JJ <	> Allowance for flushing &			0.00	0.00	0.00	0.00	0.50	0.50	
		3150.00	LF	0	0	0	0	1,575	1,575	0.50
	TOTAL Clean interior of piping			0	0	0	0	26,775	26,775	
B_.05. 01. 02.03. Demo exist hyd fluid piping										
L RSM JJ <	> Demo existing 3" hydraulic			0.00	0.00	0.00	0.00	10.50	10.50	
		12600	LF	0	0	0	0	132,300	132,300	10.50
L RSM JJ <	> Demo existing 3" hydraulic			0.00	0.00	0.00	0.00	7.50	7.50	
		3150.00	LF	0	0	0	0	23,625	23,625	7.50
	TOTAL Demo exist hyd fluid piping			0	0	0	0	155,925	155,925	
	TOTAL Demo Exist Hydraulic Piping Sys			0	0	0	0	285,838	285,838	
B_.05. 01. 03. Demo Exist Power Units										
L RSM JJ <	> Allowance for disconnect & prep			0.00	0.00	0.00	0.00	3600.00	3600.00	
		10.00	EA	0	0	0	0	36,000	36,000	3600.00
L RSM JJ <	> Allowance for removal and			0.00	0.00	0.00	0.00	1800.00	1800.00	
		10.00	EA	0	0	0	0	18,000	18,000	1800.00
	TOTAL Demo Exist Power Units	10.00	EA	0	0	0	0	54,000	54,000	5400.00
B_.05. 01. 04. Miscellaneous Demo										
L RSM JJ <	> Allowance for Misc Pump Sys			0.00	0.00	0.00	0.00	50000	50000.00	
		1.00	LS	0	0	0	0	50,000	50,000	50000.00
	TOTAL Miscellaneous Demo			0	0	0	0	50,000	50,000	

B_.05. 01. 05. Modify Exist Pump Supt Platforms

Note:

1. Assumed steel framing of existing pump platform deck and grating similar to existing (12) Phase 1-17th Street pump platforms, except costs abstracted for (10) pumps for Orleans Avenue Canal.

B_.05. 01. 05.01. Demo Exist Stl & Grating (E-W)										
L RSM SS <	> Allowance for demo of exist			0.00	0.00	0.00	0.00	250.00	250.00	
		10.00	TON	0	0	0	0	2,500	2,500	250.00

B_.05. Mechanical Systems		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM SS <	> Allowance for demo of exist			0.00	0.00	0.00	0.00	5.00	5.00	
		2200.00	SF	0	0	0	0	11,000	11,000	5.00
L RSM SS <	> Allowance for disposal of demo			0.00	0.00	0.00	0.00	50.00	50.00	
		29.20	TON	0	0	0	0	1,460	1,460	50.00
	TOTAL Demo Exist Stl & Grating (E-W)			0	0	0	0	14,960	14,960	
B_.05. 01. 05.02. Install New Stl & Grating (E-W)										
L RSM SS <	> Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
		10.00	TON	0	0	0	0	17,000	17,000	1700.00
L RSM SS <	> Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
		2750.00	SF	0	0	0	0	8,250	8,250	3.00
L RSM SS <	> Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
		10.00	TON	0	0	0	0	10,000	10,000	1000.00
L RSM SS <	> Allowance for new Grating			0.00	0.00	0.00	0.00	25.00	25.00	
		2200.00	SF	0	0	0	0	55,000	55,000	25.00
	TOTAL Install New Stl & Grating (E-W)			0	0	0	0	90,250	90,250	
	TOTAL Modify Exist Pump Supt Platforms			0	0	0	0	105,210	105,210	
B_.05. 01. 06. Install New Pumps w/ Elec Driver										
L RSM JJ <	> New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
		10.00	EA	0	0	0	0	17000000	17,000,000	1700000
L RSM JJ <	> Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
		10.00	EA	0	0	0	0	4150000	4,150,000	415000.00
	TOTAL Install New Pumps w/ Elec Driver	10.00	EA	0	0	0	0	21150000	21,150,000	2115000
B_.05. 01. 07. Install New Motor Power Units										
L RSM JJ <	> Motors for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
		10.00	EA	0	0	0	0	5000000	5,000,000	500000.00
	TOTAL Install New Motor Power Units	10.00	EA	0	0	0	0	5000000	5,000,000	500000.00

B_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.05. 01. 08. Replace Storage Tks w/ Dbl Wall									
B_.05. 01. 08.01. Disconnect-Clean Exist Fuel Tank Notes: 1. Assume tank 5% full 20,000 gal x .05 = 100 gal									
L RSM JJ < > Disconnect existing fuel oil			0.00	0.00	0.00	0.00	500.00	500.00	
	1.00	LS	0	0	0	0	500	500	500.00
L RSM JJ < > Transfer re-usable Fuel, incl			0.00	0.00	0.00	0.00	1.00	1.00	
	100.00	GAL	0	0	0	0	100	100	1.00
L RSM JJ < > Clean and Flush tank prior to			0.00	0.00	0.00	0.00	500.00	500.00	
	1.00	LS	0	0	0	0	500	500	500.00
TOTAL Disconnect-Clean Exist Fuel Tank	2.00	EA	0	0	0	0	1,100	1,100	550.00
B_.05. 01. 08.02. Removal and Disposal of Exist Tk									
L RSM JJ < > Removal and disposal of existing			0.00	0.00	0.00	0.00	2000.00	2000.00	
	2.00	EA	0	0	0	0	4,000	4,000	2000.00
TOTAL Removal and Disposal of Exist Tk	2.00	EA	0	0	0	0	4,000	4,000	2000.00
B_.05. 01. 08.03. Install Double-Wall Storage Tank									
L RSM JJ < > New Dbl Wall Storage Tank(s) ;			0.00	0.00	0.00	0.00	22500	22500.00	
	2.00	EA	0	0	0	0	45,000	45,000	22500.00
L RSM JJ < > Install new Dbl Wall Storage			0.00	0.00	0.00	0.00	2000.00	2000.00	
	2.00	EA	0	0	0	0	4,000	4,000	2000.00
L RSM JJ < > Reconnect fuel piping; allow			0.00	0.00	0.00	0.00	1000.00	1000.00	
	2.00	EA	0	0	0	0	2,000	2,000	1000.00
TOTAL Install Double-Wall Storage Tank	2.00	EA	0	0	0	0	51,000	51,000	25500.00
TOTAL Replace Storage Tks w/ Dbl Wall	2.00	EA	0	0	0	0	56,100	56,100	28050.00
TOTAL Phase 1 Pumps Sys Modifications			0	0	0	026809648		26,809,648	
TOTAL Mechanical Systems			0	0	0	026809648		26,809,648	

B_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B_.06. Electrical Systems									
B_.06. 01. Lightning and Grounding System									
B_.06. 01. 01. Lightning Protection									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 5999 Wire, laid in trench									
16181 5999 Copper, bare stranded									
MIL GG <16181 6010 > Grounding, laid in trench,			6.86	221.53	0.00	545.00	0.00	766.53	
	0.40	MLF	3	89	0	218	0	307	766.53
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16840 0010 Lightning protection									
16840 4000 Air terminals, copper									
L MIL GG <16840 4040 > Lightning protection, air			0.48	19.28	0.00	14.67	0.00	33.95	
	22.00	EA	11	424	0	323	0	747	33.95
16840 0010 Lightning protection									
16840 4200 Air terminal bases, copper									
M MIL GG <16840 4220 > Lightning protection, air term			0.89	35.72	0.00	21.50	0.00	57.22	
	22.00	EA	20	786	0	473	0	1,259	57.22
TOTAL Lightning Protection			33	1,299	0	1,014	0	2,312	
B_.06. 01. 02. Grounding									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 0029 Rod									
MIL GG <16181 0100 > Grounding, rod, copper clad, 10'			1.82	73.05	0.00	29.40	0.00	102.45	
	16.00	EA	29	1,169	0	470	0	1,639	102.45
MIL GG <16181 6020 > Grounding, laid in trench,			9.43	304.60	0.00	1060.00	0.00	1364.60	
	1.00	MLF	9	305	0	1,060	0	1,365	1364.60
16181 0010 Grounding devices									
16181 6299 Ground conductor bonding, cadweld									

B_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
MIL GG <16181 6350 > Grounding, gnd conductor bond,			1.82	73.42	0.00	19.89	0.00	93.31	
	16.00	EA	29	1,175	0	318	0	1,493	93.31
MIL GG <16181 6380 > Grounding, gnd conductor bond,			2.08	84.12	0.00	17.29	0.00	101.41	
	50.00	EA	104	4,206	0	865	0	5,071	101.41
TOTAL Grounding			172	6,854	0	2,713	0	9,567	
TOTAL Lightning and Grounding System			205	8,153	0	3,727	0	11,880	

B_.06. 02. Electrical Power

B_.06. 02. 01. Power

16000 0000 Electrical, Generally excludes crane services
16000 0000 Raceways, Generally excludes crane services
16016 0000 Conduits
16017 0010 Conduit, to 15', incl. terminations & elbows
16017 9889 Rental, hydraulic bender

L MIL GG <16018 0000 > Remove generator power and			24.00	964.80	0.00	9.58	206868	207842.38	
	1.00	LS	24	965	0	10	206,868	207,842	207842.38

16016 0000 Conduits
16018 0010 Conduit, to 15', includes couplings only
16018 0499 Steel, rigid galvanized (RGS)

MIL GG <16018 0640 > Conduit to 15' H, 3" dia, incl			0.25	10.05	0.00	9.58	0.00	19.63	
	15000	LF	3,750	150,750	0	143,700	0	294,450	19.63

16000 0000 Electrical, Generally excludes crane services
16100 0000 Conductors & Grounding
16108 0000 Conductors
16115 0010 Shielded cable
16115 0039 Copper, XLP shielding, 5 KV

M MIL GG <16115 0400 > Shielded cable, 5kV, 1/0, no			42.11	1691.79	0.00	2184.00	0.00	3875.79	
	22.50	MLF	947	38,065	0	49,140	0	87,205	3875.79

16108 0000 Conductors
16119 0010 Wire
16119 0919 600 volt, type THWN-THHN
16119 0999 Copper, stranded

MIL GG <16119 1350 > Wire, 600 volt, type THWN-THHN,			12.31	494.52	0.00	274.50	0.00	769.02	
	8.00	MLF	98	3,956	0	2,196	0	6,152	769.02

16000 0000 Electrical, Generally excludes crane services

B_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16300 0000 Motors, Starters, Boards & Switches									
16330 0000 Switches									
16330 0010 Distribution section									
16330 0100 Aluminum bus bars, not including breakers									
B AF GG <16331 0000 > Medium voltyage soft start			40.00	1615.20	0.00	39600.00	0.00	41215.20	
	10.00	EA	400	16,152	0	396,000	0	412,152	41215.20
16000 0000 Electrical, Generally excludes crane services									
16500 0000 Power Systems & Capacitors									
16510 0000 Power Systems									
16513 0010 Generator set									
16513 2000 Diesel engine									
M MIL GG <16513 3270 > Remove generator set			177.78	6787.85	778.37	0.00	0.00	7566.22	
	10.00	EA	1,778	67,879	7,784	0	0	75,662	7566.22
B MIL GG <16513 3270 > Generator set, dsl eng, xfr			250.00	9545.41	1094.58	350000	0.00	360640.00	
	10.00	EA	2,500	95,454	10,946	3500000	0	3,606,400	360640.00
TOTAL Power			9,498	373,221	18,730	4091046	206,868	4,689,864	

B_.06. 02. 03. Gate Motor Operators

16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16350 0000 Motors									
B MIL GG <16353 0000 > Gate motor operator			0.00	76.53	0.00	5000.00	0.00	5076.53	
	5.00	EA	0	383	0	25,000	0	25,383	5076.53
TOTAL Gate Motor Operators			0	383	0	25,000	0	25,383	

B_.06. 02. 08. Control

Notes:
1. The report considers that incremental SCADA (Supervisory Control And Data Acquisition) interface will be required in considerations of ICS enhancements.

2. Estimate provides for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system.
3. Allowance includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system.
4. Allowance based on cost of SCADA upgrades per pump.
Total allowance of $3000 as follows:
$1000 - Pump House SCADA upgradecost per pump
$2000 - SCADA routing cost to remote pump motors, etc -

B_.06. Electrical Systems

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
---------- $3000 - Total estimated SCADA upgrade cost per pump									
5. Estimate assumes existing SCADA system is adequate for all Phase 3 monitoring.									
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16862 0010 Closed circuit TV system									
16862 6999 Microprocessor, matrix switcher/controller									
M CIV GG <16865 0000 > Scada control system for canal			1.00	40.38	0.00	0.00	3000.00	3040.38	
	10.00	EA	10	404	0	0	30,000	30,404	3040.38
TOTAL Control			10	404	0	0	30,000	30,404	
TOTAL Electrical Power			9,508	374,007	18,730	4116046	236,868	4,745,650	
TOTAL Electrical Systems			9,712	382,160	18,730	4119772	236,868	4,757,530	

B_.07. Miscellaneous Items	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

B_.07. Miscellaneous Items

B_.07. 01. Corrosion Protection

Note:

1. Provide coating on all major elements of the facility.

2. Soil excavation and backfill required at all platform columns and structure supports in order to provided corrosion protection below grade.

3. A cofferdam is required on the Flood side to enable drawdown of water to adequate depth to provide corrosion protection at a nominal depth below water line on Flood side.

4. On Protected side, it is assumed the pump station pumps can be used for draw-down of canal for purpose of applying corrosion protection at a nominal depth below water line on Protected side.

B_.07. 01. 01. Protective Coatings

B_.07. 01. 01.01. Soil Excavation / Backfill

L MIL AA < > Excav / Backfill around existing			0.00	0.00	0.00	0.00	50000	50000.00	
	1.00	LS	0	0	0	0	50,000	50,000	50000.00
TOTAL Soil Excavation / Backfill			0	0	0	0	50,000	50,000	

B_.07. 01. 01.02. Construct Temp Cofferdam

L MIL AA < > Construct Temp Cofferdam on			0.00	0.00	0.00	0.00	2100000	2100000.00	
	1.00	LS	0	0	0	0	2100000	2,100,000	2100000
TOTAL Construct Temp Cofferdam			0	0	0	0	2100000	2,100,000	

B_.07. 01. 01.03. Dewater Protected Side

L MIL AA < > Allowance for dewatering of			0.00	0.00	0.00	0.00	300000	300000.00	
	1.00	LS	0	0	0	0	300,000	300,000	300000.00
TOTAL Dewater Protected Side			0	0	0	0	300,000	300,000	

B_.07. 01. 01.04. Apply Protective Coating

L MIL AA < > Apply protective coating to			0.00	0.00	0.00	0.00	280000	280000.00	
	1.00	LS	0	0	0	0	280,000	280,000	280000.00
TOTAL Apply Protective Coating			0	0	0	0	280,000	280,000	

B_.07. Miscellaneous Items

	QUANTY UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Protective Coatings		0	0	0	0	2730000	2,730,000	
B_.07. 01. 02. Cathodic Protection								
L MIL AA < > Allowance to install cathodic		0.00	0.00	0.00	0.00	275000	275000.00	
	1.00 LS	0	0	0	0	275,000	275,000	275000.00
TOTAL Cathodic Protection		0	0	0	0	275,000	275,000	
TOTAL Corrosion Protection		0	0	0	0	3005000	3,005,000	
B_.07. 02. Fluid Storage Facility (On-Site)								
Note: 1. The estimate assumes The Fluid Storage Facility shall contain a 200 SF area for stockpile of waste fluids; an 1800 Sf area for new fluid storage and fluid changing of equipment.								
L RSM SS < > Allowance for (1)- 2,000 SF		0.00	0.00	0.00	0.00	725.00	725.00	
	1500.00 SF	0	0	0	0	1087500	1,087,500	725.00
TOTAL Fluid Storage Facility (On-Site)		0	0	0	0	1087500	1,087,500	
B_.07. 03. Addt'l Fuel Farm Installed (N/A)								
Notes:								
1. No additional Fuel Tanks are provided to enhance fuel reserves at to ICS facility.								
TOTAL Addt'l Fuel Farm Installed (N/A)		0	0	0	0	0	0	
B_.07. 04. 96-in Butterfly Valves								
02000 0000 Site Work								
02100 0000 Site Preparation & Excavation Support								
02160 0000 Sheet Piling								
02161 0009 Sheet piling								
02161 3900 Wood, including wales, braces and spacers								
L MIL AA <02200 0000 > Allowance for delivery of Valves		0.00	0.00	0.00	0.00	1500.00	1500.00	
	4.00 EA	0	0	0	0	6,000	6,000	1500.00
11000 0000 Equipment								
11000 0000 Equipment								
B MIL AA <11000 0001 > Allowance for modifying and		0.00	0.00	0.00	0.00	25000	25000.00	
	4.00 EA	0	0	0	0	100,000	100,000	25000.00

B_.07. Miscellaneous Items	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
15000 0000 Mechanical, Generally excludes crane services									
15100 0000 Pipe & Fittings									
15191 0000 Valves									
15193 0010 Valves, bronze									
15193 8350 Tempering water									
15193 8650 Threaded connections									
B MIL AA <15194 0000 > 96" dia Butterfly Valve			200.00	8238.90	2434.02	80000.00	0.00	90672.92	
	4.00	EA	800	32,956	9,736	320,000	0	362,692	90672.92
TOTAL 96-in Butterfly Valves	4.00	EA	800	32,956	9,736	320,000	106,000	468,692	117172.92
TOTAL Miscellaneous Items			800	32,956	9,736	320,000	4198500	4,561,192	
TOTAL Orleans Avenue Canal ICS			10,713	423,874	30,510	446661231999683		36,920,679	

C_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_. London Avenue Canal ICS									
C_.01. Exist Engine Platform Enclosures									
Notes:									
1. Phase 1, 2, 3 Power Units are exposed to hurricane wind blown debris.									
2. Hoisting equipment needs some level of protection from flying debris.									
3. Quantities reflect total for both east / west side platforms.									
C_.01.01 . Demolition									
C_.01.01 . 01. Chain Link Fencing									
L RSM SS < > Site dml, chain link, remove			0.00	0.00	0.00	0.00	3.00	3.00	
	530.00	LF	0	0	0	0	1,590	1,590	3.00
TOTAL Chain Link Fencing	530.00	LF	0	0	0	0	1,590	1,590	3.00
C_.01.01 . 02. Metal Roof-Siding Panels									
L RSM SS < > Remove metal roof and metal			0.00	0.00	0.00	0.00	1.00	1.00	
	10300	SF	0	0	0	0	10,300	10,300	1.00
TOTAL Metal Roof-Siding Panels	10300	SF	0	0	0	0	10,300	10,300	1.00
C_.01.01 . 03. Misc Steel - Roof Purlins									
L RSM SS < > Remove metal purlins supporting			0.00	0.00	0.00	0.00	0.25	0.25	
	21500	LBS	0	0	0	0	5,375	5,375	0.25
TOTAL Misc Steel - Roof Purlins	21500	LBS	0	0	0	0	5,375	5,375	0.25
TOTAL Demolition			0	0	0	0	17,265	17,265	
C_.01.02 . Structure Modifications									
C_.01.02 . 01. Add Misc Steel Framing									
C_.01.02 . 01.01. Add Welded Structural Frame									
Note:									
1. Allow 5500 LBS each Welded Frame (say 55 LF x 100 = 5500 lbs).									
2. 8 ea. x 5500 = 44,000 lbs.									
3. 44,000 / 2000 = 22 tons									
4. Cost based on $1.50/LB for material, labor, equip. incl dwelivery and handling.									

C_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
B MIL SS < > Add Welded Steel Frame			0.00	0.00	0.00	0.00	3000.00	3000.00	
	22.00	TON	0	0	0	0	66,000	66,000	3000.00
TOTAL Add Welded Structural Frame	8.00	EA	0	0	0	0	66,000	66,000	8250.00
C_.01.02 . 01.02. Add W10 Col's at Eaves of Bldg									
Notes:									
1. Allow for the addition of (4)- new W10x30 columns (at 16-ft length) at east and west enclosures.									
B MIL SS < > Add W10 Wide-Flange Columns at			0.00	0.00	0.00	0.00	2100.00	2100.00	
	1.92	TON	0	0	0	0	4,032	4,032	2100.00
TOTAL Add W10 Col's at Eaves of Bldg	3840.00	LB	0	0	0	0	4,032	4,032	1.05
C_.01.02 . 01.03. Add New Roof Purlins									
B MIL SS < > Add new purlins to support			0.00	0.00	0.00	0.00	1.10	1.10	
	43200	LB	0	0	0	0	47,520	47,520	1.10
TOTAL Add New Roof Purlins	47520	LB	0	0	0	0	47,520	47,520	1.00
C_.01.02 . 01.04. Add MC6 Girts at Bldg Perimeter									
B MIL SS < > Add new MC6x8.2 Girts btwn			0.00	0.00	0.00	0.00	3.00	3.00	
	22000	LB	0	0	0	0	66,000	66,000	3.00
TOTAL Add MC6 Girts at Bldg Perimeter	19200	LB	0	0	0	0	66,000	66,000	3.44
TOTAL Add Misc Steel Framing			0	0	0	0	183,552	183,552	
C_.01.02 . 02. Add Precast Wall & Roof Panels									
Note:									
1. Estimates assumes 6" +/- thick precast panels.									
2. Cost incl materills, labor, equip, etc for installation onto existing bldg.									
B MIL SS < > Add new perimeter wall panels			0.00	0.00	0.00	0.00	10.00	10.00	
	15840	SF	0	0	0	0	158,400	158,400	10.00
TOTAL Add Precast Wall & Roof Panels	15840	SF	0	0	0	0	158,400	158,400	10.00

C_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.01.02 . 03. Add Overhead & Personnel Doors									
Notes:									
1. Allow (2)- commercial grade hollow metal doors at each enclosure.									
2. Allow (1)-commercial grade, sectional, steel, heavy duty, overhead door at each enclosure. Assume 10-ft x 10-ft size.									
B MIL SS < > Overhead coml, no frame, manual,			0.00	0.00	0.00	0.00	1200.00	1200.00	
	2.00	EA	0	0	0	0	2,400	2,400	1200.00
B MIL SS < > Coml stl dr, fl, 3'-4" x 7'-0",			0.00	0.00	0.00	0.00	500.00	500.00	
	4.00	EA	0	0	0	0	2,000	2,000	500.00
TOTAL Add Overhead & Personnel Doors			0	0	0	0	4,400	4,400	
C_.01.02 . 04. Add Louvers & Ventilators									
Notes:									
1. Install louvers for air intake each side of enclosure. Provide at East and West enclosures									
2. Assume (14) ea side , at 4-ft x 4-ft size.									
3. Total louver area = (14 ea x 2 sides x 4 x 4) x 2 enclosures = 896 SF. (SAY 1000 SF total)									
4. Provide a protective aluminum shroud over top & sides of louver.									
5. Provide (2)- powered wall exhausters at ea enclosure; with shroud protection.									
B MIL JJ < > Wall louvers, aluminum, with			0.00	0.00	0.00	0.00	40.00	40.00	
	1000.00	SF	0	0	0	0	40,000	40,000	40.00
B MIL JJ < > Protective aluminum shroud over			0.00	0.00	0.00	0.00	250.00	250.00	
	56.00	EA	0	0	0	0	14,000	14,000	250.00
B AF JJ < > Fan, wall exhers, 1 HP, cntfgl,			0.00	0.00	0.00	0.00	1500.00	1500.00	
	4.00	EA	0	0	0	0	6,000	6,000	1500.00
TOTAL Add Louvers & Ventilators			0	0	0	0	60,000	60,000	

C_.01. Exist Engine Platform Enclosures	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.01.02 . 05. Modify Exist Gen Exhaust Vents									
Notes:									
1. Existing exhaust vents pentrate the metal siding of the bldg.									
2. Vents need to be modified to function with the new exterior precast concrete panel system.									
3. Includes adapting exterior shrouds on vent penetration thru new precast concrte panels.									
B MIL JJ < > Allowance to modify exist			0.00	0.00	0.00	0.00	500.00	500.00	
	12.00	EA	0	0	0	0	6,000	6,000	500.00
TOTAL Modify Exist Gen Exhaust Vents			0	0	0	0	6,000	6,000	
C_.01.02 . 06. Modify Exist Utility Runs									
B MIL JJ < > Allowance to modify utility runs			0.00	0.00	0.00	0.00	10000	10000.00	
	1.00	LS	0	0	0	0	10,000	10,000	10000.00
TOTAL Modify Exist Utility Runs			0	0	0	0	10,000	10,000	
TOTAL Structure Modifications			0	0	0	0	422,352	422,352	
C_.01.03 . Allow for Misc Enclosure Mods									
L RSM SS < > Allowance for misc modifications			0.00	0.00	0.00	0.00	25000	25000.00	
	1.00	LS	0	0	0	0	25,000	25,000	25000.00
TOTAL Allow for Misc Enclosure Mods			0	0	0	0	25,000	25,000	
TOTAL Exist Engine Platform Enclosures			0	0	0	0	464,617	464,617	

C_.02. New Engine Platform & Encl (N/A)	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.02. New Engine Platform & Encl (N/A)									
Notes:									
New Engine Platforms with Enclosures are not required at London Avenue Pump Station.									
TOTAL New Engine Platform & Encl (N/A)			0	0	0	0	0	0	
C_.03. Phase 3 Pump Platform Enclosure									
Notes:									
1. Phase 3 Power Units are exposed to hurricane wind blown debris.									
2. For purpose of cost development, estimate assumes enclosure similar in size and framing to London Ave. Generator Platform.									
3. Quantities reflect total for one platform.									
C_.03.01 . Demolition									
C_.03.01 . 01. Chain Link Fencing									
L RSM SS < > Site dml, chain link, remove			0.00	0.00	0.00	0.00	3.00	3.00	
	265.00	LF	0	0	0	0	795	795	3.00
TOTAL Chain Link Fencing	265.00	LF	0	0	0	0	795	795	3.00
C_.03.01 . 02. Metal Roof-Siding Panels									
L RSM SS < > Remove metal roof and metal			0.00	0.00	0.00	0.00	1.00	1.00	
	5150.00	SF	0	0	0	0	5,150	5,150	1.00
TOTAL Metal Roof-Siding Panels	5150.00	SF	0	0	0	0	5,150	5,150	1.00
C_.03.01 . 03. Misc Steel - Roof Purlins									
L RSM SS < > Remove metal purlins supporting			0.00	0.00	0.00	0.00	0.25	0.25	
	10750	LBS	0	0	0	0	2,688	2,688	0.25
TOTAL Misc Steel - Roof Purlins	10750	LBS	0	0	0	0	2,688	2,688	0.25
TOTAL Demolition			0	0	0	0	8,633	8,633	

C_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.03.02 . Structure Modifications									
C_.03.02 . 01. Add Misc Steel Framing									
C_.03.02 . 01.01. Add Welded Structural Frame									
Note:									
1. Allow 5500 LBS each Welded Frame (say 55 LF x 100 = 5500 lbs).									
2. 8 ea. x 5500 = 44,000 lbs.									
3. 44,000 / 2000 = 22 tons									
4. Cost based on $1.50/LB for material, labor, equip. incl dwelivery and handling.									
B MIL SS < > Add Welded Steel Frame			0.00	0.00	0.00	0.00	3000.00	3000.00	
	11.00	TON	0	0	0	0	33,000	33,000	3000.00
TOTAL Add Welded Structural Frame	4.00	EA	0	0	0	0	33,000	33,000	8250.00
C_.03.02 . 01.02. Add W10 Col's at Eaves of Bldg									
B MIL SS < > Add W10 Wide-Flange Columns at			0.00	0.00	0.00	0.00	2100.00	2100.00	
	0.96	TON	0	0	0	0	2,016	2,016	2100.00
TOTAL Add W10 Col's at Eaves of Bldg	1920.00	LB	0	0	0	0	2,016	2,016	1.05
C_.03.02 . 01.03. Add New Roof Purlins									
B MIL SS < > Add new purlins to support			0.00	0.00	0.00	0.00	1.10	1.10	
	21600	LB	0	0	0	0	23,760	23,760	1.10
TOTAL Add New Roof Purlins	21600	LB	0	0	0	0	23,760	23,760	1.10
C_.03.02 . 01.04. Add MC6 Girts at Bldg Perimeter									
B MIL SS < > Add new MC6x8.2 Girts btwn			0.00	0.00	0.00	0.00	3.00	3.00	
	11000	LB	0	0	0	0	33,000	33,000	3.00
TOTAL Add MC6 Girts at Bldg Perimeter	11000	LB	0	0	0	0	33,000	33,000	3.00
TOTAL Add Misc Steel Framing			0	0	0	0	91,776	91,776	
C_.03.02 . 02. Add Precast Wall & Roof Panels									
Note:									
1. Estimates assumes 6" +/- thick precast panels.									

C_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
2. Cost incl materils, labor, equip, etc for installation onto existing bldg.									
B MIL SS < > Add new perimeter wall panels			0.00	0.00	0.00	0.00	10.00	10.00	
	7920.00	SF	0	0	0	0	79,200	79,200	10.00
TOTAL Add Precast Wall & Roof Panels	7920.00	SF	0	0	0	0	79,200	79,200	10.00
C_.03.02 . 03. Add Overhead & Personnel Doors									
Notes:									
1. Allow (2)- commercial grade hollow metal doors at each enclosure.									
2. Allow (1)-commercial grade, sectional, steel, heavy duty, overhead door at each enclosure. Assume 10-ft x 10-ft size.									
B MIL SS < > Overhead coml, no frame, manual,			0.00	0.00	0.00	0.00	1200.00	1200.00	
	1.00	EA	0	0	0	0	1,200	1,200	1200.00
B MIL SS < > Coml stl dr, fl, 3'-4" x 7'-0",			0.00	0.00	0.00	0.00	500.00	500.00	
	2.00	EA	0	0	0	0	1,000	1,000	500.00
TOTAL Add Overhead & Personnel Doors			0	0	0	0	2,200	2,200	
C_.03.02 . 04. Add Louvers & Ventilators									
Notes:									
1. Install louvers for air intake each side of enclosure. Provide at East and West enclosures									
2. Assume (14) ea side , at 4-ft x 4-ft size.									
3. Total louver area = (14 ea x 2 sides x 4 x 4) x 2 enclosures = 896 SF. (SAY 1000 SF total)									
4. Provide a protective aluminum shroud over top & sides of louver.									
5. Provide (2)- powered wall exhausters at ea enclosure; with shroud protection.									
B MIL JJ < > Wall louvers, aluminum, with			0.00	0.00	0.00	0.00	40.00	40.00	
	500.00	SF	0	0	0	0	20,000	20,000	40.00
B MIL JJ < > Protective aluminum shroud over			0.00	0.00	0.00	0.00	250.00	250.00	
	28.00	EA	0	0	0	0	7,000	7,000	250.00
B AF JJ < > Fan, wall exhers, 1 HP, cntfgl,			0.00	0.00	0.00	0.00	1500.00	1500.00	
	2.00	EA	0	0	0	0	3,000	3,000	1500.00

C_.03. Phase 3 Pump Platform Enclosure	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Add Louvers & Ventilators			0	0	0	0	30,000	30,000	
C_.03.02 . 05. Modify Exist Gen Exhaust Vents									
Notes:									
1. Existing exhaust vents pentrate the metal siding of the bldg.									
2. Vents need to be modified to function with the new exterior precast concrete panel system.									
3. Includes adapting exterior shrouds on vent penetration thru new precast concrte panels.									
B MIL JJ < > Allowance to modify exist			0.00	0.00	0.00	0.00	500.00	500.00	
	6.00	EA	0	0	0	0	3,000	3,000	500.00
TOTAL Modify Exist Gen Exhaust Vents			0	0	0	0	3,000	3,000	
C_.03.02 . 06. Modify Exist Utility Runs									
B MIL JJ < > Allowance to modify utility runs			0.00	0.00	0.00	0.00	5000.00	5000.00	
	1.00	LS	0	0	0	0	5,000	5,000	5000.00
TOTAL Modify Exist Utility Runs			0	0	0	0	5,000	5,000	
TOTAL Structure Modifications			0	0	0	0	211,176	211,176	
C_.03.03 . Allow for Misc Enclosure Mods									
L RSM SS < > Allowance for misc modifications			0.00	0.00	0.00	0.00	25000	25000.00	
	1.00	LS	0	0	0	0	25,000	25,000	25000.00
TOTAL Allow for Misc Enclosure Mods			0	0	0	0	25,000	25,000	
TOTAL Phase 3 Pump Platform Enclosure			0	0	0	0	244,809	244,809	

C_.04. Gate Operations	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.04. Gate Operations									
Note:									
1. Allow for removal and disposal of existing (13) needle gates, and replacement with (13) roller gates and associated framing.									
2. Provide gates with rollers to allow response to emergency closures during differential head conditions, and need for quicker repsponse time for placement of gates.									
3. See "Item E_Capacity Modifications" for alternative of providing additional pumping equipment and expanded facilities to accommodate enhanced capacity.									
C_.04. 01. Roller Gates and Guides									
C_.04. 01. 01. Roller Gates									
L RSM SS < > Allowance for fabrication and	151.00	TON	0.00 0	0.00 0	0.00 0	0.00 0	1700.00 256,700	1700.00 256,700	1700.00
L RSM SS < > Allowance for Corrosion	15000	SF	0.00 0	0.00 0	0.00 0	0.00 0	3.00 45,000	3.00 45,000	3.00
L RSM SS < > Allowance for installation of	151.00	TON	0.00 0	0.00 0	0.00 0	0.00 0	1000.00 151,000	1000.00 151,000	1000.00
TOTAL Roller Gates	13.00	EA	0	0	0	0	452,700	452,700	34823.08
C_.04. 01. 02. Gate Guide Columns									
L RSM SS < > Allow for fab and delivery of	56.00	TON	0.00 0	0.00 0	0.00 0	0.00 0	1700.00 95,200	1700.00 95,200	1700.00
L RSM SS < > Allowance for Corrosion	7200.00	SF	0.00 0	0.00 0	0.00 0	0.00 0	3.00 21,600	3.00 21,600	3.00
L RSM SS < > Allowance for installation of	56.00	TON	0.00 0	0.00 0	0.00 0	0.00 0	1000.00 56,000	1000.00 56,000	1000.00
TOTAL Gate Guide Columns			0	0	0	0	172,800	172,800	
C_.04. 01. 03. Add Platform Expansion & Ladders									
L RSM SS < > Allowance for fabrication and	12.00	TON	0.00 0	0.00 0	0.00 0	0.00 0	1700.00 20,400	1700.00 20,400	1700.00
L RSM SS < > Allowance for installation of	12.00	TON	0.00 0	0.00 0	0.00 0	0.00 0	1000.00 12,000	1000.00 12,000	1000.00

C_.04. Gate Operations	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Add Platform Expansion & Ladders			0	0	0	0	32,400	32,400	
C_.04. 01. 04. Removal / Dispose of Exist Gates									
L RSM SS < > Allowance for gate removal from			0.00	0.00	0.00	0.00	1000.00	1000.00	
	51.00	TON	0	0	0	0	51,000	51,000	1000.00
L RSM SS < > Allowance for off-site removal			0.00	0.00	0.00	0.00	0.02	0.02	
	102000	LBS	0	0	0	0	2,040	2,040	0.02
TOTAL Removal / Dispose of Exist Gates	13.00	EA	0	0	0	0	53,040	53,040	4080.00
C_.04. 01. 05. Fill Void of Needle Gate Seat									
Notes:									
1. Allow 12-ft / gate x 13 gates = 156 LF									
L RSM SS < > Fill void of Needle Gate Seats			0.00	0.00	0.00	0.00	100.00	100.00	
	156.00	LF	0	0	0	0	15,600	15,600	100.00
TOTAL Fill Void of Needle Gate Seat	13.00	EA	0	0	0	0	15,600	15,600	1200.00
C_.04. 01. 06. Install Gate Operator / Motor									
L RSM SS < > Install gate operator; reuse			0.00	0.00	0.00	0.00	2500.00	2500.00	
	5.00	EA	0	0	0	0	12,500	12,500	2500.00
TOTAL Install Gate Operator / Motor	13.00	EA	0	0	0	0	12,500	12,500	961.54
TOTAL Roller Gates and Guides			0	0	0	0	739,040	739,040	
TOTAL Gate Operations			0	0	0	0	739,040	739,040	

C_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.05. Mechanical Systems									
C_.05. 01. Phase 1 Pumps Sys Modifications									
Notes:									
1. Replace existing Phase 1 pumps (12 ea) with new 350 cfs pumps (12 ea) - FSI type.									
2. See "Item E_Capacity Modifications" for alternative of providing additional pumping equipment and expanded facilities to accommodate enhanced capacity.									
C_.05. 01. 01. Demo Exist Phase 1 Pumps									
L RSM JJ < > Allowance for disconnect & prep			0.00	0.00	0.00	0.00	7100.00	7100.00	
	12.00	EA	0	0	0	0	85,200	85,200	7100.00
L RSM JJ < > Allowance for removal and			0.00	0.00	0.00	0.00	3750.00	3750.00	
	12.00	EA	0	0	0	0	45,000	45,000	3750.00
TOTAL Demo Exist Phase 1 Pumps	12.00	EA	0	0	0	0	130,200	130,200	10850.00
C_.05. 01. 02. Demo Exist Hydraulic Piping Sys									
C_.05. 01. 02.01. Install Valves & drain Hyd Fluid									
L RSM JJ < > Purchase (8)-3"gate valves ---1			0.00	0.00	0.00	0.00	500.00	500.00	
	8.00	EA	0	0	0	0	4,000	4,000	500.00
L RSM JJ < > Purchase (2)-1" gate valves ---1			0.00	0.00	0.00	0.00	200.00	200.00	
	2.00	EA	0	0	0	0	400	400	200.00
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	16320	LF	0	0	0	0	53,040	53,040	3.25
L RSM JJ < > Allowance for installing valves			0.00	0.00	0.00	0.00	3.25	3.25	
	4080.00	LF	0	0	0	0	13,260	13,260	3.25
L RSM JJ < > Fluid Containment and Disposal			0.00	0.00	0.00	0.00	10.00	10.00	
	6160.00	GAL	0	0	0	0	61,600	61,600	10.00
TOTAL Install Valves & drain Hyd Fluid			0	0	0	0	132,300	132,300	
C_.05. 01. 02.02. Clean interior of piping									
L RSM JJ < > Allowance for flushing &			0.00	0.00	0.00	0.00	2.00	2.00	
	16320	LF	0	0	0	0	32,640	32,640	2.00

C_.05. Mechanical Systems		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM JJ <	> Allowance for flushing &			0.00	0.00	0.00	0.00	0.50	0.50	
		4080.00	LF	0	0	0	0	2,040	2,040	0.50
TOTAL	Clean interior of piping			0	0	0	0	34,680	34,680	
C_.05. 01. 02.03. Demo exist hyd fluid piping										
L RSM JJ <	> Demo existing 3" hydraulic			0.00	0.00	0.00	0.00	10.50	10.50	
		16320	LF	0	0	0	0	171,360	171,360	10.50
L RSM JJ <	> Demo existing 1" hydraulic			0.00	0.00	0.00	0.00	7.50	7.50	
		4080.00	LF	0	0	0	0	30,600	30,600	7.50
TOTAL	Demo exist hyd fluid piping			0	0	0	0	201,960	201,960	
TOTAL	Demo Exist Hydraulic Piping Sys			0	0	0	0	368,940	368,940	
C_.05. 01. 03. Demo Exist Power Units										
L RSM JJ <	> Allowance for disconnect & prep			0.00	0.00	0.00	0.00	3600.00	3600.00	
		12.00	EA	0	0	0	0	43,200	43,200	3600.00
L RSM JJ <	> Allowance for removal and			0.00	0.00	0.00	0.00	1800.00	1800.00	
		12.00	EA	0	0	0	0	21,600	21,600	1800.00
TOTAL	Demo Exist Power Units	12.00	EA	0	0	0	0	64,800	64,800	5400.00
C_.05. 01. 04. Miscellaneous Demo										
L RSM JJ <	> Allowance for Misc Pump Sys			0.00	0.00	0.00	0.00	50000	50000.00	
		1.00	LS	0	0	0	0	50,000	50,000	50000.00
TOTAL	Miscellaneous Demo			0	0	0	0	50,000	50,000	

C_.05. 01. 05. Modify Exist Pump Supt Platforms

Note:

1. Assumed steel framing of existing pump platform deck and grating similar to existing Phase 1-17th Street pump platforms.

C_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.05. 01. 05.01. Demo Exist Stl & Grating (E-W)									
L RSM SS < > Allowance for demo of exist			0.00	0.00	0.00	0.00	250.00	250.00	
	13.00	TON	0	0	0	0	3,250	3,250	250.00
L RSM SS < > Allowance for demo of exist			0.00	0.00	0.00	0.00	5.00	5.00	
	2640.00	SF	0	0	0	0	13,200	13,200	5.00
L RSM SS < > Allowance for disposal of demo			0.00	0.00	0.00	0.00	50.00	50.00	
	35.00	TON	0	0	0	0	1,750	1,750	50.00
TOTAL Demo Exist Stl & Grating (E-W)			0	0	0	0	18,200	18,200	
C_.05. 01. 05.02. Install New Stl & Grating (E-W)									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	13.00	TON	0	0	0	0	22,100	22,100	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	3300.00	SF	0	0	0	0	9,900	9,900	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	13.00	TON	0	0	0	0	13,000	13,000	1000.00
L RSM SS < > Allowance for new Grating			0.00	0.00	0.00	0.00	25.00	25.00	
	2640.00	SF	0	0	0	0	66,000	66,000	25.00
TOTAL Install New Stl & Grating (E-W)			0	0	0	0	111,000	111,000	
TOTAL Modify Exist Pump Supt Platforms			0	0	0	0	129,200	129,200	
C_.05. 01. 06. Install New Pumps w/ Elec Driver									
L RSM JJ < > New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
	12.00	EA	0	0	0		020400000	20,400,000	1700000
L RSM JJ < > Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
	12.00	EA	0	0	0	0	4980000	4,980,000	415000.00
TOTAL Install New Pumps w/ Elec Driver	12.00	EA	0	0	0		025380000	25,380,000	2115000
C_.05. 01. 07. Install New Motor Power Units									
L RSM JJ < > Motors for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
	12.00	EA	0	0	0	0	6000000	6,000,000	500000.00
TOTAL Install New Motor Power Units	12.00	EA	0	0	0	0	6000000	6,000,000	500000.00

C_.05. Mechanical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.05. 01. 08. Replace Storage Tks w/ Dbl Wall									
C_.05. 01. 08.01. Disconnect-Clean Exist Fuel Tank									
Notes:									
1. Assume tank 5% full									
20,000 gal x .05 = 100 gal									
L RSM JJ < > Disconnect existing fuel oil			0.00	0.00	0.00	0.00	500.00	500.00	
	1.00	LS	0	0	0	0	500	500	500.00
L RSM JJ < > Transfer re-usable Fuel, incl			0.00	0.00	0.00	0.00	1.00	1.00	
	100.00	GAL	0	0	0	0	100	100	1.00
L RSM JJ < > Clean and Flush tank prior to			0.00	0.00	0.00	0.00	500.00	500.00	
	1.00	LS	0	0	0	0	500	500	500.00
TOTAL Disconnect-Clean Exist Fuel Tank	2.00	EA	0	0	0	0	1,100	1,100	550.00
C_.05. 01. 08.02. Removal and Disposal of Exist Tk									
L RSM JJ < > Removal and disposal of existing			0.00	0.00	0.00	0.00	2000.00	2000.00	
	2.00	EA	0	0	0	0	4,000	4,000	2000.00
TOTAL Removal and Disposal of Exist Tk	2.00	EA	0	0	0	0	4,000	4,000	2000.00
C_.05. 01. 08.03. Install Double-Wall Storage Tank									
L RSM JJ < > New Dbl Wall Storage Tank(s) ;			0.00	0.00	0.00	0.00	22500	22500.00	
	2.00	EA	0	0	0	0	45,000	45,000	22500.00
L RSM JJ < > Install new Dbl Wall Storage			0.00	0.00	0.00	0.00	2000.00	2000.00	
	2.00	EA	0	0	0	0	4,000	4,000	2000.00
L RSM JJ < > Reconnect fuel piping; allow			0.00	0.00	0.00	0.00	1000.00	1000.00	
	2.00	EA	0	0	0	0	2,000	2,000	1000.00
TOTAL Install Double-Wall Storage Tank	2.00	EA	0	0	0	0	51,000	51,000	25500.00
TOTAL Replace Storage Tks w/ Dbl Wall	2.00	EA	0	0	0	0	56,100	56,100	28050.00
TOTAL Phase 1 Pumps Sys Modifications			0	0	0	032179240		32,179,240	
TOTAL Mechanical Systems			0	0	0	032179240		32,179,240	

C_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.06. Electrical Systems									
Notes:									
1. The report considers that incremental SCADA (Supervisory Control And Data Acquisition) interface will be required in considerations of ICS enhancements.									
2. Estimate provides for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system.									
3. Allowance includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system.									
4. Allowance based on cost of SCADA upgrades per pump. Total allowance of $3000 as follows:									
$1000 - Pump House SCADA upgradecost per pump									
$2000 - SCADA routing cost to remote pump motors, etc									
$3000 - Total estimated SCADA upgrade cost per pump									
5. Estimate assumes existing SCADA system is adequate for all Phase 3 monitoring.									
C_.06. 01. Lightning and Grounding System									
C_.06. 01. 01. Lightning Protection									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 5999 Wire, laid in trench									
16181 5999 Copper, bare stranded									
MIL GG <16181 6010 > Grounding, laid in trench,			6.86	221.53	0.00	545.00	0.00	766.53	
	0.40	MLF	3	89	0	218	0	307	766.53
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16840 0010 Lightning protection									
16840 4000 Air terminals, copper									
L MIL GG <16840 4040 > Lightning protection, air			0.48	19.28	0.00	14.67	0.00	33.95	
	22.00	EA	11	424	0	323	0	747	33.95
16840 0010 Lightning protection									
16840 4200 Air terminal bases, copper									
M MIL GG <16840 4220 > Lightning protection, air term			0.89	35.72	0.00	21.50	0.00	57.22	
	22.00	EA	20	786	0	473	0	1,259	57.22
TOTAL Lightning Protection			33	1,299	0	1,014	0	2,312	

C_.06. Electrical Systems

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.06. 01. 02. Grounding									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 0029 Rod									
MIL GG <16181 0100 > Grounding, rod, copper clad, 10'			1.82	73.05	0.00	29.40	0.00	102.45	
	16.00	EA	29	1,169	0	470	0	1,639	102.45
MIL GG <16181 6020 > Grounding, laid in trench,			9.43	304.60	0.00	1060.00	0.00	1364.60	
	1.00	MLF	9	305	0	1,060	0	1,365	1364.60
16181 0010 Grounding devices									
16181 6299 Ground conductor bonding, cadweld									
MIL GG <16181 6350 > Grounding, gnd conductor bond,			1.82	73.42	0.00	19.89	0.00	93.31	
	16.00	EA	29	1,175	0	318	0	1,493	93.31
MIL GG <16181 6380 > Grounding, gnd conductor bond,			2.08	84.12	0.00	17.29	0.00	101.41	
	50.00	EA	104	4,206	0	865	0	5,071	101.41
TOTAL Grounding			172	6,854	0	2,713	0	9,567	
TOTAL Lightning and Grounding System			205	8,153	0	3,727	0	11,880	
C_.06. 02. Electrical Power									
C_.06. 02. 01. Power									
16000 0000 Electrical, Generally excludes crane services									
16000 0000 Raceways, Generally excludes crane services									
16016 0000 Conduits									
16017 0010 Conduit, to 15', incl. terminations & elbows									
16017 9889 Rental, hydraulic bender									
L MIL GG <16018 0000 > Remove generator power and			24.00	964.80	0.00	9.58	226564	227538.38	
	1.00	LS	24	965	0	10	226,564	227,538	227538.38
16016 0000 Conduits									
16018 0010 Conduit, to 15', includes couplings only									
16018 0499 Steel, rigid galvanized (RGS)									
MIL GG <16018 0640 > Conduit to 15' H, 3" dia, incl			0.25	10.05	0.00	9.58	0.00	19.63	
	18000	LF	4,500	180,900	0	172,440	0	353,340	19.63
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									

C_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16108 0000 Conductors									
16115 0010 Shielded cable									
16115 0039 Copper, XLP shielding, 5 KV									
M MIL GG <16115 0400 > Shielded cable, 5kV, 1/0, no			42.11	1691.79	0.00	2184.00	0.00	3875.79	
	26.95	MLF	1,135	45,594	0	58,859	0	104,453	3875.79
16108 0000 Conductors									
16119 0010 Wire									
16119 0919 600 volt, type THWN-THHN									
16119 0999 Copper, stranded									
MIL GG <16119 1350 > Wire, 600 volt, type THWN-THHN,			12.31	494.52	0.00	274.50	0.00	769.02	
	8.00	MLF	98	3,956	0	2,196	0	6,152	769.02
16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16330 0000 Switches									
16330 0010 Distribution section									
16330 0100 Aluminum bus bars, not including breakers									
B AF GG <16331 0000 > Medium voltyage soft start			40.00	1615.20	0.00	39600.00	0.00	41215.20	
	12.00	EA	480	19,382	0	475,200	0	494,582	41215.20
16000 0000 Electrical, Generally excludes crane services									
16500 0000 Power Systems & Capacitors									
16510 0000 Power Systems									
16513 0010 Generator set									
16513 2000 Diesel engine									
M MIL GG <16513 3270 > Remove generator set			177.78	6787.85	778.37	0.00	0.00	7566.22	
	12.00	EA	2,133	81,454	9,340	0	0	90,795	7566.22
B MIL GG <16513 3270 > Generator set, dsl eng, xfr			250.00	9545.41	1094.58	350000	0.00	360640.00	
	12.00	EA	3,000	114,545	13,135	4200000	0	4,327,680	360640.00
TOTAL Power			11,371	446,796	22,475	4908704	226,564	5,604,540	
C_.06. 02. 03. Gate Motor Operators									
16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16350 0000 Motors									
B MIL GG <16353 0000 > Gate motor operator			0.00	76.53	0.00	5000.00	0.00	5076.53	
	5.00	EA	0	383	0	25,000	0	25,383	5076.53
TOTAL Gate Motor Operators			0	383	0	25,000	0	25,383	

C_.06. Electrical Systems	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
C_.06. 02. 08. Control									
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16862 0010 Closed circuit TV system									
16862 6999 Microprocessor, matrix switcher/controller									
M CIV GG <16865 0000 > Scada control system for canal			1.00	40.38	0.00	0.00	3000.00	3040.38	
	12.00	EA	12	485	0	0	36,000	36,485	3040.38
TOTAL Control			12	485	0	0	36,000	36,485	
TOTAL Electrical Power			11,383	447,663	22,475	4933704	262,564	5,666,407	
TOTAL Electrical Systems			11,587	455,816	22,475	4937431	262,564	5,678,287	

C_.07. Miscellaneous Items	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

C_.07. Miscellaneous Items

C_.07. 01. Corrosion Protection

Note:

1. Provide coating on all major elements of the facility.

2. Soil excavation and backfill required at all platform columns and structure supports in order to provided corrosion protection below grade.

3. A cofferdam is required on the Flood side to enable drawdown of water to adequate depth to provide corrosion protection at a nominal depth below water line on Flood side.

4. On Protected side, it is assumed the pump station pumps can be used for draw-down of canal for purpose of applying corrosion protection at a nominal depth below water line on Protected side.

C_.07. 01. 01. Protective Coatings

C_.07. 01. 01.01. Soil Excavation / Backfill

L MIL AA < > Excav / Backfill around existing		0.00	0.00	0.00	0.00	51000	51000.00	
	1.00 LS	0	0	0	0	51,000	51,000	51000.00
TOTAL Soil Excavation / Backfill		0	0	0	0	51,000	51,000	

C_.07. 01. 01.02. Construct Temp Cofferdam

L MIL AA < > Construct Temp Cofferdam on		0.00	0.00	0.00	0.00	2100000	2100000.00	
	1.00 LS	0	0	0	0	2100000	2,100,000	2100000
TOTAL Construct Temp Cofferdam		0	0	0	0	2100000	2,100,000	

C_.07. 01. 01.03. Dewater Protected Side

L MIL AA < > Allowance for dewatering of		0.00	0.00	0.00	0.00	300000	300000.00	
	1.00 LS	0	0	0	0	300,000	300,000	300000.00
TOTAL Dewater Protected Side		0	0	0	0	300,000	300,000	

C_.07. 01. 01.04. Apply Protective Coating

L MIL AA < > Apply protective coating to		0.00	0.00	0.00	0.00	285000	285000.00	
	1.00 LS	0	0	0	0	285,000	285,000	285000.00
TOTAL Apply Protective Coating		0	0	0	0	285,000	285,000	

C_.07. Miscellaneous Items

		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
	TOTAL Protective Coatings			0	0	0	0	2736000	2,736,000	
C_.07. 01. 02. Cathodic Protection										
L MIL AA <	> Allowance to install cathodic			0.00	0.00	0.00	0.00	300000	300000.00	
		1.00	LS	0	0	0	0	300,000	300,000	300000.00
	TOTAL Cathodic Protection			0	0	0	0	300,000	300,000	
	TOTAL Corrosion Protection			0	0	0	0	3036000	3,036,000	
C_.07. 02. Fluid Storage Facility (On-Site)										
Note:										
1. The estimate assumes The Fluid Storage Facility shall contain a 200 SF area for stockpile of waste fluids; an 1800 Sf area for new fluid storage and fluid changing of equipment.										
L RSM SS <	> Allow for (1)- onsite stor &			0.00	0.00	0.00	0.00	725.00	725.00	
		1500.00	SF	0	0	0	0	1087500	1,087,500	725.00
	TOTAL Fluid Storage Facility (On-Site)			0	0	0	0	1087500	1,087,500	
C_.07. 03. Addt'l Fuel Farm Installed										
Notes:										
1. Additional Fuel Tanks are provided to enhance fuel reserves at to ICS facility. The additional of these tanks align reserve capacity with OPTION 1 & OPTION 2 Conceptual Designs for New Pump Station Facilities.										
2. The added tanks are in addition to the existing single wall tanks to be replaced by double wall tanks as shown elewhere in the estimate.										
L MIL AA <	> Install Fuel Farm Tanks and			0.00	0.00	0.00	0.00	54000	54000.00	
		3.00	EA	0	0	0	0	162,000	162,000	54000.00
	TOTAL Addt'l Fuel Farm Installed	3.00	EA	0	0	0	0	162,000	162,000	54000.00
C_.07. 04. 96-in Butterfly Valves										

02000 0000 Site Work
02100 0000 Site Preparation & Excavation Support
02160 0000 Sheet Piling
02161 0009 Sheet piling
02161 3900 Wood, including wales, braces and spacers

C_.07. Miscellaneous Items	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L MIL AA <02200 0000 > Allowance for delivery of Valves			0.00	0.00	0.00	0.00	1500.00	1500.00	
	8.00	EA	0	0	0	0	12,000	12,000	1500.00
11000 0000 Equipment									
11000 0000 Equipment									
B MIL AA <11000 0001 > Allowance for modifying and			0.00	0.00	0.00	0.00	25000	25000.00	
	8.00	EA	0	0	0	0	200,000	200,000	25000.00
15000 0000 Mechanical, Generally excludes crane services									
15100 0000 Pipe & Fittings									
15191 0000 Valves									
15193 0010 Valves, bronze									
15193 8350 Tempering water									
15193 8650 Threaded connections									
B MIL AA <15194 0000 > 96" dia Butterfly Valve			200.00	8238.90	2434.02	80000.00	0.00	90672.92	
	8.00	EA	1,600	65,911	19,472	640,000	0	725,383	90672.92
TOTAL 96-in Butterfly Valves	8.00	EA	1,600	65,911	19,472	640,000	212,000	937,383	117172.92
TOTAL Miscellaneous Items			1,600	65,911	19,472	640,000	4497500	5,222,883	
TOTAL London Avenue Canal ICS			13,187	521,727	41,948	557743138387770		44,528,876	

D__. Maintenance Facility

D__.01. Land Acquisition

		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
D__. Maintenance Facility										
Notes:										
1. The report proposes a common maintenance facility, which includes office and warehouse space, including storage space for make-up and waste oil; parts storage; records storage; and a general maintenance area. The intent is for this facility to serve all three ICS facilities.										
2. The report provides for a 25,000 SF single storage building, as a pre-engineered rigeid frame building.										
3. The foundation system to include shallow footings with a slab on grade working floor level.										
4. Assume structure is NOT pile supported.										
5. Use $725 / SF for construction costs as abstracted from the Pump Station Bldg, OPTION 2 , New Orleans Conceptual Study.										
6. Alow for land acquisition of estimated 5 acre site.										
D__.01. Land Acquisition										
	L RSM OW < > Allowance for Land Acquisition			0.00	0.00	0.00	0.00	5000000	5000000.00	
		1.00	LS	0	0	0	0	5000000	5,000,000	5000000
	TOTAL Land Acquisition			0	0	0	0	5000000	5,000,000	

D_.02. Maint & Stor Facility (Off-Site)		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
D_.02. Maint & Stor Facility (Off-Site)										
L RSM SS <	> Allowance for (1)- 2,500 SF			0.00	0.00	0.00	0.00	725.00	725.00	
		25000	SF	0	0	0	018125000		18,125,000	725.00
	TOTAL Maint & Stor Facility (Off-Site)			0	0	0	018125000		18,125,000	
	TOTAL Maintenance Facility			0	0	0	023125000		23,125,000	

E_.01. 17th Street Canal

		QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_. Capacity Improvements										
E_.01. 17th Street Canal										
E_.01. 01. New Pump/Engine Platform & Encl										
Notes:										
1. A new expanded Engine Platform is required on the west side to house (8) additional pumps and power units each. Allocate approx 500 SF area per pump.....8 x 500 SF = 4000 SF.										
2. Say platform dimensions are 40-ft x 100-ft lg. A perimeter sheetpile cofferdam to be constructed in conjunction with the pump platform. Allow $2500 /LF for for the cofferdam.										
3. The estimate provides for a free-standing structure, adjacent to the existing Engine Platform Structure, constructed upon a pile-supported elevated concrete slab similar to the existing structure. The new structure to be framed with rigid welded frames, with a superstructure of precast concrete wall and roof panels.										
4. Overhead door and personnel door access provided, in addition to louver and ventilation system appurtenances.										
5. Cost per SF allows for misc eletrical (i.e., lighting, recepticles) and misc mechanical appurtenances for new enclosed platform.										
L MIL AA <	> Construct cofferdam around new			0.00	0.00	0.00	0.00	2500.00	2500.00	
		280.00	LF	0	0	0	0	700,000	700,000	2500.00
L RSM SS <	> Allowance for (1) -4000 SF			0.00	0.00	0.00	0.00	785.00	785.00	
		4000.00	SF	0	0	0	0	3140000	3,140,000	785.00
	TOTAL New Pump/Engine Platform & Encl	1.00	EA	0	0	0	0	3840000	3,840,000	3840000
E_.01. 02. Mechanical Systems										
E_.01. 02. 01. Install New Pumps w/ Elec Driver										
L RSM JJ <	> New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
		8.00	EA	0	0	0		13600000	13,600,000	1700000
L RSM JJ <	> Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
		8.00	EA	0	0	0	0	3320000	3,320,000	415000.00
	TOTAL Install New Pumps w/ Elec Driver	8.00	EA	0	0	0		16920000	16,920,000	2115000

E_.01. 17th Street Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.01. 02. 02. Install New Motor Power Units									
L RSM JJ < > Motors for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
	8.00	EA	0	0	0	0	4000000	4,000,000	500000.00
TOTAL Install New Motor Power Units	8.00	EA	0	0	0	0	4000000	4,000,000	500000.00
E_.01. 02. 03. Install (2) New 9-ft Dia Pipes									
Notes:									
1. Assumed pipes are each 200-ft in length from pump to discharge.									
2. Say pipe thickness is 3/4" thick plate at 30.6 PSF.									
3. Estimated weight of pipe = 28.265 SF / LF x 30.6 PSF x 200 LF x 2 ea = 345964 lbs....say 350,000 lbs. = 175 tons.									
4. Say pipe supports weigh at estimated 500,000 lbs total (250,000 lbs per each 200-ft length of 9-ft dia. pipe. = 250 tons.									
E_.01. 02. 03.01. 9-ft Dia Pipes									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	175.00	TON	0	0	0	0	297,500	297,500	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	12000	SF	0	0	0	0	36,000	36,000	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	175.00	TON	0	0	0	0	175,000	175,000	1000.00
TOTAL 9-ft Dia Pipes	400.00	LF	0	0	0	0	508,500	508,500	1271.25
E_.01. 02. 03.02. Pipes Supports for 9-ft Dia Pipe									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	250.00	TON	0	0	0	0	425,000	425,000	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	5000.00	SF	0	0	0	0	15,000	15,000	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	250.00	TON	0	0	0	0	250,000	250,000	1000.00
TOTAL Pipes Supports for 9-ft Dia Pipe	30.00	EA	0	0	0	0	690,000	690,000	23000.00
TOTAL Install (2) New 9-ft Dia Pipes	400.00	LF	0	0	0	0	1198500	1,198,500	2996.25

E_.01. 17th Street Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.01. 02. 04. 48" thick Riprap at Pipe Disch									
B RSM AA < > Rip-rap, random, machine placed			0.00	0.00	0.00	0.00	75.00	75.00	
	125.00	CY	0	0	0	0	9,375	9,375	75.00
TOTAL 48" thick Riprap at Pipe Disch			0	0	0	0	9,375	9,375	
TOTAL Mechanical Systems			0	0	0		022127875	22,127,875	
E_.01. 03. Electrical Systems									
E_.01. 03. 01. Lightning and Grounding System									
E_.01. 03. 01. 5. Lightning Protection									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 5999 Wire, laid in trench									
16181 5999 Copper, bare stranded									
MIL GG <16181 6010 > Grounding, laid in trench,			6.86	221.53	0.00	545.00	0.00	766.53	
	0.40	MLF	3	89	0	218	0	307	766.53
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16840 0010 Lightning protection									
16840 4000 Air terminals, copper									
L MIL GG <16840 4040 > Lightning protection, air			0.48	19.28	0.00	14.67	0.00	33.95	
	29.00	EA	14	559	0	425	0	984	33.95
16840 0010 Lightning protection									
16840 4200 Air terminal bases, copper									
M MIL GG <16840 4220 > Lightning protection, air term			0.89	35.72	0.00	21.50	0.00	57.22	
	29.00	EA	26	1,036	0	624	0	1,659	57.22
TOTAL Lightning Protection			42	1,683	0	1,267	0	2,950	
E_.01. 03. 01.10. Grounding									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									

E_.01. 17th Street Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16181 0029 Rod									
MIL GG <16181 0100 > Grounding, rod, copper clad, 10'			1.82	73.05	0.00	29.40	0.00	102.45	
	20.00	EA	36	1,461	0	588	0	2,049	102.45
MIL GG <16181 6020 > Grounding, laid in trench,			9.43	304.60	0.00	1060.00	0.00	1364.60	
	1.00	MLF	9	305	0	1,060	0	1,365	1364.60
16181 0010 Grounding devices									
16181 6299 Ground conductor bonding, cadweld									
MIL GG <16181 6350 > Grounding, gnd conductor bond,			1.82	73.42	0.00	19.89	0.00	93.31	
	20.00	EA	36	1,468	0	398	0	1,866	93.31
MIL GG <16181 6380 > Grounding, gnd conductor bond,			2.08	84.12	0.00	17.29	0.00	101.41	
	50.00	EA	104	4,206	0	865	0	5,071	101.41
TOTAL Grounding			186	7,440	0	2,910	0	10,350	
TOTAL Lightning and Grounding System			229	9,123	0	4,177	0	13,301	
E_.01. 03. 02. Electrical Power									
E_.01. 03. 02. 5. Power									
16000 0000 Electrical, Generally excludes crane services									
16000 0000 Raceways, Generally excludes crane services									
16016 0000 Conduits									
16018 0010 Conduit, to 15', includes couplings only									
16018 0499 Steel, rigid galvanized (RGS)									
MIL GG <16018 0640 > Conduit to 15' H, 3" dia, incl			0.25	10.05	0.00	9.58	0.00	19.63	
	9050.00	LF	2,263	90,953	0	86,699	0	177,652	19.63
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16108 0000 Conductors									
16115 0010 Shielded cable									
16115 0039 Copper, XLP shielding, 5 KV									
M MIL GG <16115 0400 > Shielded cable, 5kV, 1/0, no			42.11	1691.79	0.00	2184.00	0.00	3875.79	
	14.50	MLF	611	24,531	0	31,668	0	56,199	3875.79
16108 0000 Conductors									
16119 0010 Wire									
16119 0919 600 volt, type THWN-THHN									
16119 0999 Copper, stranded									
MIL GG <16119 1350 > Wire, 600 volt, type THWN-THHN,			12.31	494.52	0.00	274.50	0.00	769.02	
	5.00	MLF	62	2,473	0	1,373	0	3,845	769.02

E_. Capacity Improvements

E_.01. 17th Street Canal

	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16330 0000 Switches									
16330 0010 Distribution section									
16330 0100 Aluminum bus bars, not including breakers									
B AF GG <16331 0000 > Medium voltyage soft start			40.00	1615.20	0.00	39600.00	0.00	41215.20	
	8.00	EA	320	12,922	0	316,800	0	329,722	41215.20
16000 0000 Electrical, Generally excludes crane services									
16500 0000 Power Systems & Capacitors									
16510 0000 Power Systems									
16513 0010 Generator set									
16513 2000 Diesel engine									
B MIL GG <16513 3270 > Generator set, dsl eng, xfr			250.00	9545.41	1094.58	350000	0.00	360640.00	
	8.00	EA	2,000	76,363	8,757	2800000	0	2,885,120	360640.00
TOTAL Power			5,255	207,241	8,757	3236540	0	3,452,537	
TOTAL Electrical Power			5,255	207,241	8,757	3236540	0	3,452,537	
TOTAL Electrical Systems			5,483	216,364	8,757	3240717	0	3,465,838	

E_.01. 04. Communication Systems

Notes:

1. The report considers that incremental SCADA (Supervisory Control And Data Acquisition) interface will be required in considerations of ICS enhancements.

2. Estimate provides for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system. This includes the replacement of all Phase 1 and Phase 2 previously installed.

3. Allowance includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system.

4. Allowance based on cost of SCADA upgrades per pump. Total allowance of $3000 as follows:

$1000 - Pump House SCADA upgrade cost per pump
$2000 - SCADA routing cost to remote pump motors, etc

$3000 - Total estimated SCADA upgrade cost per pump

E_.01. 17th Street Canal

	QUANTY UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM GG < > Allowance for SCADA system		0.00	0.00	0.00	0.00	785.00	785.00	
	8.00 EA	0	0	0	0	6,280	6,280	785.00
TOTAL Communication Systems		0	0	0	0	6,280	6,280	

E_.01. 05. Miscellaneous Items

E_.01. 05. 01. Corrosion Protection

Note:

1. Provide coating on all major elements of the facility.

2. Soil excavation and backfill required at all platform columns and structure supports in order to provided corrosion protection below grade.

3. A cofferdam is required on the Flood side to enable drawdown of water to adequate depth to provide corrosion protection at a nominal depth below water line on Flood side.

4. On Protected side, it is assumed the pump station pumps can be used for draw-down of canal for purpose of applying corrosion protection at a nominal depth below water line on Protected side.

E_.01. 05. 01.01. Protective Coatings

E_.01. 05. 01.01.01. Apply Protective Coating

Notes:

1. Allow costs of application of protective coatings for "Capacity Improvements" at 17th St. for 6 pump system = 75% of costs required for 12 pump system at Phase 1 upgrade.

	QUANTY UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L MIL AA < > Apply protective coating to		0.00	0.00	0.00	0.00	320000	320000.00	
	1.00 LS	0	0	0	0	320,000	320,000	320000.00
TOTAL Apply Protective Coating		0	0	0	0	320,000	320,000	
TOTAL Protective Coatings		0	0	0	0	320,000	320,000	

E_.01. 05. 01.02. Cathodic Protection

	QUANTY UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L MIL AA < > Allowance to install cathodic		0.00	0.00	0.00	0.00	320000	320000.00	
	1.00 LS	0	0	0	0	320,000	320,000	320000.00
TOTAL Cathodic Protection		0	0	0	0	320,000	320,000	

E_.01. 17th Street Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Corrosion Protection			0	0	0	0	640,000	640,000	

E_.01. 05. 02. 96-in Butterfly Valves

02000 0000 Site Work
02100 0000 Site Preparation & Excavation Support
02160 0000 Sheet Piling
02161 0009 Sheet piling
02161 3900 Wood, including wales, braces and spacers

L MIL AA <02200 0000 > Allowance for delivery of Valves			0.00	0.00	0.00	0.00	1500.00	1500.00	
	2.00	EA	0	0	0	0	3,000	3,000	1500.00

11000 0000 Equipment
11000 0000 Equipment

B MIL AA <11000 0001 > Allowance for modifying and			0.00	0.00	0.00	0.00	25000	25000.00	
	2.00	EA	0	0	0	0	50,000	50,000	25000.00

15000 0000 Mechanical, Generally excludes crane services
15100 0000 Pipe & Fittings
15191 0000 Valves
15193 0010 Valves, bronze
15193 8350 Tempering water
15193 8650 Threaded connections

B MIL AA <15194 0000 > 96" dia Butterfly Valve			200.00	8238.90	2434.02	80000.00	0.00	90672.92	
	2.00	EA	400	16,478	4,868	160,000	0	181,346	90672.92
TOTAL 96-in Butterfly Valves	2.00	EA	400	16,478	4,868	160,000	53,000	234,346	117172.92
TOTAL Miscellaneous Items	1.00	EA	400	16,478	4,868	160,000	693,000	874,346	874345.84
TOTAL 17th Street Canal			5,883	232,842	13,625	340071726667155		30,314,339	

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.02. Orleans Avenue Canal									
E_.02. 01. New Pump/Engine Platform & Encl									
Notes:									
1. A new expanded Engine Platform is required on the west side to house (2) additional pumps and power units each. Allocate approx 500 SF area per pump.....2 x 500 SF = 1000 SF.									
2. Say platform dimensions are 40-ft x 25-ft lg. A perimeter sheetpile cofferdam to be constructed in conjunction with the pump platform. Allow $2500 /LF for for the cofferdam.									
3. The estimate provides for a free-standing structure, adjacent to the existing Engine Platform Structure, constructed upon a pile-supported elevated concrete slab similar to the existing structure. The new structure to be framed with rigid welded frames, with a superstructure of precast concrete wall and roof panels.									
4. Overhead door and personnel door access provided, in addition to louver and ventilation system appurtenances.									
5. Cost per SF allows for misc eletrical (i.e., lighting, recepticles) and misc mechanical appurtenances for new enclosed platform.									
L MIL AA < > Construct cofferdam around new			0.00	0.00	0.00	0.00	2500.00	2500.00	
	130.00	LF	0	0	0	0	325,000	325,000	2500.00
L RSM SS < > Allowance for (1) ~1000 SF			0.00	0.00	0.00	0.00	785.00	785.00	
	1000.00	SF	0	0	0	0	785,000	785,000	785.00
TOTAL New Pump/Engine Platform & Encl	1.00	EA	0	0	0	0	1110000	1,110,000	1110000
E_.02. 02. Mechanical Systems									
E_.02. 02. 01. Install New Pumps w/ Elec Driver									
L RSM JJ < > New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
	2.00	EA	0	0	0	0	3400000	3,400,000	1700000
L RSM JJ < > Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
	2.00	EA	0	0	0	0	830,000	830,000	415000.00
TOTAL Install New Pumps w/ Elec Driver	8.00	EA	0	0	0	0	4230000	4,230,000	528750.00

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.02. 02. 02. Install New Motor Power Units									
L RSM JJ < > Motors for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
	2.00	EA	0	0	0	0	1000000	1,000,000	500000.00
TOTAL Install New Motor Power Units	8.00	EA	0	0	0	0	1000000	1,000,000	125000.00
E_.02. 02. 03. Install (1) New 9-ft Dia Pipe									
Notes:									
1. Assumed pipe is each 200-ft in length from pump to discharge.									
2. Say pipe thickness is 3/4" thick plate at 30.6 PSF.									
3. Estimated weight of pipe = 28.265 SF / LF x 30.6 PSF x 200 LF x 1 ea = 172982 lbs....say 175,000 lbs. = 88 tons.									
4. Say pipe supports weigh at estimated 250,000 lbs total for 200-ft length of 9-ft dia. pipe. = 125 tons.									
E_.02. 02. 03.01. 9-ft Dia Pipe									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	88.00	TON	0	0	0	0	149,600	149,600	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	6000.00	SF	0	0	0	0	18,000	18,000	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	88.00	TON	0	0	0	0	88,000	88,000	1000.00
TOTAL 9-ft Dia Pipe	200.00	LF	0	0	0	0	255,600	255,600	1278.00
E_.02. 02. 03.02. Pipes Supports for 9-ft Dia Pipe									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	125.00	TON	0	0	0	0	212,500	212,500	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	2500.00	SF	0	0	0	0	7,500	7,500	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	125.00	TON	0	0	0	0	125,000	125,000	1000.00
TOTAL Pipes Supports for 9-ft Dia Pipe	15.00	EA	0	0	0	0	345,000	345,000	23000.00
TOTAL Install (1) New 9-ft Dia Pipe			0	0	0	0	600,600	600,600	

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.02. 02. 04. 48" thick Riprap at Pipe Disch									
B RSM AA < > Rip-rap, random, machine placed			0.00	0.00	0.00	0.00	75.00	75.00	
	75.00	CY	0	0	0	0	5,625	5,625	75.00
TOTAL 48" thick Riprap at Pipe Disch			0	0	0	0	5,625	5,625	
TOTAL Mechanical Systems			0	0	0	0	5836225	5,836,225	
E_.02. 03. Electrical Systems									
E_.02. 03. 01. Lightning and Grounding System									
E_.02. 03. 01. 5. Lightning Protection									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 5999 Wire, laid in trench									
16181 5999 Copper, bare stranded									
MIL GG <16181 6010 > Grounding, laid in trench,			6.86	221.53	0.00	545.00	0.00	766.53	
	0.10	MLF	1	22	0	55	0	77	766.53
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16840 0010 Lightning protection									
16840 4000 Air terminals, copper									
L MIL GG <16840 4040 > Lightning protection, air			0.48	19.28	0.00	14.67	0.00	33.95	
	7.00	EA	3	135	0	103	0	238	33.95
16840 0010 Lightning protection									
16840 4200 Air terminal bases, copper									
M MIL GG <16840 4220 > Lightning protection, air term			0.89	35.72	0.00	21.50	0.00	57.22	
	7.00	EA	6	250	0	151	0	401	57.22
TOTAL Lightning Protection			10	407	0	308	0	715	
E_.02. 03. 01.10. Grounding									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16181 0029 Rod									
MIL GG <16181 0100 > Grounding, rod, copper clad, 10'			1.82	73.05	0.00	29.40	0.00	102.45	
	5.00	EA	9	365	0	147	0	512	102.45
MIL GG <16181 6020 > Grounding, laid in trench,			9.43	304.60	0.00	1060.00	0.00	1364.60	
	0.25	MLF	2	76	0	265	0	341	1364.60
16181 0010 Grounding devices									
16181 6299 Ground conductor bonding, cadweld									
MIL GG <16181 6350 > Grounding, gnd conductor bond,			1.82	73.42	0.00	19.89	0.00	93.31	
	5.00	EA	9	367	0	99	0	467	93.31
MIL GG <16181 6380 > Grounding, gnd conductor bond,			2.08	84.12	0.00	17.29	0.00	101.41	
	12.00	EA	25	1,009	0	207	0	1,217	101.41
TOTAL Grounding			46	1,818	0	719	0	2,537	
TOTAL Lightning and Grounding System			56	2,225	0	1,027	0	3,252	
E_.02. 03. 02. Electrical Power									
E_.02. 03. 02. 5. Power									
16000 0000 Electrical, Generally excludes crane services									
16000 0000 Raceways, Generally excludes crane services									
16016 0000 Conduits									
16018 0010 Conduit, to 15', includes couplings only									
16018 0499 Steel, rigid galvanized (RGS)									
MIL GG <16018 0640 > Conduit to 15' H, 3" dia, incl			0.25	10.05	0.00	9.58	0.00	19.63	
	2500.00	LF	625	25,125	0	23,950	0	49,075	19.63
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16108 0000 Conductors									
16115 0010 Shielded cable									
16115 0039 Copper, XLP shielding, 5 KV									
M MIL GG <16115 0400 > Shielded cable, 5kV, 1/0, no			42.11	1691.79	0.00	2184.00	0.00	3875.79	
	4.00	MLF	168	6,767	0	8,736	0	15,503	3875.79
16108 0000 Conductors									
16119 0010 Wire									
16119 0919 600 volt, type THWN-THHN									
16119 0999 Copper, stranded									
MIL GG <16119 1350 > Wire, 600 volt, type THWN-THHN,			12.31	494.52	0.00	274.50	0.00	769.02	
	1.50	MLF	18	742	0	412	0	1,154	769.02

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16330 0000 Switches									
16330 0010 Distribution section									
16330 0100 Aluminum bus bars, not including breakers									
B AF GG <16331 0000 > Medium voltyage soft start			40.00	1615.20	0.00	39600.00	0.00	41215.20	
	2.00	EA	80	3,230	0	79,200	0	82,430	41215.20
16000 0000 Electrical, Generally excludes crane services									
16500 0000 Power Systems & Capacitors									
16510 0000 Power Systems									
16513 0010 Generator set									
16513 2000 Diesel engine									
B MIL GG <16513 3270 > Generator set, dsl eng, xfr			250.00	9545.41	1094.58	350000	0.00	360640.00	
	2.00	EA	500	19,091	2,189	700,000	0	721,280	360640.00
TOTAL Power			1,392	54,955	2,189	812,298	0	869,442	
TOTAL Electrical Power			1,392	54,955	2,189	812,298	0	869,442	
TOTAL Electrical Systems			1,448	57,180	2,189	813,324	0	872,694	

E_.02. 04. Communication Systems

Notes:

1. The report considers that incremental SCADA (Supervisory Control And Data Acquisition) interface will be required in considerations of ICS enhancements.

2. Estimate provides for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system. This includes the replacement of all Phase 1 and Phase 2 previously installed.

3. Allowance includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system.

4. Allowance based on cost of SCADA upgrades per pump. Total allowance of $3000 as follows:

$1000 - Pump House SCADA upgrade cost per pump
$2000 - SCADA routing cost to remote pump motors, etc

$3000 - Total estimated SCADA upgrade cost per pump

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM GG < > Allowance for SCADA system			0.00	0.00	0.00	0.00	785.00	785.00	
	2.00	EA	0	0	0	0	1,570	1,570	785.00
TOTAL Communication Systems			0	0	0	0	1,570	1,570	

E_.02. 05. Miscellaneous Items

E_.02. 05. 01. Corrosion Protection

Note:

1. Provide coating on all major elements of the facility.

2. Soil excavation and backfill required at all platform columns and structure supports in order to provided corrosion protection below grade.

3. A cofferdam is required on the Flood side to enable drawdown of water to adequate depth to provide corrosion protection at a nominal depth below water line on Flood side.

4. On Protected side, it is assumed the pump station pumps can be used for draw-down of canal for purpose of applying corrosion protection at a nominal depth below water line on Protected side.

E_.02. 05. 01.01. Protective Coatings

E_.02. 05. 01.01.01. Apply Protective Coating

Notes:

1. Allow costs of application of protective coatings for "Capacity Improvements" at 17th St. for 6 pump system = 75% of costs required for 12 pump system at Phase 1 upgrade.

L MIL AA < > Apply protective coating to			0.00	0.00	0.00	0.00	80000	80000.00	
	1.00	LS	0	0	0	0	80,000	80,000	80000.00
TOTAL Apply Protective Coating			0	0	0	0	80,000	80,000	
TOTAL Protective Coatings			0	0	0	0	80,000	80,000	

E_.02. 05. 01.02. Cathodic Protection

L MIL AA < > Allowance to install cathodic			0.00	0.00	0.00	0.00	80000	80000.00	
	1.00	LS	0	0	0	0	80,000	80,000	80000.00
TOTAL Cathodic Protection			0	0	0	0	80,000	80,000	

E_.02. Orleans Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Corrosion Protection			0	0	0	0	160,000	160,000	

E_.02. 05. 02. 96-in Butterfly Valves

02000 0000 Site Work
02100 0000 Site Preparation & Excavation Support
02160 0000 Sheet Piling
02161 0009 Sheet piling
02161 3900 Wood, including wales, braces and spacers

L MIL AA <02200 0000 > Allowance for delivery of Valves			0.00	0.00	0.00	0.00	1500.00	1500.00	
	1.00	EA	0	0	0	0	1,500	1,500	1500.00

11000 0000 Equipment
11000 0000 Equipment

B MIL AA <11000 0001 > Allowance for modifying and			0.00	0.00	0.00	0.00	25000	25000.00	
	1.00	EA	0	0	0	0	25,000	25,000	25000.00

15000 0000 Mechanical, Generally excludes crane services
15100 0000 Pipe & Fittings
15191 0000 Valves
15193 0010 Valves, bronze
15193 8350 Tempering water
15193 8650 Threaded connections

B MIL AA <15194 0000 > 96" dia Butterfly Valve			200.00	8238.90	2434.02	80000.00	0.00	90672.92	
	1.00	EA	200	8,239	2,434	80,000	0	90,673	90672.92
TOTAL 96-in Butterfly Valves	1.00	EA	200	8,239	2,434	80,000	26,500	117,173	117172.92
TOTAL Miscellaneous Items	1.00	EA	200	8,239	2,434	80,000	186,500	277,173	277172.92
TOTAL Orleans Avenue Canal			1,648	65,419	4,623	893,324	7134295	8,097,662	

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST

E_.03. London Avenue Canal

E_.03. 01. New Pump/Engine Platform & Encl

Notes:

1. A new expanded Engine Platform is required on the west side to house (6) additional pumps and power units each. Allocate approx 500 SF area per pump.....6 x 500 SF = 3000 SF.

2. Say platform dimensions are 40-ft x 75-ft lg. A perimeter sheetpile cofferdam to be constructed in conjunction with the pump platform. Allow $2500 /LF for for the cofferdam.

3. The estimate provides for a free-standing structure, adjacent to the existing Engine Platform Structure, constructed upon a pile-supported elevated concrete slab similar to the existing structure. The new structure to be framed with rigid welded frames, with a superstructure of precast concrete wall and roof panels.

4. Overhead door and personnel door access provided, in addition to louver and ventilation system appurtenances.

5. Cost per SF allows for misc eletrical (i.e., lighting, recepticles) and misc mechanical appurtenances for new enclosed platform.

L MIL AA <	> Construct cofferdam around new			0.00	0.00	0.00	0.00	2500.00	2500.00	
		230.00	LF	0	0	0	0	575,000	575,000	2500.00
L RSM SS <	> Allowance for (1) -3000 SF			0.00	0.00	0.00	0.00	785.00	785.00	
		3000.00	SF	0	0	0	0	2355000	2,355,000	785.00
	TOTAL New Pump/Engine Platform & Encl	1.00	EA	0	0	0	0	2930000	2,930,000	2930000

E_.03. 02. Mechanical Systems

E_.03. 02. 01. Install New Pumps w/ Elec Driver

L RSM JJ <	> New pump with electric driver			0.00	0.00	0.00	0.00	1700000	1700000.00	
		6.00	EA	0	0	0	0	10200000	10,200,000	1700000
L RSM JJ <	> Install New pump with electric			0.00	0.00	0.00	0.00	415000	415000.00	
		6.00	EA	0	0	0	0	2490000	2,490,000	415000.00
	TOTAL Install New Pumps w/ Elec Driver	8.00	EA	0	0	0	0	12690000	12,690,000	1586250

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.03. 02. 02. Install New Motor Power Units									
L RSM JJ < > Motors for New pumps, installed			0.00	0.00	0.00	0.00	500000	500000.00	
	6.00	EA	0	0	0	0	3000000	3,000,000	500000.00
TOTAL Install New Motor Power Units	8.00	EA	0	0	0	0	3000000	3,000,000	375000.00
E_.03. 02. 03. Install (2) New 9-ft Dia Pipes									
Notes:									
1. Assumed pipes are each 200-ft in length from pump to discharge.									
2. Say pipe thickness is 3/4" thick plate at 30.6 PSF.									
3. Estimated weight of pipe = 28.265 SF / LF x 30.6 PSF x 200 LF x 2 ea = 345964 lbs....say 350,000 lbs. = 175 tons.									
4. Say pipe supports weigh at estimated 500,000 lbs total (250,000 lbs per each 200-ft length of 9-ft dia. pipe. = 250 tons.									
E_.03. 02. 03.01. 9-ft Dia Pipes									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	175.00	TON	0	0	0	0	297,500	297,500	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	12000	SF	0	0	0	0	36,000	36,000	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	175.00	TON	0	0	0	0	175,000	175,000	1000.00
TOTAL 9-ft Dia Pipes	400.00	LF	0	0	0	0	508,500	508,500	1271.25
E_.03. 02. 03.02. Pipes Supports for 9-ft Dia Pipe									
L RSM SS < > Allow for fab and delivery of			0.00	0.00	0.00	0.00	1700.00	1700.00	
	250.00	TON	0	0	0	0	425,000	425,000	1700.00
L RSM SS < > Allowance for Corrosion			0.00	0.00	0.00	0.00	3.00	3.00	
	5000.00	SF	0	0	0	0	15,000	15,000	3.00
L RSM SS < > Allowance for installation of			0.00	0.00	0.00	0.00	1000.00	1000.00	
	250.00	TON	0	0	0	0	250,000	250,000	1000.00
TOTAL Pipes Supports for 9-ft Dia Pipe	30.00	EA	0	0	0	0	690,000	690,000	23000.00
TOTAL Install (2) New 9-ft Dia Pipes	400.00	LF	0	0	0	0	1198500	1,198,500	2996.25

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
E_.03. 02. 04. 48" thick Riprap at Pipe Disch									
B RSM AA < > Rip-rap, random, machine placed			0.00	0.00	0.00	0.00	75.00	75.00	
	125.00	CY	0	0	0	0	9,375	9,375	75.00
TOTAL 48" thick Riprap at Pipe Disch			0	0	0	0	9,375	9,375	
TOTAL Mechanical Systems			0	0	0	0	16897875	16,897,875	
E_.03. 03. Electrical Systems									
E_.03. 03. 01. Lightning and Grounding System									
E_.03. 03. 01. 5. Lightning Protection									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									
16181 5999 Wire, laid in trench									
16181 5999 Copper, bare stranded									
MIL GG <16181 6010 > Grounding, laid in trench,			6.86	221.53	0.00	545.00	0.00	766.53	
	3.00	MLF	21	665	0	1,635	0	2,300	766.53
16000 0000 Electrical, Generally excludes crane services									
16800 0000 Special Systems									
16801 0000 Special Systems									
16840 0010 Lightning protection									
16840 4000 Air terminals, copper									
L MIL GG <16840 4040 > Lightning protection, air			0.48	19.28	0.00	14.67	0.00	33.95	
	22.00	EA	11	424	0	323	0	747	33.95
16840 0010 Lightning protection									
16840 4200 Air terminal bases, copper									
M MIL GG <16840 4220 > Lightning protection, air term			0.89	35.72	0.00	21.50	0.00	57.22	
	22.00	EA	20	786	0	473	0	1,259	57.22
TOTAL Lightning Protection			51	1,874	0	2,431	0	4,305	
E_.03. 03. 01.10. Grounding									
16000 0000 Electrical, Generally excludes crane services									
16100 0000 Conductors & Grounding									
16180 0000 Grounding									
16181 0010 Grounding devices									

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16181 0029 Rod									
MIL GG <16181 0100 > Grounding, rod, copper clad, 10'			1.82	73.05	0.00	29.40	0.00	102.45	
	15.00	EA	27	1,096	0	441	0	1,537	102.45
MIL GG <16181 6020 > Grounding, laid in trench,			9.43	304.60	0.00	1060.00	0.00	1364.60	
	0.75	MLF	7	228	0	795	0	1,023	1364.60
16181 0010 Grounding devices									
16181 6299 Ground conductor bonding, cadweld									
MIL GG <16181 6350 > Grounding, gnd conductor bond,			1.82	73.42	0.00	19.89	0.00	93.31	
	15.00	EA	27	1,101	0	298	0	1,400	93.31
MIL GG <16181 6380 > Grounding, gnd conductor bond,			2.08	84.12	0.00	17.29	0.00	101.41	
	1.06	EA	2	89	0	18	0	107	101.41
TOTAL Grounding			64	2,515	0	1,553	0	4,067	
TOTAL Lightning and Grounding System			115	4,389	0	3,983	0	8,373	

E_.03. 03. 02. Electrical Power

E_.03. 03. 02. 5. Power

16000 0000 Electrical, Generally excludes crane services
16000 0000 Raceways, Generally excludes crane services
16016 0000 Conduits
16018 0010 Conduit, to 15', includes couplings only
16018 0499 Steel, rigid galvanized (RGS)

MIL GG <16018 0640 > Conduit to 15' H, 3" dia, incl			0.25	10.05	0.00	9.58	0.00	19.63	
	6800.00	LF	1,700	68,340	0	65,144	0	133,484	19.63

16000 0000 Electrical, Generally excludes crane services
16100 0000 Conductors & Grounding
16108 0000 Conductors
16115 0010 Shielded cable
16115 0039 Copper, XLP shielding, 5 KV

M MIL GG <16115 0400 > Shielded cable, 5kV, 1/0, no			42.11	1691.79	0.00	2184.00	0.00	3875.79	
	10.88	MLF	458	18,407	0	23,762	0	42,169	3875.79

16108 0000 Conductors
16119 0010 Wire
16119 0919 600 volt, type THWN-THHN
16119 0999 Copper, stranded

MIL GG <16119 1350 > Wire, 600 volt, type THWN-THHN,			12.31	494.52	0.00	274.50	0.00	769.02	
	4.00	MLF	49	1,978	0	1,098	0	3,076	769.02

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
16000 0000 Electrical, Generally excludes crane services									
16300 0000 Motors, Starters, Boards & Switches									
16330 0000 Switches									
16330 0010 Distribution section									
16330 0100 Aluminum bus bars, not including breakers									
B AF GG <16331 0000 > Medium voltyage soft start			40.00	1615.20	0.00	39600.00	0.00	41215.20	
	6.00	EA	240	9,691	0	237,600	0	247,291	41215.20
16000 0000 Electrical, Generally excludes crane services									
16500 0000 Power Systems & Capacitors									
16510 0000 Power Systems									
16513 0010 Generator set									
16513 2000 Diesel engine									
B MIL GG <16513 3270 > Generator set, dsl eng, xfr			250.00	9545.41	1094.58	350000	0.00	360640.00	
	6.00	EA	1,500	57,272	6,567	2100000	0	2,163,840	360640.00
TOTAL Power			3,947	155,688	6,567	2427604	0	2,589,860	
TOTAL Electrical Power			3,947	155,688	6,567	2427604	0	2,589,860	
TOTAL Electrical Systems			4,062	160,078	6,567	2431587	0	2,598,232	

E_.03. 04. Communication Systems

Notes:

1. The report considers that incremental SCADA (Supervisory Control And Data Acquisition) interfece will be required in considerations of ICS enhancements.

2. Estimate provides for upgrade of SCADA monitoring and control equipment to accommodate transition from a hydraulic driven system to a diesel driven system. This includes the replacement of all Phase 1 and Phase 2 previously installed.

3. Allowance includes installation of conduit, wiring, devices, interface with existing / new equipment and current SCADA monitoring system.

4. Allowance based on cost of SCADA upgrades per pump. Total allowance of $3000 as follows:

$1000 - Pump House SCADA upgrade cost per pump
$2000 - SCADA routing cost to remote pump motors, etc

$3000 - Total estimated SCADA upgrade cost per pump

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
L RSM GG < > Allowance for SCADA system			0.00	0.00	0.00	0.00	785.00	785.00	
	6.00	EA	0	0	0	0	4,710	4,710	785.00
TOTAL Communication Systems			0	0	0	0	4,710	4,710	

E_.03. 05. Miscellaneous Items

E_.03. 05. 01. Corrosion Protection

Note:

1. Provide coating on all major elements of the facility.

2. Soil excavation and backfill required at all platform columns and structure supports in order to provided corrosion protection below grade.

3. A cofferdam is required on the Flood side to enable drawdown of water to adequate depth to provide corrosion protection at a nominal depth below water line on Flood side.

4. On Protected side, it is assumed the pump station pumps can be used for draw-down of canal for purpose of applying corrosion protection at a nominal depth below water line on Protected side.

E_.03. 05. 01.01. Protective Coatings

E_.03. 05. 01.01.01. Apply Protective Coating

Notes:

1. Allow costs of application of protective coatings for "Capacity Improvements" at 17th St. for 6 pump system = 75% of costs required for 12 pump system at Phase 1 upgrade.

L MIL AA < > Apply protective coating to			0.00	0.00	0.00	0.00	240000	240000.00	
	1.00	LS	0	0	0	0	240,000	240,000	240000.00
TOTAL Apply Protective Coating			0	0	0	0	240,000	240,000	
TOTAL Protective Coatings			0	0	0	0	240,000	240,000	

E_.03. 05. 01.02. Cathodic Protection

L MIL AA < > Allowance to install cathodic			0.00	0.00	0.00	0.00	240000	240000.00	
	1.00	LS	0	0	0	0	240,000	240,000	240000.00
TOTAL Cathodic Protection			0	0	0	0	240,000	240,000	

E_.03. London Avenue Canal	QUANTY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	Other	TOTAL COST	UNIT COST
TOTAL Corrosion Protection			0	0	0	0	480,000	480,000	

E_.03. 05. 02. 96-in Butterfly Valves

02000 0000 Site Work
02100 0000 Site Preparation & Excavation Support
02160 0000 Sheet Piling
02161 0009 Sheet piling
02161 3900 Wood, including wales, braces and spacers

L MIL AA <02200 0000 > Allowance for delivery of Valves			0.00	0.00	0.00	0.00	1500.00	1500.00	
	2.00	EA	0	0	0	0	3,000	3,000	1500.00

11000 0000 Equipment
11000 0000 Equipment

B MIL AA <11000 0001 > Allowance for modifying and			0.00	0.00	0.00	0.00	25000	25000.00	
	2.00	EA	0	0	0	0	50,000	50,000	25000.00

15000 0000 Mechanical, Generally excludes crane services
15100 0000 Pipe & Fittings
15191 0000 Valves
15193 0010 Valves, bronze
15193 8350 Tempering water
15193 8650 Threaded connections

B MIL AA <15194 0000 > 96" dia Butterfly Valve			200.00	8238.90	2434.02	80000.00	0.00	90672.92	
	2.00	EA	400	16,478	4,868	160,000	0	181,346	90672.92
TOTAL 96-in Butterfly Valves	2.00	EA	400	16,478	4,868	160,000	53,000	234,346	117172.92
TOTAL Miscellaneous Items	1.00	EA	400	16,478	4,868	160,000	533,000	714,346	714345.84
TOTAL London Avenue Canal			4,462	176,555	11,436	259158720365985		23,145,163	
TOTAL Capacity Improvements			11,993	474,817	29,683	688562054167035		61,557,164	
TOTAL Permanent Enhancement of ICS			52,558	2077063	152,893	24829602********		233,579,320	

Quantity Development

NEW ORLEANS ICS PROJECT

Demo of Platform Enclosures

LONDON AVE / ORLEANS AVE. (SIMILAR) CANALS

1 GENERATOR PLATFORM ENCLOSURES

01 Demolition

01 Chain Link Fencing

QTY PER BLDG Area (LF)	NO. OF BLDG'S (EA)	TOTALS	SAY
265	2	530	530

02 Metal Roof-Siding Panels

a. Roof Panels

Qty (ea)	L	W	QTY PER BLDG Area (SF)
2	88	19.5	3432

b. Side Panels

Qty (ea)	L	W	Area (SF)
2	88	6	1056

c. End Panels

Qty (ea)	L	W	Area (SF)
2	38	6	456
4	19	2.5	190
			5134

NO. OF BLDG'S (EA)	TOTALS	SAY
2	10268	10300

03 Misc Steel - Roof Purlins

Qty (ea)	L	lbs/lf	Total LBS
24	88	5	10560

NO. OF BLDG'S (EA)	TOTALS	SAY
2	21120	21500

02 Structure Modifications

Note: See M. Vanek Worksheets for quantities of STRUCTURE MODIFICATIONS

03 Allowance for Misc Modifications

NEW ORLEANS ICS PROJECT

Demo of Platform Enclosures

17th Street Canal

1 GENERATOR PLATFORM ENCLOSURES

01 Demolition

01 Chain Link Fencing

QTY PER BLDG Area (LF)	NO. OF BLDG'S (EA)	TOTALS	SAY
225	2	450	**450**

02 Metal Roof-Siding Panels

a. Roof Panels

Qty (ea)	L	W	QTY PER BLDG Area (SF)
2	92	21	3864

b. Side Panels

Qty (ea)	L	W	Area (SF)
2	92	6	1104

c. End Panels

Qty (ea)	L	W	Area (SF)
2	40	6	480
4	20	2.5	200

5648	2	11296	**11300**

03 Misc Steel - Roof Purlins

Qty (ea)	L	lbs/lf	Total LBS			
26	90	5	11700	2	23400	**23400**

02 Structure Modifications

Note: See M. Vanek Worksheets for quantities of STRUCTURE MODIFICATIONS

03 Allowance for Misc Modifications

Client : USACE - Nashville
Project Name: New Orleans Hurricane Protection - ICS
Project No.: 41682.0100
Location: London Ave Canal
Orleans Ave Canal (Similar)

Date: January 8, 2007
Computed By: G. Hicks
Checked By: L. Schieber

Quantity Assessment for Roller Gates

(Incl Steel Framing Members, Plates, Bracing, Connection PL's, Skin Plate)

1. Replacement Gate Leaf at 17th Street:

No. Gates = 11 at 17th St.

01_LEAF FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	No. of Gates	Unit Quan	lbs/LF	Length	W F TONS W Shapes	Channel TONS C-Shapes	WT TONS Tees	ANGLE TONS L-Shapes	Paint AREA S.F./L.F.	Paint % Area to paint	Paint Total Paint S.F.	
1	**Leaf Framing**													
a.	Wt15 Vert Framing Member	WT15x45	11	6	45.00	41.00			60.885		4.256	85%	1629.24	WT15x45
b.	Misc. Angle Framing (say 1.0 ton per gate)	L4x4	11	4	12.80	26.00				7.32	1.400	85%	340.84	Misc. Angle Framing (say 1.0 ton per gate)
c.														
d.														
				SUBTOTAL TONS =		68.207	0.00	0.00	60.89	7.32			1970	SF

02_STEEL PLATE

Item No.	Description	PLATE SIZE	No. of Gates	Unit Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	PAINT % Area to be painted	PAINT Total Paint S.F.
1	**Leaf Skin Plate**																			
a.	Protected Side Skin Plate of Gate Leaf	1/2"	11	1	20.40	27.00	11.75	317.250				35.595							100%	6979.50
b.	Flange Plate , Flood Side	1/2"	11	18	20.40	1.60	1.00	1.600				3.231							100%	633.60
c.	Top Plate	1/2"	11	1	20.40	11.75	1.30	15.275				1.714							100%	336.05
d.	Diaphragm Plates	1/2"	11	18	20.40	1.60	1.00	1.600				3.231							100%	633.60
e.	Bottom Plate, flat	1/2"	11	1	20.40	11.75	1.30	15.275				1.714							100%	336.05
f.	Bottom Plate, Vert	5/8"	11	1	25.50	11.75	1.38	16.156					2.268						100%	355.44
g.	Misc Plates, 3/4"	3/4"	11	10	30.60	x	x	1.000						1.683					100%	220.00
h.	Misc Plates, 1/2"	1/2"	11	10	20.40	x	x	1.000				1.122							100%	220.00
i.	Plates for wall pipe	1/2"	11	4	20.40	3.33	1.30	4.329				1.943							100%	380.95
j.	Flange plate at Top, Flood Side	1/2"	11	5	20.40	1.30	0.50	0.650				0.365							100%	71.50
				SUBTOTAL TONS =				52.864	0.00	0.00	0.00	48.92	2.27	1.68	0.00	0.00	0.00	0.00	xxx	10166.69

SAY

		121.071	Plate + Framing	
ADD	5%	6.053545	allowance for roller, etc.	
		127.124	total tons	
SAY		128	total tons	

12136.267

SAY 13000

Client : USACE - Nashville
Project Name: New Orleans Hurricane Protection - ICS
Project No.: 41682.0100
Location: London Ave Canal
Orleans Ave Canal (Similar)

Date: January 8, 2007
Computed By: G. Hicks
Checked By: L. Schieber

Quantity Assessment for Roller Gates

(Incl Steel Framing Members, Plates, Bracing, Connection PL's, Skin Plate)

1. Replacement Guide Columns at 17th Street:

ESTIMATE MU1- 1

No. Gates = 11 at 17th St.

01_GATE GUIDE FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	Quan	lbs/LF	Length	W F TONS W Shapes	Channel TONS C-Shapes (101-300plf)	WT TONS Tees	ANGLE TONS L-Shapes (0-10 plf)	Paint AREA S.F./L.F.	Paint % Area to paint	Paint Total Paint S.F.	
1	Guide Column Framing												
a.	Vert Guide Column (locate at each exist guide column)	W30x132	12	132.00	46.00			36.432		8.500	100%	4692.00	W30x132
b.	(2) Horiz. Motor Operator Support between Guide Cols	MC10x 33.6	22	33.60	12.00		4.435			5.000	100%	1320.00	MC10x 33.6
c.													
d.													
			SUBTOTAL TONS =		40.867	0.00	4.44	36.43	0.00			6012	SF

02_STEEL PLATE

Item No.	Description	PLATE SIZE	Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	3 1/2"	PAINT % Area to be painted	PAINT Total Paint S.F.
1	Miscellaneous Plates																			
a.	Plate support for Motor Oper at ea gate	1"	11	81.20	5	3	15.000								5.049				100%	330.00
b.	Cont Plate across bottom of of sill at gates	3/4"	1	30.60	140.00	2.50	350.000						5.355						100%	350.00
							SUBTOTAL TONS =	10.404	0.00	0.00	0.00	0.00	0.00	5.36	0.00	5.05	0.00	0.00	0.00	2.00	680.00

		51.271	Plate + Framing
ADD	5%	2.5636	allowance for misc
		53.835	total tons
SAY		55	total tons

6692.000

SAY 7000

2. Replacement Guide Columns at London Ave: No. Gates = at Orleans Ave

02_GATE GUIDE FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	Quan	lbs/LF	Length	W F TONS W-Shapes	Channel TONS C-Shapes (101-300plf)	WT TONS Tees	ANGLE TONS L-Shapes (0-10 plf)	Paint AREA S.F./L.F.	Paint % Area to paint	Paint Total Paint S.F.	
1	**Guide Column Framing**												
a.	Vert Guide Column (locate at each exist guide column)	W30x132	6	132.00	41.00			16.236		6.500	100%	2091.00	W30x132
b.	(2) Horiz. Motor Operator Support between Guide Cols	MC10x 33.6	0	33.60	12.00		0.000			5.000	100%	0.00	MC10x 33.6
c.													
d.													
			SUBTOTAL TONS =		16.236	0.00	0.00	16.24	0.00			2091	SF

02_STEEL PLATE

Item No.	Description	PLATE SIZE	Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	3 1/2"	PAINT % Area to be painted	PAINT Total Paint S.F.
1	**Miscellaneous Plates**																			
a.	Plate support for Motor Oper at ea gate	1"	11	51.20	5	3	15.000								5.049				100%	330.00
b.	Cont Plate across bottom of of sill at gates	3/4"	1	30.60	140.00	2.50	350.000						5.355						100%	350.00
						SUBTOTAL TONS =	10.404	0.00	0.00	0.00	0.00	0.00	5.36	0.00	5.05	0.00	0.00	0.00	2.00	680.00

	26.640	Plate + Framing	
ADD	5% 1.332	allowance for misc	
	27.972	total tons	
SAY	28	total tons	

2771.000

SAY 2800

2. Replacement Gate Leaf at Orleans Ave : No. Gates = 5 at Orleans Ave

02_LEAF FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	No. of Gates	Unit Quan	lbs/LF	Length	W F TONS W Shapes	Channel TONS C-Shapes	WT TONS Tees	ANGLE TONS L-Shapes	Paint AREA S.F./L.F.	Paint % Area to paint	Paint Total Paint S.F.	
1	**Leaf Framing**													
a.	WT15 Vert Framing Member	WT15x45	5	6	45.00	41.00			27.675		4.250	85%	740.56	WT15x45
b.	Misc. Angle Framing (say 1.0 ton per gate)	L4x4	5	4	12.80	26.00				3.33	1.400	85%	154.70	Misc. Angle Framing (say 1.0 ton per gate)
c.														
d.														
				SUBTOTAL TONS =		31.003	0.00	0.00	27.68	3.33			895	SF

02_STEEL PLATE

Item No.	Description	PLATE SIZE	No. of Gates	Unit Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	PAINT % Area to be painted	PAINT Total Paint S.F.
1	**Leaf Skin Plate**																			
a.	Protected Side Skin Plate of Gate Leaf	1/2"	5	1	20.40	27.00	11.75	317.250				16.180							100%	3172.50
b.	Flange Plate , Flood Side	1/2"	5	21	20.40	1.60	1.00	1.600				1.714							100%	336.00
c.	Top Plate	1/2"	5	1	20.40	11.75	1.30	15.275				0.779							100%	152.75
d.	Diaphragm Plates	1/2"	5	21	20.40	1.60	1.00	1.600				1.714							100%	336.00
e.	Bottom Plate, flat	1/2"	5	1	20.40	11.75	1.30	15.275				0.779							100%	152.75
f.	Bottom Plate, Vert	5/8"	5	1	25.50	11.75	1.38	16.156					1.030						100%	161.56
g.	Misc Plates, 3/4"	3/4"	5	10	30.60	x	x	1.000						0.765					100%	100.00
h.	Misc Plates, 1/2"	1/2"	5	10	20.40	x	x	1.000				0.510							100%	100.00
i.	Plates for wall pipe	1/2"	5	8	20.40	3.33	1.30	4.329				1.766							100%	346.32
j.	Flange plate at Top, Flood Side	1/2"	5	0	20.40	1.30	0.50	0.650				0.000							100%	0.00
							SUBTOTAL TONS =	25.236	0.00	0.00	0.00	23.44	1.03	0.77	0.00	0.00	0.00	0.00	xxx	4857.88
																			SAY	

	56.239	Plate + Framing	5753.145
ADD 5%	2.81196	allowance for roller, etc.	SAY 6000
	59.051	total tons	
SAY	60	total tons	

Client : USACE - Nashville
Project Name: New Orleans Hurricane Protection - ICS
Project No.: 41682.0100
Location: London Ave Canal
Orleans Ave Canal (Similar)

Date: January 8, 2007
Computed By: G. Hicks
Checked By: L. Schieber

Quantity Assessment for Roller Gates

(Incl Steel Framing Members, Plates, Bracing, Connection PL's, Skin Plate)

1. Replacement Gate Leaf at London Ave : No. Gates = 13 at London Ave

01_LEAF FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	No. of Gates	Unit Quan	lbs/LF	Length	W F TONS W Shapes	Channel TONS C-Shapes	WT TONS Tees	ANGLE TONS L-Shapes
1	**Leaf Framing**									
a.	WT15 Vert Framing Member	WT15x45	13	6	45.00	41.00			71.955	
b.	Misc. Angle Framing (say 1.0 ton per gate)	L4x4	13	4	12.80	26.00				8.65
c.										
d.										
				SUBTOTAL TONS =		80.608	0.00	0.00	71.96	8.65

Paint AREA S.F./L.F.	% Area to paint	Total Paint S.F.	
4.250	85%	1925.46	WT15x45
1.400	85%	402.22	Misc. Angle Framing (say 1.0 ton per gate)
		2328	SF

01_STEEL PLATE

Item No.	Description	PLATE SIZE	No. of Gates	Unit Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	PAINT % Area to be painted	Total Paint S.F.
1	**Leaf Skin Plate**																			
a.	Protected Side Skin Plate of Gate Leaf	1/2"	13	1	20.40	25.50	11.70	298.350				39.581							100%	7757.10
b.	Flange Plate, Flood Side	1/2"	13	21	20.40	1.60	1.00	1.600				4.455							100%	873.60
c.	Top Plate	1/2"	13	1	20.40	11.70	1.30	15.210				2.017							100%	395.46
d.	Diaphragm Plates	1/2"	13	21	20.40	1.60	1.00	1.600				4.455							100%	873.60
e.	Bottom Plate, flat	1/2"	13	1	20.40	11.70	1.30	15.210				2.017							100%	395.46
f.	Bottom Plate, Vert	5/8"	13	1	25.50	11.70	1.38	16.088					2.667						100%	418.28
g.	Misc Plates, 3/4"	3/4"	13	10	30.60	x	x	1.000						1.989					100%	260.00
h.	Misc Plates, 1/2"	1/2"	13	10	20.40	x	x	1.000				1.326							100%	260.00
i.	Plates for wall pipe	1/2"	13	8	20.40	3.33	1.30	4.329				4.592							100%	900.43
j.	Flange plate at Top, Flood Side	1/2"	13	0	20.40	1.30	0.50	0.650				0.000							100%	0.00
							SUBTOTAL TONS =	63.079	0.00	0.00	0.00	56.42	2.67	1.99	0.00	0.00	0.00	0.00	xxx	12133.93
																			SAY	

143.687 Plate + Framing
ADD 5% 7.184356 allowance for roller, etc.
150.871 total tons
SAY 151 total tons

14461.810
SAY 15000

Client : USACE - Nashville
Project Name: New Orleans Hurricane Protection - ICS
Project No.: 41682.0100
Location: London Ave Canal
Orleans Ave Canal (Similar)

Date: January 8, 2007
Computed By: G. Hicks
Checked By: L. Schieber

Quantity Assessment for Roller Gates

(Incl Steel Framing Members, Plates, Bracing, Connection PL's, Skin Plate)

1. Replacement Guide Columns at London Ave: No. Gates = 13 at London Ave

01_GATE GUIDE FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	Quan	lbs/LF	Length	W F TONS W Shapes	Channel TONS C-Shapes (101-300plf)	WT TONS Tees	ANGLE TONS L-Shapes (0-10 plf)	Paint AREA S.F./L.F.	Paint % Area to paint	Paint Total Paint S.F.	
1	**Guide Column Framing**												
a.	Vert Guide Column (locate at each exist guide column)	W30x132	14	132.00	41.00			37.884		6.500	100%	4879.00	W30x132
b.	(2) Horiz. Motor Operator Support between Guide Cols	MC10x 33.6	26	33.60	12.00		5.242			5.000	100%	1560.00	MC10x 33.6
c.													
d.													
			SUBTOTAL TONS =		43.126	0.00	5.24	37.88	0.00			6439	SF

02_STEEL PLATE

Item No.	Description	PLATE SIZE	Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 1/2"	3 1/2"	PAINT % Area to be painted	PAINT Total Paint S.F.
1	**Miscellaneous Plates**																			
a.	Plate support for Motor Oper at ea gate	1"	11	61.20	5	3	15.000								5.049				100%	330.00
b.	Cord Plate across bottom of of sill at gates	3/4"	1	30.60	140.00	2.50	350.000						5.355						100%	350.00
					SUBTOTAL TONS =		10.404	0.00	0.00	0.00	0.00	0.00	5.36	0.00	5.05	0.00	0.00	0.00	2.00	680.00

	53.530	Plate + Framing	
ADD	5% 2.6765	allowance for misc	
	56.206	total tons	
SAY	56	total tons	

7119.000
SAY 7200

NEW ORLEANS ICS PROJECT

05_01.01 - Demo Exist Pumps (applies to Ph1 and Ph2 pumps)

LONDON AVE / ORLEANS AVE. / 17th Street

LONDON

01 Demolition

01 18 MWI pumps

EAST SIDE -	Ph1 EA	
	12	
WEST SIDE -	Ph2 EA	
	0	
	12	TOTAL

ORLEANS

01 Demolition

18 MWI pumps

EAST SIDE -	Ph1 EA	
	10	
WEST SIDE -	Ph2 EA	
	0	
	10	TOTAL

17th STREET

01 Demolition

18 MWI pumps

EAST SIDE -	Ph1 EA	
	12	
WEST SIDE -	Ph2 EA	
	6	
	18	TOTAL

BLACK & VEATCH
NEW ORLEANS ICS PROJECT
05_01.01 - Demo Existing Pumps

LONDON AVE / ORLEANS AVE. / 17th Street

CREW DEVELOPMENT:

Labor:	Base Hr Rate	Fringes	other	TOTAL
Laborers, Semi Skilled, Foreman	$18.52	$4.51	$0.00	$23.03
Laborers, Semi Skilled	$17.52	$4.51	$0.00	$22.03
Plumber / Pipe fitter	$23.52	$6.68	$0.00	$30.20
Equipment Oper, Medium	$20.25	$7.80	$0.00	$28.05
Truck Drivers, Heavy	$17.35	$7.80	$0.00	$25.15

General Equipment:	2006 Region II Base Daily Rate	2006 Region II Base Hourly Rate	Esc to 2007 (esc. by 1.05 factor)	Estimated 2007 Region II Base Hourly Rate
Truck, Hwy,	$699.28	$87.41	1.10	$96.15
Misc Equip,total (incl compressor, winches, hand tools, etc.)				$25.00
Crane, wheel mounted,				$135.00

1. Disconnect Existing Pump; prep for removal

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$120.80		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
1	Equipment Oper, Medium	$28.05		
1	Crane, wheel mounted,			$135.00
	TOTAL =	$193.91		$160.00

	No. of Pumps	No. of days	hr/day		
Productivity:	1	2	10	0.05	tanks per hr
Cost per UOM:	Tank	$3,878.20		$3,200.00	$7,078.20 / Tk Total Labor + Equip.
				SAY	$7,100 TOTAL

2. Removal and Disposal of Exist pumps

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$0.00		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
1	Equipment Oper, Medium	$28.05		
1	Crane, wheel mounted,			$135.00
1	Truck Drivers, Heavy	$25.15		
1	Truck, Hwy,			$96.15
	TOTAL =	$98.26		$256.15

	No. of Pumps	No. of days	hr/day		
Productivity:	1	1	10	0.10	tanks per hr

Cost per UOM:	Tank	$982.60		$2,561.51	$3,544.11	/ Tk Total Labor + Equip.
				SAY	$3,750	TOTAL

05_01.02 - Demo of Hydraulic Fluid System

17th STREET

1 Hydraulic Fluid Piping (Phase 1 System)

01 Demolition

01 3" dia Sch 80 Stl Piping

EAST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L
6	4	24	270

LGTH OF PIPING
LF
6480

WEST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L
6	4	24	225

LGTH OF PIPING
LF
5400

TOTAL LF =	11880	5% Add for Ph 2 → 594	3" dia piping → 12474
	Phase 1	Phase 2	Tot Ph 1 & Ph 2

02 1" dia Sch 80 Stl Piping

EAST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L
6	1	6	270

Phase 1
LGTH OF PIPING
LF
1620

WEST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L
6	1	6	225

LGTH OF PIPING
LF
1350

TOTAL LF =	2970	5% Add for Ph 2 → 149	1" dia piping → 3119
	Phase 1	Phase 2	Tot Ph 1 & Ph 2

02 Volume of Fluid to drain from piping - Phase 1 Piping

		LGTH OF PIPING LF	CF Vol / LF	Gals / LF	Volume Gals
Ph1	3"	11880	0.05	0.3671	4361.148
Ph1	1"	2970	0.0055	0.041	121.144

Volume Gals	
4361.15	Phase 1 3" dia piping
121.14	1" dia piping
4482.29	TOTAL

03 Volume of Fluid to drain from piping - Phase 2 Piping

		LGTH OF PIPING LF	CF Vol / LF	Gals / LF	Volume Gals
Ph1	3"	594	0.05	0.3671	218.0574
Ph1	1"	149	0.0055	0.041	6.057

Volume Gals	
218.06	Phase 1 3" dia piping
6.06	1" dia piping
224.11	TOTAL

NEW ORLEANS ICS PROJECT

05_01.02 - Demo of Hydraulic Fluid System

17th Street (Units at the Gate Closure Structure)

1 Hydraulic Fluid Piping

01 Demolition

01 3" dia Sch 80 Stl Piping

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L	LGTH OF PIPING LF
14	4	56	25	1400

TOTAL LF = **1400** 3" dia piping

02 1" dia Sch 80 Stl Piping

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L	LGTH OF PIPING LF
14	1	14	25	350

TOTAL LF = **350** 1" dia piping

02 Volume of Fluid to drain from piping - 3" dia Sch 80 Stl Piping

	LGTH OF PIPING LF	CF Vol / LF	Gals / LF	Volume Gals	Volume Gals	
3"	1400	0.05	0.3671	513.94	**513.94**	3" dia piping
1"	350	0.0055	0.041	14.276	**14.28**	1" dia piping
					528.22	TOTAL

NEW ORLEANS ICS PROJECT

05_01.02 - Demo of Hydraulic Fluid System

LONDON AVE / ORLEANS AVE. / 17th Street

LONDON

1 Hydraulic Fluid Piping (Phase 1 System)

01 Demolition

01 3" dia Sch 80 Stl Piping

EAST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L		Phase 1 LGTH OF PIPING LF
6	4	24	300		7200

WEST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L		LGTH OF PIPING LF
6	4	24	380		9120
				TOTAL LF =	**16320** Phase 1

3" dia piping

02 1" dia Sch 80 Stl Piping

EAST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L		Phase 1 LGTH OF PIPING LF
6	1	6	300		1800

WEST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L		LGTH OF PIPING LF
6	1	6	380		2280
				TOTAL LF =	**4080** Phase 1

1" dia piping

02 Volume of Fluid to drain from piping - 3" dia Sch 80 Stl Piping

	LGTH OF PIPING LF	CF Vol / LF	Gals / LF	Volume Gals	Volume Gals	
3"	16320	0.05	0.3671	5991.072	**5991.07**	3" dia piping
1"	4080	0.0055	0.041	166.421	**166.42**	1" dia piping
					6157.49 Phase 1	TOTAL

05_01.02 - Demo of Hydraulic Fluid System

ORLEANS

1 Hydraulic Fluid Piping (Phase 1 System)

01 Demolition

01 3" dia Sch 80 Stl Piping

EAST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L	LGTH OF PIPING LF
5	4	20	325	6500

WEST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L	LGTH OF PIPING LF
5	4	20	305	6100

TOTAL LF = **12600** **3" dia piping**

Phase 1

02 1" dia Sch 80 Stl Piping

EAST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L	Phase 1 LGTH OF PIPING LF
5	1	5	325	1625

WEST SIDE -

Rows Qty (ea)	Pipes /row Qty (ea)	No. of Pipes EA	nominal Avg Length L	LGTH OF PIPING LF
5	1	5	305	1525

TOTAL LF = **3150** **1" dia piping**

Phase 1

02 Volume of Fluid to drain from piping - 3" dia Sch 80 Stl Piping

	LGTH OF PIPING LF	CF Vol / LF	Gals / LF	Volume Gals	Volume Gals	
3"	12600	0.05	0.3671	4625.46	**4625.46**	**3" dia piping**
1"	3150	0.0055	0.041	128.487	**128.49**	**1" dia piping**
					4753.95	**TOTAL**

Phase 1

BLACK & VEATCH
NEW ORLEANS ICS PROJECT
05_01.02 - Demo of Hydraulic Fluid System

LONDON AVE / ORLEANS AVE. / 17th Street

CREW DEVELOPMENT:

Labor:	Base Hr Rate	Fringes	other	TOTAL
Laborers, Semi Skilled, Foreman	$18.52	$4.51	$0.00	$23.03
Laborers, Semi Skilled	$17.52	$4.51	$0.00	$22.03
Plumber / Pipe fitter	$23.52	$6.68	$0.00	$30.20
Equipment Oper, Medium	$20.25	$7.80	$0.00	$28.05
Truck Drivers, Heavy	$17.35	$7.80	$0.00	$25.15

General Equipment:	2006 Region II Base Daily Rate	2006 Region II Base Hourly Rate	Esc to 2007 (esc. by 1.05 factor)	Estimated 2007 Region II Base Hourly Rate
Truck, Off-Hwy, Rear Dump, 36T, 23-29CY	$699.28	$87.41	1.10	$96.15
Misc Equip,total (incl compressor, winches, hand tools, etc.)				$25.00

1. Install Valves and Drain Hydraulic Piping

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$120.80		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
	TOTAL =	$165.86		$25.00

		LF for (4)-pipe run	No. of days	hr/day			
Productivity:		1200	2	10	60	LF per hr	
Cost per UOM:	LF	$2.76			$0.42	$3.18	/ LF Total Labor + Equip.
					SAY	$3.25	TOTAL

2. Clean and prep Piping prior to demo

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$120.80		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
	TOTAL =	$165.86		$25.00

	LF for (4)-pipe run	No. of days	hr/day		
Productivity:	1200	1	10	120	LF per hr

Cost per UOM:	LF	$1.38		$0.21	$1.59	/ LF Total Labor + Equip.
					$0.41	/ LF Flush solvent Mat
				SAY	$2.00	TOTAL

3. Demo Exist Hydraulic Fluid Piping

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$120.80		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
1	Equipment Oper, Medium	$28.05		
1	Truck, Off-Hwy, Rear Dump, 36T, 23-29CY			$96.15
	TOTAL =	$193.91		$121.15

	LF for (4)-pipe run	No. of days	hr/day		
Productivity: (allow 30-ft per hour)	1200	4	10	30	LF per hr

Cost per UOM:	LF	$6.46		$4.04	$10.50	/ LF Total Labor + Equip.
				SAY	$10.50	TOTAL

BLACK & VEATCH
NEW ORLEANS ICS PROJECT
05_01.03 - Demo Existing Power Units

LONDON AVE / ORLEANS AVE. / 17th Street

CREW DEVELOPMENT:

Labor:	Base Hr Rate	Fringes	other	TOTAL
Laborers, Semi Skilled, Foreman	$18.52	$4.51	$0.00	$23.03
Laborers, Semi Skilled	$17.52	$4.51	$0.00	$22.03
Plumber / Pipe fitter	$23.52	$6.68	$0.00	$30.20
Equipment Oper, Medium	$20.25	$7.80	$0.00	$28.05
Truck Drivers, Heavy	$17.35	$7.80	$0.00	$25.15

General Equipment:	2006 Region II Base Daily Rate	2006 Region II Base Hourly Rate	Esc to 2007 (esc. by 1.05 factor)	Estimated 2007 Region II Base Hourly Rate
Truck, Hwy,	$699.28	$87.41	1.10	$96.15
Misc Equip,total (incl compressor, winches, hand tools, etc.)				$25.00
Crane, wheel mounted,				$135.00

1. Disconnect Existing Pump; prep for removal

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$120.80		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
1	Equipment Oper, Medium	$28.05		
1	Crane, wheel mounted,			$135.00
	TOTAL =	$193.91		$160.00

	No. of Pumps	No. of days	hr/day		
Productivity:	1	1	10	0.10	tanks per hr
Cost per UOM:	Tank	$1,939.10		$1,600.00	$3,539.10 / Tk Total Labor + Equip.
				SAY	$3,600 TOTAL

05_01.03 - Demo Existing Power Units (con't)

2. Removal and Disposal of Exist pumps

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (Incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
4	Plumber / Pipe fitter	$0.00		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$25.00
1	Equipment Oper, Medium	$28.05		
1	Crane, wheel mounted,			$135.00
1	Truck Drivers, Heavy	$25.15		
1	Truck, Hwy,			$96.15
	TOTAL =	$98.26		$256.15

	No. of Pumps	No. of days	hr/day			
Productivity:	1	0.5	10	0.20	tanks per hr	
Cost per UOM:	Tank	**$491.30**		**$1,280.76**	**$1,772.06**	**/ Tk Total Labor + Equip.**
				SAY	**$1,800**	**TOTAL**

Client : USACE - Nashville
Project Name: New Orleans Hurricane Protection - ICS
Project No.: 41682.0100
Location: London Ave Canal
Orleans Ave Canal (Similar)

Date: January 8, 2007
Computed By: G. Hicks
Checked By: L. Schieber

Quantity Assessment for Modification of Existing Pump Platforms

1. 17th Street:

(Abstracted from Phase 1 17th St Dwg #137....area / wt of steel impacted by 12 pumps)

No. of Platforms = 1 ea side

01_PLATFORM DECK FRAMING (MISC. STEEL FRAMING MEMBERS)

Item No.	Description	MEMBER SIZE	No. of Platforms	Unit Members	lbs/LF	Length	W F TONS W Shapes	Channel TONS C-Shapes	WT TONS Tees	ANGLE TONS L-Shapes	Paint AREA S.F./L.F.	Paint % Area to paint	Paint Total Paint S.F.	
WEST PUMP PLATFORM														
1	**West Deck Framing**													
a.	Misc Steel WF Framing	W12 X 40	1	12	40.00	13.75	3.300				4.600	100%	759.00	W12 X 40
b.		W10x33	1	12	33.00	8.83	1.748				4.320	100%	457.75	W10x33
c.		W8x10	1	6	10.00	2.10	0.063				2.60	100%	32.76	W8x10
d.		W8x10	1	6	10.00	4.40	0.132				2.60	100%	68.64	W8x10
f.														
g.	Misc Steel Bracing	WT5x10.5	1	20	10.50	7.60			0.798		2.20	100%	334.40	WT5x10.5
													0.00	
EAST PUMP PLATFORM (same as West Pump Platform)														
2	**East Deck Framing**													
a.	Misc Steel WF Framing	W12 X 40	1	12	40.00	13.75	3.300				4.600	100%	759.00	W12 X 40
b.		W10x33	1	12	33.00	8.83	1.748				4.320	100%	457.75	W10x33
c.		W8x10	1	6	10.00	2.10	0.063				2.60	100%	32.76	W8x10
d.		W8x10	1	6	10.00	4.40	0.132				2.60	100%	68.64	W8x10
f.														
g.	Misc Steel Bracing	WT5x10.5	1	20	10.50	7.60			0.798		2.20	100%	334.40	WT5x10.5
	SUBTOTAL TONS =			112		12.083	10.49	0.00	1.60	0.00			3305	SF

		12.083	Framing
ADD	5%	0.604134	allowance for misc
		12.687	total tons
SAY		13	total tons

02_STEEL GRATING

Item No.	Description	PLATE SIZE	No. of Gates	Unit Quan	LBS / SF	Length	Width	Unit Plate Area (SF)	TONS OF PLATE (BY THICKNESS) 1/16"	1/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	5"	1 1/4"	1 1/2"	3 1/2"	PAINT % Area to be painted	PAINT Total Paint S.F.
WEST PUMP PLATFORM																						
1	**West Grating**																					
a.	Replacement Grating		1	1		96.00	13.75	1320.000				0.000									100%	2640.00
b.																						
c.																						
EAST PUMP PLATFORM																						
2	**East Grating**																					
a.	Replacement Grating		1	1		96.00	13.75	1320.000														
	SUBTOTAL TONS =							2640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	xxx	2640.00
																					SAY	

5945.094

SAY 6000

NEW ORLEANS ICS PROJECT

05_01.08 - Replace Exist Fuel Stor Tank with Double-Wall Tank

LONDON AVE / ORLEANS AVE. / 17th Street

LONDON

01 **Demolition**

01 20,000 Single Wall Fuel Storage Tank

EAST SIDE -	**No. of Tanks EA**
	1
WEST SIDE -	**No. of Tanks EA**
	1
2	**TOTAL**

ORLEANS

01 **Demolition**

01 20,000 Single Wall Fuel Storage Tank

EAST SIDE -	**No. of Tanks EA**
	1
WEST SIDE -	**No. of Tanks EA**
	1
2	**TOTAL**

17th STREET

01 **Demolition**

01 20,000 Single Wall Fuel Storage Tank

EAST SIDE -	**No. of Tanks EA**
	1
WEST SIDE -	**No. of Tanks EA**
	1
2	**TOTAL**

02 **Remove Existing fuel supply piping to Phase 2 pumps (to be removed)**

BLACK & VEATCH
NEW ORLEANS ICS PROJECT
05_01.08 - Replace Storage Tanks (w/ Dbl Wall Tank)

LONDON AVE / ORLEANS AVE. / 17th Street

CREW DEVELOPMENT:

Labor:	Base Hr Rate	Fringes	other	TOTAL
Laborers, Semi Skilled, Foreman	$18.52	$4.51	$0.00	$23.03
Laborers, Semi Skilled	$17.52	$4.51	$0.00	$22.03
Plumber / Pipe fitter	$23.52	$6.68	$0.00	$30.20
Equipment Oper, Medium	$20.25	$7.80	$0.00	$28.05
Truck Drivers, Heavy	$17.35	$7.80	$0.00	$25.15

General Equipment:	2006 Region II Base Daily Rate	2006 Region II Base Hourly Rate	Esc to 2007 (esc. by 1.05 factor)	Estimated 2007 Region II Base Hourly Rate
Truck, Hwy,	$699.28	$87.41	1.10	$96.15
Misc Equip,total (incl compressor, winches, hand tools, etc.)				$10.00
Crane, wheel mounted,				$135.00

1. Removal and disposal of tank(s)

hr.	Item	LABOR 2007 Davis-Bacon Hr. Rate (incl Fringes)		EQUIP Estimated 2007 Region II Base Hourly Rate
1	Laborers, Semi Skilled, Foreman	$23.03		
1	Laborers, Semi Skilled	$22.03		
2	Plumber / Pipe fitter	$60.40		
1	Misc Equip,total (incl compressor, winches, hand tools, etc.)			$10.00
1	Equipment Oper, Medium	$28.05		
1	Crane, wheel mounted,			$135.00
1	Truck Drivers, Heavy	$25.15		$96.15
1	Truck, Hwy,			
	TOTAL =	$158.66		$241.15

	No. of Tks	No. of days	hr/day			
Productivity:	1	0.5	10	0.2	tanks per hr	
Cost per UOM:	Tank	$793.30		$1,205.76	$1,999.06	/ Tk Total Labor + Equip.
				SAY	$2,000	TOTAL

BLACK & VEATCH

Owner:	US ARMY CORPS OF ENGINEERS		Computed Date	G.M. Akers 6/11/2007
Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Checked Date	
Project No.	041669.0310	File No. 52.3121.1251	Page	of
Title:	INTERIM CLOSURE STRUCTURE COATING ESTIMATE			

17TH STREET CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/$ft^2$)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/$ft^2$)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by
Engine Platform (East)	14" dia pipe	3.665	16.17	66	3912	$6,063	$5,007	$11,070	remove /replace 142'x44'x3.5'd with 16' overhead clear	809.9	$25.00	$20,248.15	none
fuel oil	3" pipe	0.916	178.03	1	163	$253	$209	$462	none				none
fuel oil	2" pipe	0.622	16.5	1	10	$16	$13	$29	none				none
fuel oil	1" pipe	0.344	6	8	17	$26	$21	$47	none				none
Engine Platform (West)	14" dia pipe	3.665	11.17	66	2702	$4,188	$3,459	$7,647	remove /replace 142'x44'x3.5'd with 11' overhead clear	809.9	$25.00	$20,248.15	none however platform is on canal side of levee
fuel oil	3" pipe	0.916	178.03	1	163	$253	$209	$462	none				none however platform is on canal side of levee
fuel oil	2" pipe	0.622	16.5	1	10	$16	$13	$29	none				none however platform is on canal side of levee
fuel oil	1" pipe	0.344	6	8	17	$26	$21	$47	none				none however platform is on canal side of levee
Hydraulic Pipe & Pipe Rack (East)	3" pipe	0.916	97	24	2133	$3,306	$2,730	$6,037	none				none however pipe is on canal side of levee
hydraulic pipe	3" pipe	0.916	187	24	4112	$6,374	$5,264	$11,638	none				none
case drain	1" pipe	0.344	97	6	200	$311	$256	$567	none				none however pipe is on canal side of levee
case drain	1" pipe	0.344	187	6	386	$599	$494	$1,093	none				none
engine platf rack	C10x15.3	2.100	4.75	32	319	$495	$409	$903	none				none
engine platf rack	C8x11.5	1.710	4	34	233	$360	$298	$658	none				none
pipe rack strngr	C10x15.3	2.100	84	6	1058	$1,641	$1,355	$2,995	none				none
pipe rack strngr	C10x15.3	2.100	52	6	655	$1,016	$839	$1,854	none				none however rack is over water
pipe rack	C8x11.5	1.710	5	33	282	$437	$361	$798	none				none
pipe rack	C8x11.5	1.710	5	18	154	$239	$197	$436	none				none however rack is over water
pipe rack x's	L5x5x3/8"	1.667	17.565	14	410	$635	$525	$1,160	none				none
pipe rack x's	L5x5x3/8"	1.667	17.565	11	322	$499	$412	$911	none				none however x's are over water
pipe rack pile	HP 14x73	7.046	31.67	8	1785	$2,767	$2,285	$5,052	remove /replace 7'x7'x3.5' d	50.8	$25.00	$1,270.37	none
pipe rack pile	HP 14x73	7.046	29.67	6	1254	$1,944	$1,606	$3,550	none				lower canal
pump platf rack	C10x15.3	2.100	5.17	22	239	$370	$306	$676	none				none however rack is over water
pump platf rack	C6x8.2	1.320	3.33	21	92	$143	$118	$261	none				none however rack is over water
Hydraulic Pipe & Pipe Rack (West)	3" pipe	0.916	132.835	24	2921	$4,528	$3,739	$8,267	none				none however pipe is on canal side of levee
case drain	1" pipe	0.344	132.835	8	274	$425	$351	$777	none				none however pipe is on canal side of levee
engine platf rack	C10x15.3	2.100	4.75	20	200	$309	$255	$565	none				none however rack is on canal side of levee
engine platf rack	C8x11.5	1.710	4	16	109	$170	$140	$310	none				none however rack is on canal side of levee
pipe rack strngr	C10x15.3	2.100	56	6	706	$1,094	$903	$1,997	none				none however rack is on canal side of levee
pipe rack strngr	C10x15.3	2.100	25	6	315	$488	$403	$891	none				none however rack is over water
pipe rack	C8x11.5	1.710	5	21	180	$278	$230	$508	none				none however rack is on canal side of levee
pipe rack	C8x11.5	1.710	5	6	51	$80	$66	$145	none				none however rack is over water
pipe rack x's	L5x5x3/8"	1.667	17.565	4	117	$182	$150	$331	none				none however rack is on canal side of levee
pipe rack pile	HP 14x73	7.046	16.67	8	705	$1,092	$902	$1,994	remove /replace 7'x7'x3.5' d	38.1	$25.00	$952.78	none however pile is on canal side of levee
pump platf rack	C10x15.3	2.100	7	10	147	$228	$188	$416	none				none however rack is over water
pump platf rack	C10x15.3	2.100	2	8	34	$52	$43	$95	none				none however rack is over water
pump platf rack	C6x8.2	1.320	3.33	18	79	$123	$101	$224	none				none however rack is over water
Pump Platform (East)	HP 14x73	7.046	12.5	12	1057	$1,638	$1,353	$2,991	none				lower canal
flow control	PZ27	1.49	12.5	412.5	7683	$11,908	$9,834	$21,742	remove /replace 140'x3.5'x3.5' d	63.5	$25.00	$1,587.96	lower canal
retaining wall	PZ27	1.49	3	55	246	$381	$315	$696	remove /replace 55'x3.5'x3.5' d	24.95	$25.00	$623.64	lower canal
framing	C15x33.9	3.067	141	1	432	$670	$553	$1,224	none				none however framing is over water

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS	Computed		G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date		6/11/2007
	Project No.	041669.0310 File No. 52.3121.1251	Checked		
	Title:	INTERIM CLOSURE STRUCTURE	Date		
		COATING ESTIMATE	Page		of

17TH STREET CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/ft^2)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/ft^2)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by
framing	W14x43	4.891	96	3	1409	$2,183	$1,803	$3,986	none				none however framing is over water
framing	W14x43	4.891	22.5	7	770	$1,194	$986	$2,180	none				none however framing is over water
framing	W12x40	4.609	22.5	12	1244	$1,929	$1,593	$3,522	none				none however framing is over water
framing	W10x33	4.227	13.75	12	697	$1,081	$893	$1,974	none				none however framing is over water
framing	W8x10	2.600	9	18	421	$653	$539	$1,192	none				none however framing is over water
framing	W8x10	2.600	2.13	6	33	$52	$43	$94	none				none however framing is over water
discharge i.d.	9' dia pipe	28.274	279.430	2	15801	$24,492	$20,226	$44,718	none				see non-overflow structure
discharge i.d.	5' dia pipe	15.708	15.096	3	711	$1,103	$911	$2,013	none				none, pipe interior
discharge i.d.	5' dia pipe	15.708	26.677	3	1257	$1,949	$1,609	$3,558	none				none, pipe interior
discharge support	HP 14x73	7.046	4.67	8	263	$408	$337	$745	none				lower canal
discharge support	HP 14x73	7.046	4.84	22	750	$1,163	$960	$2,123	none				lower canal
discharge support	HP 14x73	7.046	4.67	14	461	$714	$590	$1,304	remove /replace 7'x7'x3.5' d	88.9	$25.00	$2,223.15	lower canal
discharge support	HP 14x73	7.046	4.67	16	526	$816	$674	$1,490	remove /replace 7'x7'x3.5' d	101.6	$25.00	$2,540.74	see non-overflow structure
discharge support	HP 14x73	7.046	4.84	6	205	$317	$262	$579	remove /replace 7'x7'x3.5' d	38.1	$25.00	$952.78	see non-overflow structure
discharge support	HP 14x73	7.046	11.33	12	958	$1,485	$1,226	$2,711	none				see non-overflow structure
discharge support	TS14x10x5/8"	4.000	16.5	2	132	$205	$169	$374	none				see non-overflow structure
Pump Platform (West)	HP 14x73	7.046	12.5	12	1057	$1,638	$1,353	$2,991	none				lower canal
flow control	PZ27	1.49	12.5	412.5	7683	$11,908	$9,834	$21,742	remove /replace 140'x3.5'x3.5' d	63.52	$25.00	$1,587.96	lower canal
retaining wall	PZ27	1.49	3	n/a	n/a	n/a	n/a	n/a					
framing	C15x33.9	3.067	141	1	432	$670	$553	$1,224	none				none however framing is over water
framing	W14x43	4.891	96	3	1409	$2,183	$1,803	$3,986	none				none however framing is over water
framing	W14x43	4.891	22.5	7	770	$1,194	$986	$2,180	none				none however framing is over water
framing	W12x40	4.609	22.5	12	1244	$1,929	$1,593	$3,522	none				none however framing is over water
framing	W10x33	4.227	13.75	12	697	$1,081	$893	$1,974	none				none however framing is over water
framing	W8x10	2.600	9	18	421	$653	$539	$1,192	none				none however framing is over water
framing	W8x10	2.600	2.13	6	33	$52	$43	$94	none				none however framing is over water
discharge i.d.	9' dia pipe	28.274	238.188	2	13469	$20,877	$17,241	$38,118	none				see non-overflow structure
discharge i.d.	5' dia pipe	15.708	15.096	3	711	$1,103	$911	$2,013	none				none, pipe interior
discharge i.d.	5' dia pipe	15.708	26.677	3	1257	$1,949	$1,609	$3,558	none				none, pipe interior
discharge support	HP 14x73	7.046	4.67	22	724	$1,122	$927	$2,049	none				lower canal
discharge support	HP 14x73	7.046	4.84	11	375	$581	$480	$1,062	none				lower canal
discharge support	HP 14x73	7.046	4.67	12	395	$612	$505	$1,117	none				see non-overflow structure
discharge support	HP 14x73	7.046	4.84	4	136	$211	$175	$386	none				see non-overflow structure
discharge support	HP 14x73	7.046	11.33	12	958	$1,485	$1,226	$2,711	none				see non-overflow structure
discharge support	TS14x10x5/8"	4.000	16.5	2	132	$205	$169	$374	none				see non-overflow structure
Non-Overflow Structure (East)	PZ35	1.42	22	112.870	3526	$5,465	$4,513	$9,979	flood side trench & protected side trench each 27' x 6' x 6' d	72	$25.00	$1,800.00	flood side & protected side by 150' long coffer dam
	PZ35	1.42	5	57.460	408	$632	$522	$1,154	remove /replace 60'x3.5'x3.5' d	27.2	$25.00	$680.56	none
Non-Overflow Structure (West)	PZ35	1.42	22	112.870	3526	$5,465	$4,513	$9,979	none				flood side & protected side by 150' long coffer dam
	PZ35	1.42	11.5	30.000	490	$759	$627	$1,386	remove /replace 15'x3.5'x3.5' d	6.81	$25.00	$170.14	none
aux cell	PZ35	1.42	11.5	100.720	1645	$2,549	$2,105	$4,655	flood side trench & protected side trench each 50' x 6' x 6' d	133.33	$25.00	$3,333.33	none
floodwall	PS27.5	1.11	13.5	338.010	5065	$7,851	$6,483	$14,334	remove /replace 60'x3.5'x3.5' d	27.2	$25.00	$680.56	none
floodwall	PS27.5	1.11	11.5	317.340	4051	$6,279	$5,185	$11,464	remove /replace 60'x3.5'x3.5' d	27.2	$25.00	$680.56	none
Gate Closure Monolith [Water]	14" dia pipe	3.665	9	6	198	$307	$253	$560	none				none however is over water
Totals					112339			$317,919				$59,581	
											say	$60,000	

[1]Includes multiplier for complex structure and adherent mill scale

[2]Includes multiplier for complex structure

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
	Project No.	041669.0310	File No. 52.3121.1251	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		COATING ESTIMATE		Page	of

17TH STREET CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/ft^2)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/ft^2)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by

A. Add for multiplier from conditions of contractor working over water:

	30%	$95,376
	Total	$413,294
	say	$425,000

B. Add for cofferdam with gates on flood side of non-overflow structure:

	Say Cost / SF		Est Total Length of Cofferdam (LF)	Est Total Height of CD (LF)	Est Area of Cofferdam (SF)	
Abstracted costs derived from Duncan Pump Station concept:	$75	xxxxx	450	50	22500	$1,687,500

Add for Well-point Dewatering System:		Bare Costs		
	1st Month	$	50,000.00	
	next 5 months	$	175,000.00	
		$	225,000.00	$ 225,000

C. Add for dewatering of protected side:

	Say +/- Cost / MO		Est Total Length of Coating time (MO)			
Abstracted costs USACE-LRN WCD Project:	$50,000	xxxxx	6			$300,000

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/12/2007
	Project No.	041669.0310	File No. 52.3121.1251	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		COATING ESTIMATE		Page	of

ORLEANS AVENUE CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/$ft^2$)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/$ft^2$)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by
Equipment Platform (East)	HP 14x73	7.046	11.17	68	5352	$8,295	$6,850	$15,145	remove /replace 138'x41'x3.5'd with 11' overhead clear	733.4	$25.00	$18,336.11	none
fuel oil	3" pipe	0.916	114.32	1	105	$162	$134	$296	none				none
fuel oil	2" pipe	0.622	35.5	1	22	$34	$28	$62	none				none
fuel oil	1" pipe	0.344	30.5	5	53	$81	$67	$149	none				none
Equipment Platform (West)	HP 14x73	7.046	11.17	68	5352	$8,295	$6,850	$15,145	remove /replace 138'x411'x3.5'd with 11' overhead clear	733.4	$25.00	$18,336.11	none
fuel oil	3" pipe	0.916	114.32	1	105	$162	$134	$296	none				none
fuel oil	2" pipe	0.622	35.5	1	22	$34	$28	$62	none				none
fuel oil	1" pipe	0.344	30.5	5	53	$81	$67	$149	none				none
Hydraulic Pipe & Pipe Rack (East)	3" pipe	0.916	198.5	20	3638	$5,638	$4,656	$10,295	none				none however pipe is on canal side of levee
hydraulic pipe	3" pipe	0.916	159.84	20	2929	$4,540	$3,749	$8,290	none				none
case drain	1" pipe	0.344	198.5	5	342	$530	$437	$967	none				none however pipe is on canal side of levee
case drain	1" pipe	0.344	159.84	5	275	$426	$352	$779	none				none
equip platf rack	L5x5x3/8"	1.667	9.865833	23	378	$586	$484	$1,070	none				none
pipe rack pile	HP 14x73	7.046	12	8	676	$1,048	$866	$1,914	remove /replace 7'x7'x3.5' d	50.8	$25.00	$1,270.37	none
pipe rack pile	HP 14x73	7.046	12	7	592	$917	$758	$1,675	remove /replace 7'x7'x3.5' d	44.5	$25.00	$1,111.57	none however pile is on canal side of levee
pipe rack pile	HP 14x73	7.046	12	9	761	$1,179	$974	$2,153	none				lower canal
Hydraulic Pipe & Pipe Rack (West)	3" pipe	0.916	197	20	3610	$5,596	$4,621	$10,217	none				none however pipe is on canal side of levee
hydraulic pipe	3" pipe	0.916	138.34	20	2535	$3,930	$3,245	$7,175	none				none
case drain	1" pipe	0.344	197	5	339	$526	$434	$960	none				none however pipe is on canal side of levee
case drain	1" pipe	0.344	138.34	5	238	$369	$305	$674	none				none
equip platf rack	L5x5x3/8"	1.667	9.865833	23	378	$586	$484	$1,070	none				none
pipe rack	HP 14x73	7.046	12	6	507	$786	$649	$1,436	remove /replace 7'x7'x3.5' d	38.1	$25.00	$952.78	none
pipe rack	HP 14x73	7.046	12	7	592	$917	$758	$1,675	remove /replace 7'x7'x3.5' d	44.5	$25.00	$1,111.57	none however pile is on canal side of levee
pipe rack	HP 14x73	7.046	12	9	761	$1,179	$974	$2,153	none				lower canal
Pump Platform (East)	HP 14x73	7.046	6	12	507	$786	$649	$1,436	none				lower canal
discharge i.d.	9' dia pipe	28.274	142.250	2	8044	$12,468	$10,296	$22,765	none				see non-overflow structure
discharge i.d.	5' dia pipe	15.708	63.708	2	2001	$3,102	$2,562	$5,664	none				none, pipe interior
discharge i.d.	5' dia pipe	15.708	46.708	3	2201	$3,412	$2,817	$6,229	none				none, pipe interior
discharge support	HP 14x73	7.046	4	18	507	$786	$649	$1,436	none				lower canal
discharge support	HP 14x73	7.046	5	4	141	$218	$180	$399	none				see non-overflow structure
Pump Platform (West)	HP 14x73	7.046	6	12	507	$786	$649	$1,436	none				lower canal
discharge i.d.	9' dia pipe	28.274	142.250	2	8044	$12,468	$10,296	$22,765	none				see non-overflow structure
discharge i.d.	5' dia pipe	15.708	63.708	2	2001	$3,102	$2,562	$5,664	none				none, pipe interior
discharge i.d.	5' dia pipe	15.708	46.708	3	2201	$3,412	$2,817	$6,229	none				none, pipe interior
discharge support	HP 14x73	7.046	4	18	507	$786	$649	$1,436	none				lower canal
discharge support	HP 14x73	7.046	5	4	141	$218	$180	$399	v				see non-overflow structure
Non-Overflow Structure (East)	PS27.5	1.11	22	380.698	9297	$14,410	$11,900	$26,310	flood side trench & protected side trench each 120' x 6' x 6' d	160	$25.00	$4,000.00	flood side by 180' long coffer dam & protected side by lower canal
Non-Overflow Structure (West)	PS27.5	1.11	22	380.698	9297	$14,410	$11,900	$26,310	flood side trench & protected side trench each 120' x 6' x 6' d	160	$25.00	$4,000.00	flood side by 180' long coffer dam & protected side by lower canal
Gate Closure Monolith [Water]	n/a					$0	$0	$0					
Totals					75012			$212,283				$49,119	

[1] Includes multiplier for complex structure and adherent mill scale

[2] Includes multiplier for complex structure

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/12/2007
	Project No.	041669.0310	File No. 52.3121.1251	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		COATING ESTIMATE		Page	of

ORLEANS AVENUE CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/ft^2)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/ft^2)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by
A. Add for multiplier from conditions of contractor working over water:							**30%**	$63,685					
							Total	$275,968					
							say	**$280,000**					

B. Add for cofferdam with gates on flood side of non-overflow structure:

	Say Cost / SF		Est Total Length of Cofferdam (LF)	Est Total Height of CD (LF)	Est Area of Cofferdam (SF)	
Abstracted costs derived from Duncan Pump Station concept:	$75	xxxxx	500	50	25000	$1,875,000

Add for Well-point Dewatering System:		Bare Costs		
	1st Month	$	50,000.00	
	next 5 months	$	175,000.00	
		$	225,000.00	$ 225,000

C. Add for dewatering of protected side:

	Say +/- Cost / MO		Est Total Length of Coating time (MO)			
Abstracted costs USACE-LRN WCD Project:	$50,000	xxxxx	6			$300,000

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
	Project No.	041669.0310	File No. 52.3121.1251	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		COATING ESTIMATE		Page	of

LONDON AVENUE CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/$ft^2$)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/$ft^2$)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by
Equipment Platform (East)	HP 14x73	7.046	11.17	77	6060	$9,393	$7,757	$17,150	remove /replace 154'x41'x3.5'd with 11' overhead clear	818.5	$25.00	$20,462.04	none
fuel oil	3" pipe	0.916	125.32	1	115	$178	$147	$325	none				none
fuel oil	2" pipe	0.622	35.5	1	22	$34	$28	$62	none				none
fuel oil	1" pipe	0.344	30.5	6	63	$98	$81	$178	none				none
Equipment Platform (West)	HP 14x73	7.046	11.17	77	6060	$9,393	$7,757	$17,150	remove /replace 154'x41'x3.5'd with 11' overhead clear	818.5	$25.00	$20,462.04	none
fuel oil	3" pipe	0.916	125.32	1	115	$178	$147	$325	none				none
fuel oil	2" pipe	0.622	35.5	1	22	$34	$28	$62	none				none
fuel oil	1" pipe	0.344	30.5	6	63	$98	$81	$178	none				none
Hydraulic Pipe & Pipe Rack (East)	3" pipe	0.916	185.61	24	4082	$6,327	$5,225	$11,551	none				none however pipe is on canal side of levee
hydraulic pipe	3" pipe	0.916	135.4	24	2978	$4,615	$3,811	$8,427	none				none
case drain	1" pipe	0.344	185.61	6	383	$594	$491	$1,085	none				none however pipe is on canal side of levee
case drain	1" pipe	0.344	135.4	6	280	$434	$358	$791	none				none
equip platf rack	L5x5x3/8"	1.667	9.866	31	510	$790	$652	$1,443	none				none
pipe rack pile	HP 14x73	7.046	7	6	296	$459	$379	$837	remove /replace 7'x7'x3.5' d	38.1	$25.00	$952.78	none
pipe rack pile	HP 14x73	7.046	12	5	423	$655	$541	$1,196	remove /replace 7'x7'x3.5' d	31.8	$25.00	$793.98	none however pile is on canal side of levee
pipe rack pile	HP 14x73	7.046	15	12	1268	$1,966	$1,623	$3,589	none				lower canal
Hydraulic Pipe & Pipe Rack (West)	3" pipe	0.916	174.36	24	3834	$5,943	$4,908	$10,851	none				none however pipe is on canal side of levee
hydraulic pipe	3" pipe	0.916	149.25	24	3282	$5,087	$4,201	$9,289	none				none
case drain	1" pipe	0.344	174.36	6	360	$558	$461	$1,019	none				none however pipe is on canal side of levee
case drain	1" pipe	0.344	149.25	6	308	$478	$395	$872	none				none
equip platf rack	L5x5x3/8"	1.667	9.866	31	510	$790	$652	$1,443	none				none
pipe rack	HP 14x73	7.046	7	6	296	$459	$379	$837	remove /replace 7'x7'x3.5' d	38.1	$25.00	$952.78	none
pipe rack	HP 14x73	7.046	12	5	423	$655	$541	$1,196	remove /replace 7'x7'x3.5' d	31.8	$25.00	$793.98	none however pile is on canal side of levee
pipe rack	HP 14x73	7.046	15	12	1268	$1,966	$1,623	$3,589	none				lower canal
Pump Platform (East)	HP 14x73	7.046	6	14	592	$917	$758	$1,675	none				lower canal
discharge i.d.	9' dia pipe	28.274	143.755	2	8129	$12,600	$10,405	$23,006	none				see non-overflow structure
discharge i.d.	5' dia pipe	15.708	63.708	3	3002	$4,653	$3,843	$8,496	none				none, pipe interior
discharge i.d.	5' dia pipe	15.708	46.708	3	2201	$3,412	$2,817	$6,229	none				none, pipe interior
discharge support	HP 14x73	7.046	4	20	564	$874	$721	$1,595	none				lower canal
discharge support	HP 14x73	7.046	5	4	141	$218	$180	$399	none				see non-overflow structure
Pump Platform (West)	HP 14x73	7.046	6	14	592	$917	$758	$1,675	none				lower canal
discharge i.d.	9' dia pipe	28.274	143.755	2	8129	$12,600	$10,405	$23,006	none				see non-overflow structure
discharge i.d.	5' dia pipe	15.708	63.708	3	3002	$4,653	$3,843	$8,496	none				none, pipe interior
discharge i.d.	5' dia pipe	15.708	46.708	3	2201	$3,412	$2,817	$6,229	none				none, pipe interior
discharge support	HP 14x73	7.046	4	20	564	$874	$721	$1,595	none				lower canal
discharge support	HP 14x73	7.046	5	4	141	$218	$180	$399	v				see non-overflow structure
Non-Overflow Structure (East)	PS27.5	1.11	22	286.450	6995	$10,842	$8,954	$19,796	flood side trench & protected side trench each 90' x 6' x 6' d	120	$25.00	$3,000.00	flood side by 150' long coffer dam & protected side by lower canal
Non-Overflow Structure (West)	PS27.5	1.11	22	286.450	6995	$10,842	$8,954	$19,796	flood side trench & protected side trench each 90' x 6' x 6' d	120	$25.00	$3,000.00	flood side by 150' long coffer dam & protected side by lower canal
Gate Closure Monolith [Water]	n/a					$0	$0	$0					
Totals					76269			$215,840				$50,418	
											say	$51,000	

[1]Includes multiplier for complex structure and adherent mill scale

[2]Includes multiplier for complex structure

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
	Project No.	041669.0310	File No. 52.3121.1251	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		COATING ESTIMATE		Page	of

LONDON AVENUE CANAL

Coating is to the lessor of 3 feet below grade or water line except 6 feet below at non-overflow structure

Structure	Material of Construction	surface area per ft	lineal ft per each	quantity	Steel Surface Area (ft^2)	Suface Prep, SSPC-SP6, labor & mat'l (@1.55 $/$ft^2$)[1]	Coating, surface tolerant epoxy 10-11 dft in 2 coats, labor & mat'l (@ 1.28 $/$ft^2$)[2]	Installed Cost	Soil Excavation / Backfill: Soil removal / replacement Area	Volume (CY)	Estimated Cost per CY	Cost	Dewater by

A. Add for multiplier from conditions of contractor working over water:

30%	$64,752
Total	$280,592
say	$285,000

B. Add for cofferdam with gates on flood side of non-overflow structure:

Abstracted costs derived from Duncan Pump Station concept:	Say Cost / SF		Est Total Length of Cofferdam (LF)	Est Total Height of CD (LF)	Est Area of Cofferdam (SF)	
	$75	xxxxx	300	50	25000	$1,875,000

Add for Well-point Dewatering System:		Bare Costs	
	1st Month	$	50,000.00
	next 5 months	$	175,000.00
		$	225,000.00

$ 225,000

C. Add for dewatering of protected side:

Abstracted costs USACE-LRN WCD Project:	Say +/- Cost / MO		Est Total Length of Coating time (MO)			
	$50,000	xxxxx	6			$300,000

BLACK & VEATCH

Owner:	US ARMY CORPS OF ENGINEERS		Computed	F. (J.) Yang
Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
Project No.	041669.0310	File No. 52.3121.1252	Checked	
Title:	INTERIM CLOSURE STRUCTURE		Date	
	CATHODIC PROTECTION ESTIMATE		Page	of

17th Street Canal

Cathodic protection current density is 2 mA/ft^2 in soil and 4 mA/ft^2 in water.
All protected structure is uncoated carbon steel.

Structure	Material of Construction	Pipe Dia (in)	Sheet Piling Wall Length (ft)	Quantity	Depth of Burial (ft)	Burial Area (ft^2)	Immersion Depth (ft)	Immersion Area (ft^2)	Required Current (A)
Engine Platform (East)	Pipe	14		66	70	16,925			34
Engine Platform (West)	Pipe	14		66	70	16,925			34
Pump Platform (East)	PZ 22		100.16		41	7,515	9	1,650	22
Pump Platform	PZ 27		212		41	19,427	9	4,264	56
Pump Platform	PZ 35		55		41	4,803	9	1,054	14
Pump Platform	HP14x73			60	41	16,777	9	3,683	48
Conduit Support	HP14x73			14	41	3,915	9	368	9
Pump Bell				6			6	1130.4	5
Pump Platform (West)	PZ 22		100.16		41	7,515	9	1,650	22
Pump Platform	PZ 27		212		41	19,427	9	4,264	56
Pump Platform	PZ 35		55		41	4,803	9	1,054	14
Platform Piles	HP14x73			80	41	22,370	9	4,910	64
Conduit Support	HP14x73			6	43	1,760			4
Pump Bell				6			6	1130.4	5
Interim Closure Structure	PS 27.5		1375		29	66391.88			133
Aux End Cell	PZ 35		128		56	15267.84			31
	Pipe	24		18	124	14,017			28
West End Cell	PZ 40		171		56	23556.96		173	48
	Pipe	30		14	124	13,628			27
East End Cell	PZ 40		171		56	23556.96		173	48

BLACK & VEATCH

Owner:	US ARMY CORPS OF ENGINEERS		Computed	F. (J.) Yang
Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
Project No.	041669.0310	File No. 52.3121.1252	Checked	
Title:	INTERIM CLOSURE STRUCTURE		Date	
	CATHODIC PROTECTION ESTIMATE		Page	of

17th Street Canal

Cathodic protection current density is 2 mA/ft^2 in soil and 4 mA/ft^2 in water.
All protected structure is uncoated carbon steel.

Structure	Material of Construction	Pipe Dia (in)	Sheet Piling Wall Length (ft)	Quantity	Depth of Burial (ft)	Burial Area (ft^2)	Immersion Depth (ft)	Immersion Area (ft^2)	Required Current (A)
	Pipe	30		14	124	13,628			27
Cofferdam	PZ 35		345		54	39681.9			79
	Pipe	30		80	91	57,148	10	13,904	170
	W 24x84							1,008	4
	W21x101							721	3
SUM						409,035		41,138	983

Required Current (A)	983
Number of Anode Beds (@60 A/bed)	17
Total Cost (@$25,000 /bed)	$425,000

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	F. (J.) Yang
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
	Project No.	041669.0310	File No. 52.3121.1252	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		CATHODIC PROTECTION ESTIMATE		Page	of

Orleans Avenue Canal

Cathodic protection current density is 2 mA/ft^2 in soil and 4 mA/ft^2 in water.
All protected structure is uncoated carbon steel.

Structure	Material of Construction	Pipe Dia (in)	Sheet Piling Wall Length (ft)	Quantity	Depth of Burial (ft)	Burial Area (ft^2)	Immersion Depth (ft)	Immersion Area (ft^2)	Required Current (A)
Engine Platform (East)	HP14x73			68	70	32,463			65
Engine Platform (East)	HP14x73			68	70	32,463			65
Pump Station (East)	HP14x73			12	60	4,910	10	818	13
Conduit Support	HP14x73			23	60	9,412	10	1,569	25
Pump Bell				5			6	942	4
Pipe Support	HP14x73			28	45	8,593	10	1,910	25
Pump Station (West)									
	HP14x73			12	60	4,910	10	818	13
Conduit Support	HP14x73			24	60	9,821	10	1,637	26
Pump Bell				5			6	942	4
Pipe Support	HP14x73			28	45	8,593	10	1,910	25
Interim Closure Structure	PS 27.5		191		50	15900.8			32
	HP14x73			63	58	12460.1			25
West Circular Cell 2	PS 27.5		191		46	14628.7	4	764	32
	HP14x73			63	50	10741.5			21
West Arc Cell	PS 27.5		28		50	2331.0			5
	HP14x73			4	50	682.0			1
East Circular Cell 1	PS 27.5		191		50	15900.8			32
	HP14x73			63	58	12460.1			25
East Circular Cell 2	PS 27.5		191		46	14628.7	4	764	32

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS	Computed	F. (J.) Yang
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date	6/11/2007
	Project No.	041669.0310 File No. 52.3121.1252	Checked	
	Title:	INTERIM CLOSURE STRUCTURE	Date	
		CATHODIC PROTECTION ESTIMATE	Page	of

Orleans Avenue Canal

Cathodic protection current density is 2 mA/ft^2 in soil and 4 mA/ft^2 in water.
All protected structure is uncoated carbon steel.

Structure	Material of Construction	Pipe Dia (in)	Sheet Piling Wall Length (ft)	Quantity	Depth of Burial (ft)	Burial Area (ft^2)	Immersion Depth (ft)	Immersion Area (ft^2)	Required Current (A)
	HP14x73			63	50	10741.5			21
East Arc Cell	PS 27.5		28		50	2331.0			5
	HP14x73			4	50	682.0			1
Gate Sill	PZ 27		230		41	20085.9	2	690	43
Gate guide				6	15			669.87	3
Pile Frame		24		18	107	24190.6			48
		30		18			10	2826	11
		18						94	0
SUM						268930.6		16353.3	603

Required Current (A)	603
Number of Anode Beds (@60 A/bed)	11
Total Cost (@$25,000 /bed)	$275,000

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	F. (J.) Yang
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
	Project No.	041669.0310	File No. 52.3121.1252	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		CATHODIC PROTECTION ESTIMATE		Page	of

London Avenue Canal

Cathodic protection current density is 2 mA/ft^2 in soil and 4 mA/ft^2 in water.

All protected structure is uncoated carbon steel.

Structure	Material of Construction	Pipe Dia (in)	Sheet Piling Wall Length (ft)	Quantity	Depth of Burial (ft)	Burial Area (ft^2)	Immersion Depth (ft)	Immersion Area (ft^2)	Required Current (A)
Engine Platform (East)	HP14x73			68	70	32,463			65
Engine Platform (West)	HP14x73			68	70	32,463			65
									0
Pump Station (East)	HP14x73			14	60	5,729	10	955	15
Conduit Support	HP14x73			23	60	9,412	10	477	21
Pump Bell				6			6	1130.4	5
Pipe Support	HP14x73			26	45	7,979	10	1,773	23
Pump Station (East)	HP14x73			14	60	5,729	10	955	15
Conduit Support	HP14x73			19	60	7,775	10	477	17
Pump Bell				6			6	1130.4	5
Pipe Support	HP14x73			28	45	8,593	10	1,910	25
Interim Closure Structure	PS 27.5		164		50	13653.0			27
	HP14x73			63	58	12460.1			25
West Circular Cell 2	PS 27.5		164		46	12560.8	4	656	28
	HP14x73			63	50	10741.5			21
West Arc Cell	PS 27.5		28		50	2331.0			5
	HP14x73			4	50	682.0			1
East Circular Cell 1	PS 27.5		164		50	13653.0			27
	HP14x73			63	58	12460.1			25
East Circular Cell 2	PS 27.5		164		46	12560.8	4	656	28
	HP14x73			63	50	10741.5			21

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS		Computed	F. (J.) Yang
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/11/2007
	Project No.	041669.0310	File No. 52.3121.1252	Checked	
	Title:	INTERIM CLOSURE STRUCTURE		Date	
		CATHODIC PROTECTION ESTIMATE		Page	of

London Avenue Canal

Cathodic protection current density is 2 mA/ft^2 in soil and 4 mA/ft^2 in water.

All protected structure is uncoated carbon steel.

Structure	Material of Construction	Pipe Dia (in)	Sheet Piling Wall Length (ft)	Quantity	Depth of Burial (ft)	Burial Area (ft^2)	Immersion Depth (ft)	Immersion Area (ft^2)	Required Current (A)
East Arc Cell	PS 27.5		28		50	2331.0			5
	HP14x73			4	50	682.0			1
									0
Gate Sill Foundation	PZ 27		510		41	44538.3	2	1530	95
Gate guide				12	30			2679.48	11
Pile Frame		24		42	100	52752.0			106
		30		42			10	6594	26
		18						210	1
SUM						312290		21133	709

Required Current (A)	709
Number of Anode Beds (@60 A/bed)	12
Total Cost (@$25,000 /bed)	$300,000

BLACK & VEATCH

Owner:	US ARMY CORPS OF ENGINEERS		Computed	B.P. Louque
Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION		Date	6/14/2007
Project No.	041669.0310	File No. 52.3121.1253	Checked	
Title:	INTERIM CLOSURE STRUCTURE		Date	
	PROTECTIVE COATING O&M COST ESTIMATE		Page	of

17th Street Canal

Maintenance Painting Sequence

Painting Operation	Work Occurs in Year	Cost per ft2
Initial Painting	0	$2.83
Touch-Up	12	$1.13
Maintenance Repaint	16	$1.98
Full Repaint	22	$3.82

O&M Cost and Work Intervals Calculated per SSPC-Painting Manual, Volume 1, Good Painting Practice.

Practical System Life (P) = 12 Years

Touch Up Costs = 40 % of Intitial Painting Costs

Maintenance Repaint Costs = 70 % of Initial Painting Costs

Full Repaint Costs = 135% of Initial Painting Costs

Total Painting Costs for 50 Year Structure Life, Field Applicaition

Painting Operation	Original Painting Cost	Touch-Up	Maint Repaint	Full Repaint	Touch-Up	Maint. Repaint	Full Repaint	Totals
Year	0	12	16	22	24	38	44	
Cost in Current Dollars	$2.83	$1.13	$1.98	$3.82	$1.13	$1.98	$3.82	$13.87
NFV Costs @ 2.5 % Inflation	$2.83	$1.52	$2.94	$6.58	$2.05	$5.06	$11.32	$29.47
NPV Costs @ 9% Interest	$2.83	$0.54	$0.74	$0.99	$0.26	$0.19	$0.26	$2.98

Total Surface Area Requiring Painting

Estimated Surface Area 112339 ft2

O&M Net Present Value $334,261 NPV Costs @ 9% Internest Times Surface Area

BLACK & VEATCH

Owner:	US ARMY CORPS OF ENGINEERS	Computed	B.P. Louque
Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date	6/14/2007
Project No.	041669.0310 File No. 52.3121.1253	Checked	
Title:	INTERIM CLOSURE STRUCTURE	Date	
	PROTECTIVE COATING O&M COST ESTIMATE	Page	of

Orleans Avenue

Maintenance Painting Sequence

Painting Operation	Work Occurs in Year	Cost per ft2
Initial Painting	0	$2.83
Touch-Up	12	$1.13
Maintenance Repaint	16	$1.98
Full Repaint	22	$3.82

O&M Cost and Work Intervals Calculated per SSPC-Painting Manual, Volume 1, Good Painting Practice.

Practical System Life (P) = 12 Years

Touch Up Costs = 40 % of Intitial Painting Costs

Maintenance Repaint Costs = 70 % of Initial Painting Costs

Full Repaint Costs = 135% of Initial Painting Costs

Total Painting Costs for 50 Year Structure Life, Field Applicaition

Painting Operation	Original Painting Cost	Touch-Up	Maint Repaint	Full Repaint	Touch-Up	Maint. Repaint	Full Repaint	Totals
Year	0	12	16	22	24	38	44	
Cost in Current Dollars	$2.83	$1.13	$1.98	$3.82	$1.13	$1.98	$3.82	$13.87
NFV Costs @ 2.5 % Inflation	$2.83	$1.52	$2.94	$6.58	$2.05	$5.06	$11.32	$29.47
NPV Costs @ 9% Interest	$2.83	$0.54	$0.74	$0.99	$0.26	$0.19	$0.26	$2.98

Total Surface Area Requiring Painting

Estimated Surface Area 75012 ft2

O&M Net Present Value $223,196 NPV Costs @ 9% Internest Times Surface Area

BLACK & VEATCH

Owner:	US ARMY CORPS OF ENGINEERS	Computed	B.P. Louque
Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date	6/14/2007
Project No.	041669.0310 File No. 52.3121.1253	Checked	
Title:	INTERIM CLOSURE STRUCTURE	Date	
	PROTECTIVE COATING O&M COST ESTIMATE	Page	of

London Avenue

Maintenance Painting Sequence

Painting Operation	Work Occurs in Year	Cost per ft2
Initial Painting	0	$2.83
Touch-Up	12	$1.13
Maintenance Repaint	16	$1.98
Full Repaint	22	$3.82

O&M Cost and Work Intervals Calculated per SSPC-Painting Manual, Volume 1, Good Painting Practice.

Practical System Life (P) = 12 Years

Touch Up Costs = 40 % of Intitial Painting Costs

Maintenance Repaint Costs = 70 % of Initial Painting Costs

Full Repaint Costs = 135% of Initial Painting Costs

Total Painting Costs for 50 Year Structure Life, Field Applicaition

Painting Operation	Original Painting Cost	Touch-Up	Maint Repaint	Full Repaint	Touch-Up	Maint. Repaint	Full Repaint	Totals
Year	0	12	16	22	24	38	44	
Cost in Current Dollars	$2.83	$1.13	$1.98	$3.82	$1.13	$1.98	$3.82	$13.87
NFV Costs @ 2.5 % Inflation	$2.83	$1.52	$2.94	$6.58	$2.05	$5.06	$11.32	$29.47
NPV Costs @ 9% Interest	$2.83	$0.54	$0.74	$0.99	$0.26	$0.19	$0.26	$2.98

Total Surface Area Requiring Painting

Estimated Surface Area 76269 ft2

O&M Net Present Value $226,936 NPV Costs @ 9% Internest Times Surface Area

Life Cycle Costs

Life Cycle Cost (LCC) Detail
New Orleans
17th Street, London & Orleans Canals

INPUT DATA IIF= 0.98

Study Period, yrs	50	
Lifecycle cost analysis formula per ETL-1110-2-361	PV=C*(IIF)^n	
Total Flow	26,250	CFS

	17th St.	London Ave	Orleans Ave.	Total
Pumping Units	37	26	12	75
Pumping Station Capacity (CFS)	12,950	9,100	4,200	26,250

INITIAL CAPITAL COSTS

Item Description				$	$	$	$
Pump Station Construction	1	LS	-	$181,228,079	$125,502,194	$83,503,428	$390,233,701
Maintenance Building Construction	1	LS	$41,556,365	$20,501,140	$14,406,207	$6,649,018	$41,556,365

50 YR LCC OPERATING

Item Description	Qty	Unit	Unit Labor Cost ($/unit)	PV $ Total Cost	PV $ Total Cost	PV $ Total Cost	PV $ Total Cost
Operations and Maintenance Chief (Prorated to each pump station)	1	EA	$2,544,204	$1,255,141	$881,991	$407,073	$2,544,204
Electrical Foreman (Prorated to each pump station)	1	EA	$2,149,275	$1,060,309	$745,082	$343,884	$2,149,275
Mechanical Foreman (Prorated to each pump station)	1	EA	$2,250,624	$1,110,308	$780,216	$360,100	$2,250,624
Pump Station Operator (One per pump station)	3	EA	$1,913,021	$1,913,021	$1,913,021	$1,913,021	$5,739,064
Electrical Trade Laborer (One per pump station)	3	EA	$1,557,784	$1,557,784	$1,557,784	$1,557,784	$4,673,353
Mechanical Trade Laborer (One per pump station)	3	EA	$1,868,936	$1,868,936	$1,868,936	$1,868,936	$5,606,808

50 YR LCC MAINTENANCE

Item Description	Qty	Unit	Unit Cost ($/unit)				
Level I and Level II Engine PM Subtotals	1	EA	$98,071	$3,628,626	$2,549,845	$1,176,852	$7,355,323
Engine 25 Year Overhaul Subtotals	1	EA	$33,191	$1,228,051	$862,955	$398,287	$2,489,292
Drive-Pump 25 Year Overhaul Subtotals	1	EA	$205,178	$7,591,586	$5,334,628	$2,462,136	$15,388,351
Cathodic Protection System Energy	1	EA	-	$632,897	$630,229	$515,284	$1,778,410
Cathodic Protection System Inspection	1	LS	$140,201	$140,201	$140,201	$140,201	$420,602
Cathodic Protection System Replace Anodes (Once @ 25 yr)	1	LS	-	$256,473	$181,039	$165,953	$603,465
Coatings and Finishes	1	LS	-	$702,918	$491,114	$495,289	$1,689,321
SUB TOTAL LIFE CYCLE COSTS				**$224,675,470**	**$157,845,443**	**$101,957,245**	**$484,478,158**
Historical Operatioins and Maintenance Costs from Sewer & Water Board	1000 CFS		$500,000	$6,475,000	$4,550,000	$2,100,000	$13,125,000
TOTAL LIFE CYCLE COSTS				**$231,150,470**	**$162,395,443**	**$104,057,245**	**$497,603,158**

O&M Cost Detail
New Orleans
17th Street, Orleans & London Canals

INPUT DATA

Study Period, yrs 50

Lifecycle cost analysis formula per ETL-1110-2-361 PV=C*(IIF)n IIF= 0.98

OPERATION COSTS

Item Description	Qty	Unit	Unit Labor Cost ($/unit)	**Total Labor Cost ($/unit)**	Unit Equipment Cost ($/unit)	**Total Equipment Cost ($/unit)**	Unit Material Cost ($/unit)	**Total Material Cost ($/unit)**	**Total Cost (C) ($)**	Notes
Operators										
Operation & Maintenance Chief	1	ea	$81,661	**$81,661**	$0	**$0**	$0	**$0**	**$81,661**	SAC Yearly Salary w/Benefits
Canal Operator	1	ea	$61,402	**$61,402**	$0	**$0**	$0	**$0**	**$61,402**	SAC Yearly Salary w/Benefits
Maintenance Staff										
Operation & Maintenance Chief	0	ea	$81,661	**$0**	$0	**$0**	$0	**$0**	**$0**	SAC Priced above
Electrical Foreman	1	ea	$68,985	**$68,985**	$0	**$0**	$0	**$0**	**$68,985**	SAC Yearly Salary w/Benefits
Mechanical Foreman	1	ea	$72,238	**$72,238**	$0	**$0**	$0	**$0**	**$72,238**	SAC Yearly Salary w/Benefits
Electrical Trade Laborers	1	ea	$50,000	**$50,000**	$0	**$0**	$0	**$0**	**$50,000**	SAC Yearly Salary w/Benefits
Mechanical Trade Laborers	1	ea	$59,987	**$59,987**	$0	**$0**	$0	**$0**	**$59,987**	SAC Yearly Salary w/Benefits
Total				**$394,273**		**$0**		**$0**	**$394,273**	

Operation and Maintenance Labor Costs Ratio CFS per site

50 Year Present Value Calculations for Salaries

Period (n)	Operation & Maintenance Chief	Electrical Foreman	Mechanical Foreman	Canal Operator	Electrical Trade Laborers	Mechanical Trade Laborers
1	**$80,028**	**$67,605**	**$70,793**	**$60,174**	**$49,000**	**$58,787**
2	**$78,427**	**$66,253**	**$69,377**	**$58,970**	**$48,020**	**$57,612**
3	**$76,859**	**$64,928**	**$67,990**	**$57,791**	**$47,060**	**$56,459**
4	**$75,322**	**$63,630**	**$66,630**	**$56,635**	**$46,118**	**$55,330**
5	**$73,815**	**$62,357**	**$65,297**	**$55,503**	**$45,196**	**$54,223**
6	**$72,339**	**$61,110**	**$63,991**	**$54,392**	**$44,292**	**$53,139**
7	**$70,892**	**$59,888**	**$62,712**	**$53,305**	**$43,406**	**$52,076**
8	**$69,474**	**$58,690**	**$61,457**	**$52,239**	**$42,538**	**$51,035**
9	**$68,085**	**$57,516**	**$60,228**	**$51,194**	**$41,687**	**$50,014**
10	**$66,723**	**$56,366**	**$59,024**	**$50,170**	**$40,854**	**$49,014**
11	**$65,389**	**$55,238**	**$57,843**	**$49,167**	**$40,037**	**$48,033**
12	**$64,081**	**$54,134**	**$56,686**	**$48,183**	**$39,236**	**$47,073**
13	**$62,799**	**$53,051**	**$55,553**	**$47,220**	**$38,451**	**$46,131**
14	**$61,543**	**$51,990**	**$54,442**	**$46,275**	**$37,682**	**$45,209**
15	**$60,312**	**$50,950**	**$53,353**	**$45,350**	**$36,928**	**$44,305**
16	**$59,106**	**$49,931**	**$52,286**	**$44,443**	**$36,190**	**$43,418**
17	**$57,924**	**$48,933**	**$51,240**	**$43,554**	**$35,466**	**$42,550**
18	**$56,765**	**$47,954**	**$50,215**	**$42,683**	**$34,757**	**$41,699**
19	**$55,630**	**$46,995**	**$49,211**	**$41,829**	**$34,062**	**$40,865**
20	**$54,518**	**$46,055**	**$48,227**	**$40,992**	**$33,380**	**$40,048**
21	**$53,427**	**$45,134**	**$47,262**	**$40,173**	**$32,713**	**$39,247**
22	**$52,359**	**$44,231**	**$46,317**	**$39,369**	**$32,059**	**$38,462**
23	**$51,311**	**$43,347**	**$45,391**	**$38,582**	**$31,417**	**$37,693**
24	**$50,285**	**$42,480**	**$44,483**	**$37,810**	**$30,789**	**$36,939**
25	**$49,280**	**$41,630**	**$43,593**	**$37,054**	**$30,173**	**$36,200**
26	**$48,294**	**$40,797**	**$42,721**	**$36,313**	**$29,570**	**$35,476**
27	**$47,328**	**$39,981**	**$41,867**	**$35,587**	**$28,978**	**$34,767**
28	**$46,382**	**$39,182**	**$41,029**	**$34,875**	**$28,399**	**$34,071**
29	**$45,454**	**$38,398**	**$40,209**	**$34,177**	**$27,831**	**$33,390**
30	**$44,545**	**$37,630**	**$39,405**	**$33,494**	**$27,274**	**$32,722**
31	**$43,654**	**$36,878**	**$38,617**	**$32,824**	**$26,729**	**$32,068**
32	**$42,781**	**$36,140**	**$37,844**	**$32,167**	**$26,194**	**$31,426**
33	**$41,925**	**$35,417**	**$37,087**	**$31,524**	**$25,670**	**$30,798**
34	**$41,087**	**$34,709**	**$36,346**	**$30,894**	**$25,157**	**$30,182**
35	**$40,265**	**$34,015**	**$35,619**	**$30,276**	**$24,654**	**$29,578**
36	**$39,460**	**$33,334**	**$34,906**	**$29,670**	**$24,161**	**$28,987**
37	**$38,670**	**$32,668**	**$34,208**	**$29,077**	**$23,677**	**$28,407**
38	**$37,897**	**$32,014**	**$33,524**	**$28,495**	**$23,204**	**$27,839**
39	**$37,139**	**$31,374**	**$32,854**	**$27,925**	**$22,740**	**$27,282**
40	**$36,396**	**$30,747**	**$32,197**	**$27,367**	**$22,285**	**$26,736**
41	**$35,668**	**$30,132**	**$31,553**	**$26,820**	**$21,839**	**$26,202**
42	**$34,955**	**$29,529**	**$30,922**	**$26,283**	**$21,403**	**$25,677**
43	**$34,256**	**$28,938**	**$30,303**	**$25,758**	**$20,974**	**$25,164**
44	**$33,571**	**$28,360**	**$29,697**	**$25,242**	**$20,555**	**$24,661**
45	**$32,899**	**$27,793**	**$29,103**	**$24,738**	**$20,144**	**$24,167**
46	**$32,241**	**$27,237**	**$28,521**	**$24,243**	**$19,741**	**$23,684**
47	**$31,597**	**$26,692**	**$27,951**	**$23,758**	**$19,346**	**$23,210**
48	**$30,965**	**$26,158**	**$27,392**	**$23,283**	**$18,959**	**$22,746**
49	**$30,345**	**$25,635**	**$26,844**	**$22,817**	**$18,580**	**$22,291**
50	**$29,738**	**$25,122**	**$26,307**	**$22,361**	**$18,208**	**$21,845**
Total	**$2,544,204**	**$2,149,275**	**$2,250,624**	**$1,913,021**	**$1,557,784**	**$1,868,936**

Item Description	Qty	Unit	Unit Labor Cost	Total Labor Cost	Unit Equipment Cost	Total Equipment Cost	Unit Material Cost	Total Material Cost	Present Value Cost
Maintenance Tasks	Per	Engine							
Pump Rebuild	1	EA							
Pump Rebuild Task Total		Rebuild cost 20% of new pump cost of $17,000,000					$340,000.00	**$340,000**	**$205,178**
Engine Complete Overhaul									
Level I & Level II Engine Maintenance	1	LS				**950+2300=**	$3,250.00	**$3,250.00**	
Engine Complete Overhaul Task Total							$55,000.00	**$55,000**	**$33,191**

Louisiana Machinery Quotations

Annual Level I Inspection: $950 (at 6 months)

Annual Level II PM: $2300 (at 12 months) – Does not include a load bank test which is recommended – If you include that you can add approximately $3500

Top End Overhaul: $22,000 - $25,000 – 8,000 to 10,000 hours

Major Overhaul: $49,000 - $55,000 – 16,000 to 20,000 hours

50 Year Present Value Calculations for Corrosion Protection

Canal Square Footage for Coatings

Cathodic Protection Power	Period (n)	CP Power 17th Current Value	CP Power 17th	CP Power orleans Current Value	CP Power orleans	CP Power london Current Value	CP Power london	CP Power
	1	$20,314.00	**$19,907.72**	$16,539.00	**$16,208.22**	$20,314.00	$17,592.00	**$17,240.16**
	2	$20,314.00	**$19,509.57**	$16,539.00	**$15,884.06**	$20,314.00	**$19,509.57**	
	3	$20,314.00	**$19,119.37**	$16,539.00	**$15,566.37**	$20,314.00	**$19,119.37**	
	4	$20,314.00	**$18,736.99**	$16,539.00	**$15,255.05**	$20,314.00	**$18,736.99**	
	5	$20,314.00	**$18,362.25**	$16,539.00	**$14,949.95**	$20,314.00	**$18,362.25**	
	6	$20,314.00	**$17,995.00**	$16,539.00	**$14,650.95**	$20,314.00	**$17,995.00**	
	7	$20,314.00	**$17,635.10**	$16,539.00	**$14,357.93**	$20,314.00	**$17,635.10**	
	8	$20,314.00	**$17,282.40**	$16,539.00	**$14,070.77**	$20,314.00	**$17,282.40**	
	9	$20,314.00	**$16,936.75**	$16,539.00	**$13,789.35**	$20,314.00	**$16,936.75**	
	10	$20,314.00	**$16,598.02**	$16,539.00	**$13,513.57**	$20,314.00	**$16,598.02**	
	11	$20,314.00	**$16,266.06**	$16,539.00	**$13,243.30**	$20,314.00	**$16,266.06**	
	12	$20,314.00	**$15,940.74**	$16,539.00	**$12,978.43**	$20,314.00	**$15,940.74**	
	13	$20,314.00	**$15,621.92**	$16,539.00	**$12,718.86**	$20,314.00	**$15,621.92**	
	14	$20,314.00	**$15,309.48**	$16,539.00	**$12,464.48**	$20,314.00	**$15,309.48**	
	15	$20,314.00	**$15,003.29**	$16,539.00	**$12,215.19**	$20,314.00	**$15,003.29**	
	16	$20,314.00	**$14,703.23**	$16,539.00	**$11,970.89**	$20,314.00	**$14,703.23**	
	17	$20,314.00	**$14,409.16**	$16,539.00	**$11,731.47**	$20,314.00	**$14,409.16**	
	18	$20,314.00	**$14,120.98**	$16,539.00	**$11,496.84**	$20,314.00	**$14,120.98**	
	19	$20,314.00	**$13,838.56**	$16,539.00	**$11,266.91**	$20,314.00	**$13,838.56**	
	20	$20,314.00	**$13,561.79**	$16,539.00	**$11,041.57**	$20,314.00	**$13,561.79**	
	21	$20,314.00	**$13,290.55**	$16,539.00	**$10,820.74**	$20,314.00	**$13,290.55**	
	22	$20,314.00	**$13,024.74**	$16,539.00	**$10,604.32**	$20,314.00	**$13,024.74**	
	23	$20,314.00	**$12,764.25**	$16,539.00	**$10,392.24**	$20,314.00	**$12,764.25**	
	24	$20,314.00	**$12,508.96**	$16,539.00	**$10,184.39**	$20,314.00	**$12,508.96**	
	25	$20,314.00	**$12,258.78**	$16,539.00	**$9,980.70**	$20,314.00	**$12,258.78**	
	26	$20,314.00	**$12,013.61**	$16,539.00	**$9,781.09**	$20,314.00	**$12,013.61**	
	27	$20,314.00	**$11,773.33**	$16,539.00	**$9,585.47**	$20,314.00	**$11,773.33**	
	28	$20,314.00	**$11,537.87**	$16,539.00	**$9,393.76**	$20,314.00	**$11,537.87**	
	29	$20,314.00	**$11,307.11**	$16,539.00	**$9,205.88**	$20,314.00	**$11,307.11**	
	30	$20,314.00	**$11,080.97**	$16,539.00	**$9,021.77**	$20,314.00	**$11,080.97**	
	31	$20,314.00	**$10,859.35**	$16,539.00	**$8,841.33**	$20,314.00	**$10,859.35**	
	32	$20,314.00	**$10,642.16**	$16,539.00	**$8,664.50**	$20,314.00	**$10,642.16**	
	33	$20,314.00	**$10,429.32**	$16,539.00	**$8,491.21**	$20,314.00	**$10,429.32**	
	34	$20,314.00	**$10,220.73**	$16,539.00	**$8,321.39**	$20,314.00	**$10,220.73**	
	35	$20,314.00	**$10,016.32**	$16,539.00	**$8,154.96**	$20,314.00	**$10,016.32**	
	36	$20,314.00	**$9,815.99**	$16,539.00	**$7,991.86**	$20,314.00	**$9,815.99**	
	37	$20,314.00	**$9,619.67**	$16,539.00	**$7,832.02**	$20,314.00	**$9,619.67**	
	38	$20,314.00	**$9,427.28**	$16,539.00	**$7,675.38**	$20,314.00	**$9,427.28**	
	39	$20,314.00	**$9,238.73**	$16,539.00	**$7,521.88**	$20,314.00	**$9,238.73**	
	40	$20,314.00	**$9,053.96**	$16,539.00	**$7,371.44**	$20,314.00	**$9,053.96**	
	41	$20,314.00	**$8,872.88**	$16,539.00	**$7,224.01**	$20,314.00	**$8,872.88**	
	42	$20,314.00	**$8,695.42**	$16,539.00	**$7,079.53**	$20,314.00	**$8,695.42**	
	43	$20,314.00	**$8,521.51**	$16,539.00	**$6,937.94**	$20,314.00	**$8,521.51**	
	44	$20,314.00	**$8,351.08**	$16,539.00	**$6,799.18**	$20,314.00	**$8,351.08**	
	45	$20,314.00	**$8,184.06**	$16,539.00	**$6,663.20**	$20,314.00	**$8,184.06**	
	46	$20,314.00	**$8,020.38**	$16,539.00	**$6,529.93**	$20,314.00	**$8,020.38**	
	47	$20,314.00	**$7,859.97**	$16,539.00	**$6,399.33**	$20,314.00	**$7,859.97**	
	48	$20,314.00	**$7,702.77**	$16,539.00	**$6,271.35**	$20,314.00	**$7,702.77**	
	49	$20,314.00	**$7,548.72**	$16,539.00	**$6,146.92**	$20,314.00	**$7,548.72**	
	50	$20,314.00	**$7,397.74**	$16,539.00	**$6,023.00**	$20,314.00	**$7,397.74**	
		Total	**$632,897**	Total	**$515,284**	Total		**$630,229**

CP Inspect Current Value	CP Inspect	17th st	CP Replace	orleans	CP Replace	london	CP Replace	Coatings and Finishes 17th	112339	Coatings and Finishes Orleans	75012	Coatings and Finishes London	76269	Level I & II Engine Inspection	
$4,500.00	**$4,410.00**	$0.00		$0.00		$0.00		$0.00	0	**$0.00**	$0.00	0	**$0.00**	$3,250.00	**$3,121.30**
$4,500.00	**$4,321.80**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$3,058.87**
$4,500.00	**$4,235.36**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,997.70**
$4,500.00	**$4,150.66**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,937.74**
$4,500.00	**$4,067.64**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,878.99**
$4,500.00	**$3,986.29**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,821.41**
$4,500.00	**$3,906.56**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,764.98**
$4,500.00	**$3,828.43**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,709.68**
$4,500.00	**$3,751.86**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,655.49**
$4,500.00	**$3,676.83**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,602.38**
$4,500.00	**$3,603.29**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,550.33**
$4,500.00	**$3,531.23**	$0.00		$0.00		$0.00		$1.13	126943.07	**$99,614.35**	$1.13	84763.56	**$66,515.38**	$1.13 86183.97	**$67,630.00**
$4,500.00	**$3,460.60**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,499.32**
$4,500.00	**$3,391.39**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,449.34**
$4,500.00	**$3,323.56**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,400.35**
$4,500.00	**$3,257.09**	$0.00		$0.00		$0.00		$1.98	222431.22	**$160,995.21**	$1.98	148523.76	**$107,501.16**	$1.98 151012.62	**$109,302.59**
$4,500.00	**$3,191.95**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,305.30**
$4,500.00	**$3,128.11**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,259.19**
$4,500.00	**$3,065.55**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,214.01**
$4,500.00	**$3,004.24**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,169.73**
$4,500.00	**$2,944.15**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,126.33**
$4,500.00	**$2,885.27**	$0.00		$0.00		$0.00		$3.82	429134.98	**$275,148.77**	$3.82	286545.84	**$183,724.80**	$3.82 291347.58	**$186,803.53**
$4,500.00	**$2,827.56**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,042.13**
$4,500.00	**$2,771.01**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$2,001.29**
$4,500.00	**$2,715.59**	$425,000.00	**$256,472.51**	$275,000.00	**$165,952.80**	$300,000.00	**$181,039.42**	$0.00			$0.00			$3,250.00	**$1,961.26**
$4,500.00	**$2,661.28**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,922.04**
$4,500.00	**$2,608.05**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,883.59**
$4,500.00	**$2,555.89**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,845.92**
$4,500.00	**$2,504.77**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,809.00**
$4,500.00	**$2,454.68**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,772.82**
$4,500.00	**$2,405.59**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,737.37**
$4,500.00	**$2,357.47**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,702.62**
$4,500.00	**$2,310.32**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,668.57**
$4,500.00	**$2,264.12**	$0.00		$0.00		$0.00		$1.13	126943.07	**$63,869.80**	$1.13	84763.56	**$42,647.71**	$1.13 86183.97	**$43,362.38**
$4,500.00	**$2,218.84**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,635.20**
$4,500.00	**$2,174.46**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,602.49**
$4,500.00	**$2,130.97**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,570.44**
$4,500.00	**$2,088.35**	$0.00		$0.00		$0.00		$1.98	222431.22	**$103,225.41**	$1.98	148523.76	**$68,926.59**	$1.98 151012.62	**$70,081.62**
$4,500.00	**$2,046.58**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,539.03**
$4,500.00	**$2,005.65**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,508.25**
$4,500.00	**$1,965.54**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,478.09**
$4,500.00	**$1,926.23**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,448.53**
$4,500.00	**$1,887.70**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,419.56**
$4,500.00	**$1,849.95**	$0.00		$0.00		$0.00		$3.82	156.62	**$64.39**	$3.82	63178.98	**$25,972.87**	$3.82 33894.397	**$13,933.98**
$4,500.00	**$1,812.95**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,391.16**
$4,500.00	**$1,776.69**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,363.34**
$4,500.00	**$1,741.16**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,336.07**
$4,500.00	**$1,706.33**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,309.35**
$4,500.00	**$1,672.21**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,283.17**
$4,500.00	**$1,638.76**	$0.00		$0.00		$0.00		$0.00			$0.00			$3,250.00	**$1,257.50**
	$140,200.59		**$256,472.51**		**$165,952.80**		**$181,039.42**			**$702,917.93**			**$495,288.52**		**$491,114**

$98,071

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS			Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION			Date	6/14/2007
	Project No.	041669.0310	File No.	52.3121.1253	Checked	
	Title:	INTERIM CLOSURE STRUCTURE			Date	
		CATHODIC PROTECTION O AND M ESTIMATE			Page	of

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17th Street Canal

ENERGY

Cathodic protection current provided at 30 V through 80% efficient rectifiers.
Energy Cost based on Entergy New Orleans Inc. schedule MNR-17
Future value levels based on 2.5% inflation and 9% interest rates.

Required Current	983	from F. (J.) Yang estimate	
Assumed Voltage (V)	30		
Power (kW)	29.49		
Rectifier Power	36.86		
Rectifier Annual Power (kWh)	322,916	26,910	kWh per month
Annual Energy Cost Per Schedule	MMNR-17		
Demand Charge	$10,548		
Energy Charge	$9,765		
Total	$20,313.20		

	Current Cost
Annual CP Energy Cost	$20,314

CP MONITORING

Cathodic protection monitoring consists of bi-monthly cp site inspections and an annual cp current survey.

	Current Cost
Annual CP Monitoring Cost	$4,500

CP REPLACEMENT

Cathodic protection deep well anode beds required replacement in 25 years.

	Current Cost (Capitol)
CP Replacemnt Cost	$425,000

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS			Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION			Date	6/14/2007
	Project No.	041669.0310	File No.	52.3121.1253	Checked	
	Title:	INTERIM CLOSURE STRUCTURE			Date	
		CATHODIC PROTECTION O AND M ESTIMATE			Page	of

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Orleans Avenue Canal

ENERGY

Cathodic protection current provided at 30 V through 80% efficient rectifiers.
Energy Cost based on Entergy New Orleans Inc. schedule MNR-17
Future value levels based on 2.5% inflation and 9% interest rates.

Required Current	603	from F. (J.) Yang estimate	
Assumed Voltage (V)	30		
Power (kW)	18.09		
Rectifier Power	22.61		
Rectifier Annual Power (kWh)	198,086	16,507	kWh per month
Annual Energy Cost Per Schedule	MMNR-17		
Demand Charge	$10,548		
Energy Charge	$5,990		
Total	$16,538.35		

	Current Cost
Annual CP Energy Cost	$16,539

CP MONITORING

Cathodic protection monitoring consists of bi-monthly cp site inspections and an annual cp current survey.

	Current Cost
Annual CP Monitoring Cost	$4,500

CP REPLACEMENT

Cathodic protection deep well anode beds required replacement in 25 years.

	Current Cost (Capitol)
CP Replacemnt Cost	$275,000

BLACK & VEATCH	Owner:	US ARMY CORPS OF ENGINEERS			Computed	G.M. Akers
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION			Date	6/14/2007
	Project No.	041669.0310	File No.	52.3121.1253	Checked	
	Title:	INTERIM CLOSURE STRUCTURE			Date	
		CATHODIC PROTECTION O AND M ESTIMATE			Page	of

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London Avenue Canal

ENERGY

Cathodic protection current provided at 30 V through 80% efficient rectifiers.
Energy Cost based on Entergy New Orleans Inc. schedule MNR-17
Future value levels based on 2.5% inflation and 9% interest rates.

Required Current	709	from F. (J.) Yang estimate	
Assumed Voltage (V)	30		
Power (kW)	21.27		
Rectifier Power	26.59		
Rectifier Annual Power (kWh)	232,907	19,409	kWh per month
Annual Energy Cost Per Schedule	MMNR-17		
Demand Charge	$10,548		
Energy Charge	$7,043		
Total	$17,591.33		

	Current Cost
Annual CP Energy Cost	$17,592

CP MONITORING

Cathodic protection monitoring consists of bi-monthly cp site inspections and an annual cp current survey.

	Current Cost
Annual CP Monitoring Cost	$4,500

CP REPLACEMENT

Cathodic protection deep well anode beds required replacement in 25 years.

	Current Cost (Capitol)
CP Replacemnt Cost	$300,000

	Owner:	US ARMY CORPS OF ENGINEERS	Computed	B.P. Louque
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date	6/14/2007
BLACK & VEATCH	Project No.	041669.0310 File No. 52.3121.1253	Checked	
	Title:	INTERIM CLOSURE STRUCTURE	Date	
		PROTECTIVE COATING O&M COST ESTIMATE	Page	of

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17th Street Canal

Maintenance Painting Sequence

Painting Operation	Work Occurs in Year	Cost per ft2
Initial Painting	0	$2.83
Touch-Up	12	$1.13
Maintenanc e Repaint	16	$1.98
Full Repaint	22	$3.82

O&M Cost and Work Intervals Calculated per SSPC-Painting Manual, Volume 1, Good Painting Practice.

Practical System Life (P) = 12 Years

Touch Up Costs = 40 % of Intitial Painting Costs

Maintenance Repaint Costs = 70 % of Initial Painting Costs

Full Repaint Costs = 135% of Initial Painting Costs

Total Painting Costs for 50 Year Structure Life, Field Applicaition

Painting Operation	Original Painting Cost	Touch-Up	Maint Repaint	Full Repaint	Touch-Up	Maint. Repaint	Full Repaint	Totals
Year	0	12	16	22	34	38	44	
Cost in Current Dollars	$2.83	$1.13	$1.98	$3.82	$1.13	$1.98	$3.82	$13.87

Total Surface Area Requiring Painting

Estimated Surface Area	112339 ft2

	Owner:	US ARMY CORPS OF ENGINEERS	Computed	B.P. Louque
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date	6/14/2007
BLACK & VEATCH	Project No.	041669.0310 File No. 52.3121.1253	Checked	
	Title:	INTERIM CLOSURE STRUCTURE	Date	
		PROTECTIVE COATING O&M COST ESTIMATE	Page	of

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Orleans Avenue

Maintenance Painting Sequence

Painting Operation	Work Occurs in Year	Cost per ft2
Initial Painting	0	$2.83
Touch-Up	12	$1.13
Maintenanc e Repaint	16	$1.98
Full Repaint	22	$3.82

O&M Cost and Work Intervals Calculated per SSPC-Painting Manual, Volume 1, Good Painting Practice.

Practical System Life (P) = 12 Years

Touch Up Costs = 40 % of Intitial Painting Costs

Maintenance Repaint Costs = 70 % of Initial Painting Costs

Full Repaint Costs = 135% of Initial Painting Costs

Total Painting Costs for 50 Year Structure Life, Field Applicaition

Painting Operation	Original Painting Cost	Touch-Up	Maint Repaint	Full Repaint	Touch-Up	Maint. Repaint	Full Repaint	Totals
Year	0	12	16	22	34	38	44	
Cost in Current Dollars	$2.83	$1.13	$1.98	$3.82	$1.13	$1.98	$3.82	$13.87

Total Surface Area Requiring Painting

Estimated Surface Area	75012	ft2

	Owner:	US ARMY CORPS OF ENGINEERS	Computed	B.P. Louque
	Project:	NEW ORLEANS EMERGENCY PLAN RESTORATION	Date	6/14/2007
BLACK & VEATCH	Project No.	041669.0310 File No. 52.3121.1253	Checked	
	Title:	INTERIM CLOSURE STRUCTURE	Date	
		PROTECTIVE COATING O&M COST ESTIMATE	Page	of

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London Avenue

Maintenance Painting Sequence

Painting Operation	Work Occurs in Year	Cost per ft2
Initial Painting	0	$2.83
Touch-Up	12	$1.13
Maintenanc e Repaint	16	$1.98
Full Repaint	22	$3.82

O&M Cost and Work Intervals Calculated per SSPC-Painting Manual, Volume 1, Good Painting Practice.

Practical System Life (P) = 12 Years

Touch Up Costs = 40 % of Intitial Painting Costs

Maintenance Repaint Costs = 70 % of Initial Painting Costs

Full Repaint Costs = 135% of Initial Painting Costs

Total Painting Costs for 50 Year Structure Life, Field Applicaition

Painting Operation	Original Painting Cost	Touch-Up	Maint Repaint	Full Repaint	Touch-Up	Maint. Repaint	Full Repaint	Totals
Year	0	12	16	22	34	38	44	
Cost in Current Dollars	$2.83	$1.13	$1.98	$3.82	$1.13	$1.98	$3.82	$13.87

Total Surface Area Requiring Painting

Estimated Surface Area	76269 ft2