APPENDIX B
COST ESTIMATES AND RISK ANALYSIS

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ATTACHMENTS

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B.1 COST ENGINEERING GENERAL INFORMATION

U.S. Army Corps of Engineers cost estimates for planning purposes are prepared in accordance with the following guidance:

- Engineer Technical Letter (ETL) 1110-2-573, Construction Cost Estimating Guide for Civil Works, 30 September 2008
- Engineer Regulation (ER) 1110-1-1300, Cost Engineering Policy and General Requirements, 26 March 1993
- ER 1110-2-1302, Civil Works Cost Engineering, 15 September 2008
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, as amended
- Engineer Manual (EM) 1110-2-1304 (Tables Revised 31 March 2009), Civil Works Construction Cost Index System, 31 March 2000
- CECW-CP Memorandum for Distribution, Subject: USACE Civil Works Feasibility Study Program Execution and Delivery, 8 February 2012
- CECW-CP Memorandum for Distribution, Subject: Initiatives to Improve the Accuracy of Total Project Costs in Civil Works Feasibility Studies Requiring Congressional Authorization, 19 September 2007
- CECW-CE Memorandum for Distribution, Subject: Application of Cost Risk Analysis
- Methods to Develop Contingencies for Civil Works Total Project Costs, 3 July 2007
- Cost and Schedule Risk Analysis Process, March 2008
- Engineering and Construction Bulleting (ECB) 2012-18, Engineering Within the Planning Modernization Paradigm, 18 May 2012

The goal of the cost estimates for the CEPP PACR is to present a Total Project Cost (Construction and Non-Construction costs) for the tentatively selected plan (TSP) at the current price level (2018) to be used for project authorization and to escalate costs for budgeting purposes. In addition, the costing efforts are intended to produce a final product (cost estimate) that is reliable and accurate, and that supports the definition of the Government's and the Non-Federal sponsor's obligations.

The cost estimating effort for the study also yielded a series of alternative plan formulation cost estimates for decision making. The final set of plan formulation cost estimates used for plan selection relies on historic construction feature unit pricing. The cost estimate supporting the EAA Reservoir project TSP is prepared in the MII Microcomputer Aided Cost Estimating System (MCACES/MII) format to the Civil Works Work Breakdown Structure (CWWBS) sub-feature level. This estimate is supported by the preferred labor, equipment, materials, and crew/production breakdown. A fully funded cost estimate (escalated for inflation through project completion) will serve as the Baseline Cost Estimate or Total Project Cost Summary and was produced by the Cost Engineer for the draft report. A risk analysis has been produced by the Cost Engineer for the draft report. It addresses the project uncertainties and sets contingencies for the Tentatively Selected Plan's cost items. The cost estimates were prepared using the data provided by SFWMD and current understanding of construction cost in the market place and a series of assumptions that were input into the Rough Order of Magnitude (ROM) cost models. The ROM costs were developed with support from the South Florida Water Management District and incorporated historical costs from projects of similar scope. The ROM combined project estimates from completed projects as well as estimated costs from larger type projects such as A-1 FEB, the C-43 Storage Reservoir, Modified Waters Delivery (MWD) and Everglades Agricultural Area (EAA). For this estimate the cost developed during the ROM cost estimating process were supplemented with costs developed using the TRACES MCACES/MII and production estimates based on crew sizing observations of similar work items observed during the A-1 FEB construction project and input from the District's chief estimator and other District staff.

The ROM cost estimating evaluation was a major factor in the process of screening potential features and components of the overall project. The ROM estimated costs and generated quantities based on factors and presets from multiple resource points that were built into the Excel Spreadsheet. The ROM did have a few pitfalls such as not being able to capture the entirety of the scope. Some items, such as real estate, O&M and contingencies had to be created outside of the tool for completion and then combined with the total for a total cost. Contingency for the ROM process was developed using the guidelines established in the DCM-7 memorandum.

During the process of developing preliminary costs, a comparison/reasonable check was prepared of the costs of similar features proposed in The Yellow Book and CEPP. The Yellow Book costs were escalated to 2018 using 79% escalation rate. The CEPP costs were escalated to 2018 using 6.85% escalation rate. The tables below compare the previous costs with the new features proposed in the CEPP PACR TSP.

Table B.1 COST COMPARISON – CERP (YELLOWBOOK) CEPP, and CEPP PACR

CERP CEPP and PACR FEATURE DESCRIPTIONS	FY99 Yellow Book Costs (include PED and Construction Management)	FY99 Yellow Book Escalated Construction Cost to FY18	CEPP Construction First Cost FY 18	CEPP + PACR TSP First Cost FY 18
	Implementation Plan Construction & Real Estate	1.799 Cost Escalation Factor from FY 99	1.068 Cost Escalation Factor from FY 14 (includes 44% contingency)	(includes 34% contingency)
EAA Storage and Conveyance (G)	**$436,648,000**	**$785,529,752**	**$622,075,824**	**$1,693,098,187**
(G) EAA Storage Reservoirs 360kaf total (3 comp)	$350,112,000	$629,851,488		
CEPP Flow Equalization Basin 60kaf (1 comp) - A2 FEB			$545,826,000	
CEPP PACR 240kaf A-2 Reservoir, A-2 FEB and Conveyance improvements				$1,666,098,187
Real Estate	$86,536,000	$155,678,264	$36,642,000	$27,000,000
Flow to Northwest and Central Water Conservation Area 3A (II, RR)	**$30,877,000**	**$55,547,723**	**239,225,592**	**$239,225,592**
WCA 3 Decompart-mentalization & Sheetflow Enhancement (AA, QQ, SS) *QQ grp 1 costs, **QQ grp 2 costs	**$211,687,000**	**$380,824,913**	**$395,122,620**	**$395,122,620**
ENP/L-31N Seepage Management and S-356 Structures (U, V with pilot project, and FF) * V grp costs, ** FF grp costs	**$337,081,000**	**$606,408,719**	**$111,866,592**	**$111,866,592**
TOTALS	**$1,016,293,000**	**$1,828,311,107**	**$1,368,290,628**	**$2,439,312,991**
	PED, S&A, EDC		**$512,374,068**	**$274,906,203**
	TOTAL	**$1,828,311,107**	**$1,880,664,696**	**$2,714,219,194**

B.1.1 Final Array of Alternatives/Summary of Cost

Optimized components from the screening of treatment and storage, distribution and conveyance and the resulting seepage management measures were combined into a limited final array of alternatives to undergo a detailed evaluation. Operational optimization in the form of Everglades' rain-driven operations was utilized for the development of the Final Array of Alternatives. Evaluation of the Final Array was conducted utilizing hydrologic models. These ecological Performance Measures were developed from (restoration, coordination and verification) RECOVER Conceptual Ecological Models (CEM) and approved by RECOVER. RECOVER is responsible for establishing the system wide ecological goals for the central & southern Florida ecosystem.

B.1.1.1 Alternative R240A

Alternative R240A includes a 240,000 ac-ft above-ground reservoir and a 6,500-acre STA, located on the A-2 parcel and A-2 Expansion area, that will work in conjunction with the existing 60,000 ac-ft A-1 FEB, STA-2, and STA-3/4 to meet State water quality standards. The proposed A-2 East Reservoir is 10,500 acres and designed to have a normal full storage water depth of approximately 23 feet. This alternative also includes 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA. For this alternative, A-2 East Reservoir outflows can be sent to the new A-2 West STA (located adjacent to and directly west of the A-2 East Reservoir), to the existing A-1 FEB, to the existing STA-2, and/or to the existing STA-3/4. Outflows from the A-2 West STA would be conveyed to the Miami Canal south of the existing G-373 divide structure. A-2 East Reservoir outflows can also be conveyed to either the Miami or North New River Canals via the intake canal.

Alternative R240A also includes an intake canal located adjacent to and directly north of the A-2 West STA, the A-2 East Reservoir, and the A-1 FEB. The intake canal extends from the Miami Canal to the North New River Canal, which allows flexibility to convey water into the reservoir from either side of the project area. A new inflow pump station conveys water into the A-2 East Reservoir from the intake canal.

B.1.1.2 Alternative R240B

Alternative R240B includes a 240,000 ac-ft above-ground reservoir and a 6,500-acre STA, located on the A-2 parcel and A-2 Expansion area, that will work in conjunction with the existing 60,000 ac-ft A-1 FEB, STA-2 and STA-3/4 to meet State water quality standards. The proposed A-2 West Reservoir is 10,500 acres and designed to have a normal full storage water depth of approximately 23 feet. This alternative also includes 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA. For this alternative, A-2 West Reservoir outflows can be sent to the new A-2 East STA (located adjacent to and directly east of the A-2 West Reservoir), to the existing A-1 FEB (via the existing STA-3/4/A-1 FEB inflow canal), to the existing STA-2, and/or to the existing STA-3/4. Outflows from the A-2 East STA would be conveyed to the Miami Canal south of the existing G-373 divide structure via a new east-west A-2 East STA outflow canal located adjacent to and directly south of the A-2 West Reservoir. A-2 West Reservoir outflows can also be conveyed to either the Miami Canal via a reservoir outflow structure or to the North New River Canal via the intake canal.

Alternative R240B also includes an intake canal located adjacent to and directly north of the A-2 West Reservoir, the A-2 East STA, and the A-1 FEB. The intake canal extends from the Miami Canal to the North

New River Canal, which allows flexibility to convey water into the reservoir from either side of the project area. A new inflow pump station conveys water into the A-2 West Reservoir from the intake canal.

B.1.1.3 Alternative R360C

Alternative R360C includes a 360,000 ac-ft above-ground reservoir and an 11,500-acre STA, located on the A-1 parcel, the A-2 parcel, and the A-2 Expansion area, that will work in conjunction with the existing STA-2 and STA-3/4 to meet State water quality standards. The proposed A-1 Reservoir and A-2 East Reservoir are 20,500 acres combined and designed to have a normal full storage water depth of approximately 18 feet. For this alternative, the existing 16,500-acre shallow A-1 FEB is modified to a reservoir. This alternative also includes 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA. For this alternative, A-1 Reservoir and A-2 East Reservoir outflows can be sent to the new A-2 West STA (located adjacent to and directly west of the A-2 East Reservoir), to the existing STA-2, and/or to the existing STA-3/4. Outflows from the A-2 West STA would be conveyed to the Miami Canal south of the existing G-373 divide structure. A-1 Reservoir outflows can be conveyed to the North New River Canal via a reservoir outflow structure and A-2 East Reservoir outflows can be conveyed to either the Miami or North New River Canals via the intake canal.

Alternative R360C also includes an intake canal located adjacent to and directly north of the A-2 West STA, the A-2 East Reservoir and the A-1 Reservoir. The intake canal extends from the Miami Canal to the North New River Canal, which allows flexibility to convey water into the reservoir from either side of the project area. A new inflow pump station conveys water into the A-1/A-2 East Reservoir from the intake canal.

B.1.1.4 Alternative R360D

Alternative R360D includes a 360,000 ac-ft above-ground reservoir and an 11,500-acre STA, located on the A-1 parcel, the A-2 parcel, and the A-2 Expansion area, that will work in conjunction with the existing STA-2 and STA-3/4 to meet State water quality standards. The proposed A-2 Reservoir and the A-1 North Reservoir are 20,500 acres combined and designed to have a normal full storage water depth of approximately 18 feet. For this alternative, the existing 16,500-acre shallow A-1 FEB is modified to be a 11,500-acre STA in the south (A-1 South STA) and a 3,500-acre reservoir in the north (A-1 North Reservoir). This alternative also includes 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA. For this alternative, A-1 North Reservoir, and A-2 Reservoir outflows can be sent to the new A-1 South STA, to the existing STA-2, and/or to the existing STA-3/4. Outflows from the A-1 South STA would be conveyed to the Miami Canal south of the existing G-373 divide structure via a new east-west A-1 South STA outflow canal located adjacent to and directly south of the A-2 Reservoir. A-1 North Reservoir outflows can be conveyed to the North New River Canal via a reservoir outflow structure and A-2 Reservoir outflows can be conveyed to the Miami Canal via a reservoir outflow structure.

Alternative R360D does not include an intake canal along the north boundary of the project area and instead includes two inflow pump stations, one located at the northeast corner of the A-1 North Reservoir that would convey water from North New River Canal and one located at the northwest corner of the A-2 Reservoir that would convey water from the Miami Canal. Having separate inflow pump stations allows flexibility to convey water into the A-1 North Reservoir and A-2 Reservoir from either side of the project area.

B.1.1.5 Alternative C360C

Alternative C360C includes the exact same storage, treatment and conveyance improvements and related infrastructure as Alternative R360C above. However, Alternative C360C includes additional operational flexibility and can serve multiple purposes including water supply as identified in Component G of the CERP.

B.1.2 Tentatively Selected Plan (TSP)

The TSP was chosen according to Cost Effectiveness/Incremental Cost Analysis procedures and resulted directly from the plan formulation described above. The scope of work for the TSP is found in Appendix A, Engineering. The MCACES/MII cost estimate for the TSP (Section B3, below) is based on that scope and is formatted in the Civil Works Work Breakdown Structure (CWWBS). The notes provided in the body of the estimate detail the estimate parameters and assumptions. These include pricing at the Fiscal Year 2018 price level. For project justification purposes, the estimate costs are categorized under the appropriate CWWBS code and include both construction and non-construction costs.

The construction costs fall under the following feature codes:

- 03 Reservoirs
- 06 Fish & Wildlife Facilities
- 08 Roads, Railroads, and Bridges
- 09 Channels and Canals
- 11 Levees & Floodwalls
- 13 Pumping Plant
- 14 Recreation Facilities
- 15 Floodway Control-Diversion Structures
- 18 Cultural Resource Preservation

The non-construction costs fall under the following feature codes:

- 01 Lands and Damages
- 30 Planning, Engineering and Design
- 31 Construction Management

B.1.2.1 Construction Cost

The SFWMD, as local sponsor for the authorized Central Everglades Planning Project (CEPP) plan, has completed the initial planning and prepared the attached construction cost estimate for the Post Authorization Change Report (PACR). The described in earlier section of this report the PACR was prepared in an effort incorporate some of the projects developed during the CEPP, like increasing the amount of water storage and treatment, and improving conveyance to reduce damaging discharges to the Northern Estuaries and send additional water south to the Everglades.

The CEPP study recommended increments of the following components that were included in CERP. The Component designations below are consistent with the CERP designations in the Yellow Book:

- Everglades Agricultural Storage Reservoirs (Component G)
- WCA 3 Decompartmentalization and Sheetflow Enhancement (Components AA and QQ)

- S-356 Pump Station Modifications (Component FF)
- L-31 N Improvements for Seepage Management (Component V)
- System-wide Operational Changes – Everglades Rain-Driven Operations (Component H)
- Flow to Northwest and Central WCA 3A (Component II)

As authorized, execution of CEPP is expected to deliver approximately 210,000 ac-ft of flow on an average annual basis to the central portion of the Everglades that otherwise would be undesirably discharged to the Northern Estuaries, thus improving ecosystem conditions in the central Everglades and Northern Estuaries.

The scope of the CEPP PACR focuses on the final increments of four specific components of the CERP (the assigned letter refers to its CERP designation):

- Everglades Agricultural Storage Reservoirs (Component G)
- Flow to Northwest and Central WCA 3A (Component II)
- Environmental Water Supply Deliveries to the St. Lucie Estuary (Component C)
- Environmental Water Supply Deliveries to the Caloosahatchee Estuary (Component E)

The CEPP PACR also includes consideration of updated System-wide Operational Changes – Everglades Rain-Driven Operations (Component H). The development of the A-2 Reservoir and the A-2 STA and the associated improvements described in this report are intended to further reduce the damaging discharges from Lake Okeechobee to the Northern Estuaries and redirect flow south to meet the CERP flow goal to the central Everglades.

For the construction costs, unit prices for heavy construction-related work were developed during the ROM cost estimating process and entered into MCACES/MII. The spreadsheet, database and MCACES/MII documents have been internally reviewed. These costs include all major project components categorized under the appropriate CWWBS to the sub-feature level. The Total Project Cost Summary (TPCS) on the Tentatively Selected Plan contains contingencies as noted in the estimate (below) and were determined as a result of the risk analysis.

The earthwork quantities were developed using AutoCAD Civil 3D and cross sections developed for every scenario considered. These quantities were put into a spreadsheet developed in coordination with the SFWMD that used historical costs for land development, excavation and embankment construction for the recently completed A-1 Flow Equalization Basin. In this spreadsheet, some of the individual construction operations were combined to develop crew-unit processes. For example, “Levee Build-up” included multiple operations for the excavation, hauling, dumping, spreading and compaction of material needed to construct the levee.

Earthwork quantity calculations were broken down into individual/crew operation once the data was input into MCACES. Attempts were made to take multiple material handling operations into consideration. For smaller levee/canal cross sections, it was anticipated that the material would be blasted and excavated to form the canal and that the material would be used immediately adjacent to the canal to construct the levee. This would require the material to be handled by large excavators in series to stockpile the material before it is loaded, hauled, dumped, spread and compacted.

For the proposed internal STA levees where canals are not being proposed, the general fill material needed for their construction will need to be excavated from the borrow canals located along the internal perimeter of the project. This material will need to be blasted, excavated, and hauled from the borrow area to the berm construction site. At that point it will be dumped and spread and compacted using large bulldozers. Additional borrow materials are also available at the existing A-1 FEB site (approximately 1 million cubic yards have been processed and stockpiled and are available) for the A-2 project.

For the largest levees/dams being constructed around the perimeter of the reservoir, it is anticipated that the number of excavators, loaders, dump trucks, pans, scrapers, and bulldozers needed will need to be scaled up to accommodate the proposed width and height of the construction. In addition, consideration has to be made for the width of the levee as well as the proposed height. It is also assumed that in some cases there will not be enough material available in the adjacent inflow/outflow canals to build the levee and so material will need to be excavated and hauled from the adjacent borrow canals and/or the existing stockpiles located at the A-1 FEB site. These dams to be constructed with a seepage barrier cutoff wall located under the base of the levee/dam near the center of the cross section. This will require specialty equipment to excavate the trench and mix the cutoff wall material.

The cost estimate does take into consideration the approximately 1 million cubic yards of processed material already stockpiled in the previously constructed A-1 project area located immediate adjacent to this project. In the case of this material the crews used will include load and haul but not need to include excavate and stockpile – which will save some material handling costs. No on-road hauling will be required.

Pricing for the proposed slurry wall, needed to limit seepage under the proposed levees, was provided by a local contractor with experience working on the Lake Okeechobee 70-foot-deep slurry wall. The estimate provided by the contractor is included in the project quantity take-off worksheet package.

The schedule proposes to begin construction at the site with the slurry wall. After the slurry-cutoff wall has been completed the culverts will be constructed followed by levee/dams, which will then be constructed using a combination of excavators, haulers and bulldozers in combination. For this project, the cost for blasting the rock material was assumed to use a blasting pattern that is expected to produce material suitable for the random fill portions of the embankment, and will generally not need to be processed to construct the levees. It is assumed that the bedding stone and other portions of the material will need to be processed and that quantity of material will need to be handled a couple of more times adding to the cost of construction. The levees also include the installation of roller compacted concrete wave run-up barriers on the inside of the levees as well as wave walls at the top of the levee/dam to prevent overtopping should wave run-up occur. Quantity calculations for earthwork associated with levee/dam construction are included in **Attachment B**.

Costs for the culverts, spillways and pumping plant were developed using historical prices during the ROM cost estimating phase using the design type, number of barrels and/or pumps needed and general location. The costs were further developed by estimating the excavation and concrete volumes needed, and using historical District costs for buy-items like the large stainless steel gates and control systems. These costs were developed and combined in coordination with the SFWMD and based on structures of similar capacity and construction currently being operated by the District. Any quantities associated with the construction of these "typical" structures are included in **Attachment B** for reference. They are intended to be used as a guide and as more detailed information related to structure construction is developed, these estimates will be refined. The estimated costs for the project's recreational features were developed during the revised CEPP PACR planning process. The direct cost for each feature were listed and totaled.

B.1.2.2 Non-Construction Cost

Non-construction costs typically include Lands and Damages (Real Estate), Planning/Pre-Construction Engineering & Design (PED), Engineering During Construction (EDC) and Construction Management Costs (Supervision & Administration, S&A). These costs were provided by the SFWMD either as a lump sum cost or as a percentage of the total Construction Contract Cost. Lands and Damages are provided by Real Estate and are best described in the Real Estate Appendix, **Appendix D**. PED costs are for the preparation of contract plans and specifications (P&S) and include itemized costs that were provided by the PDT, as well as percentages for Engineering During Construction (EDC) that were provided by the project manager. Construction Management costs are for the supervision and administration of a contract and include Project Management and Contract Administrationi costs. These costs were provided by the project manager and are included as a percentage of the total construction contract cost.

The main report details both cost allocation and cost apportionment for the Federal Government and the Non-Federal Sponsor. Also included in the main report are the Non-Federal Sponsor's obligations (items of local cooperation).

B.1.3 Plan Formulation Cost Estimates

Unit prices for the remaining major or variable construction elements were developed in MCACES/MII based on input from the SFWMD. Design details, information and assumptions were provided in the Engineering Appendix (**Appendix A**). An abbreviated risk analysis was done to establish the contingency for each of the alternatives. The possibility that a particular feature may indeed not be built, or that its capacity or configuration may indeed be radically altered, is not within the scope of cost risk analysis. The range estimates are based on the scope of work presented with limited design information. The design variances assumed for the cost risk analysis are not within a range that would perceive to change the fundamental nature of the component feature; however, within any project for which design is limited there will be a higher rate at which the contingency will be applied. These factors are largely into play when a project is in its planning phase. As with most risks, mitigating factors such as a more detailed design will reduce these risks and therefore, reduce the contingency. The design data itself cannot be taken as exact. From the standpoint of cost, it must be assumed that a design specific such as levee length is, in fact, the most probable value of a range of values. The cost estimates rely on assumed values for criteria essential for the estimate, but for which there is limited or no engineering data. It should be noted that even with risk mitigation cost should not be swayed. As the design increases with detail, costs go up but the contingency percentage goes down. Costs should be balanced once this takes effect.

B.1.4 Construction Schedule

A construction schedule has been produced by the Cost Engineer and is included in the draft report by utilizing input from the cost development team and reflects all project construction components. The schedule considers not only durations of individual components of construction, but also the timing of construction contracts based on funding and construction windows. The construction schedule was combined with the project schedule to create an overall schedule that will be used for the generation of the TPCS. The construction schedule will change as the project moves through the various project lifecycle phases.

The EAA A-2 project has an accelerated schedule that include three years of design followed by five additional years of construction. Because of this accelerated schedule and in an effort to limit the risks associated with weather and other possible program delays, portions of the proposed construction have been selected to be performed while the project design is still under way. The intent is to complete the design and procurement of these early contracts as the final design of the remaining items of work continue so that they can begin as soon as possible. The two primary construction items that have been moved up, include the construction of the slurry wall and the installation of the project culverts. It is expected that the slurry wall will progress at a pace of approximately 80-100 linear feet per day and this will allow that process to get ahead of levee construction. Relevant experience has also shown that having the culverts in place as the levee construction approaches allows the levee builder to simply construct the levee over the culverts and eliminated the need for him to leave a gap in the levee for culvert construction. The levees are simply built right on top of the culverts without delay or rework.

B.1.5 Total Project Cost Summary

The cost estimate for the TSP is prepared with an identified price level date and escalation is used to adjust the pricing to the project schedule. This estimate is known as the Fully Funded Cost Estimate or Total Project Cost Summary. It includes all Federal and Non-Federal costs: Lands, Easements, Rights of Way and Relocations; Construction features; Preconstruction Engineering and Design; Engineering during Construction, Construction Management; Contingency; and Inflation.

B.1.6 Construction Cost Estimate

An MII cost estimate was produced by the SFWMD contracted engineering firm and reviewed by LEGIS. The estimate was produced using labor, material, equipment and site-specific information obtained from the non-federal sponsor. The estimate is based on the engineering appendix and the assumptions and quantity take offs document. The assumptions and quantity take offs document was produced in collaboration with the non-federal sponsor, SFWMD. Non-construction costs were included as percentages of the total construction contract cost including; Planning, Engineering and Design, Engineering during Construction, Construction Management, supervision and administration and Lands and Damages. . A construction schedule and TPCS was also developed by the Cost Engineer.

Once all reviews and comments were addressed, the estimate and other supporting products were adjusted to account for any changes that affect cost and schedule. The final estimate was reviewed by Legis, Inc. The evaluation results can be found in Annex E of the Post Authorization Report.

B.2 PLAN FORMULATION COST ESTIMATES

TABLE B.2

	SUMMARY OF COSTS FOR EAA-A2 ALTERNATIVE PLANS*			
	240 A	**240 B**	**360 C**	**360 D**
Cost Component				
Construction Features	1,737,000,000	1,756,000,000	2,108,000,000	2,201,000,000
Lands	34,000,000	34,000,000	34,000,000	34,000,000
Total First Cost	1,771,000,000	1,790,000,000	2,142,000,000	2,235,000,000
Interest During Construction				
Construction	106,260,000	107,400,000	128,520,000	134,100,000
Lands	3,740,000	3,740,000	3,740,000	3,740,000
Total Interest During Construction	110,000,000	111,140,000	132,260,000	137,840,000
Total Project Investment	1,881,000,000	2,372,000,000	2,486,000,000	2,343,000,000
Average Annual Cost				
Interest & Amortization	112,860,000	142,320,000	149,160,000	140,580,000
Operation, Maintenance, Repair, Rehabilitation, and Replacement	4,761,000	4,694,000	5,368,000	6,309,000
Average Annual Cost	117,621,000	147,014,000	154,528,000	146,889,000

*Costs are planning level costs from the ROM and do not coincide exactly with the detailed costs of the tentatively selected plan presented in other sections of the report. Computation of the detailed estimate for the recommended plan will be based on additional engineering and design.

B.3 RECOMMENDED PLAN COST ESTIMATE

Please see the following pages for the cost broken down by features.

The EAA A-2 storage project proposes 240,000 ac-ft above-ground reservoir and a 6,500-acre STA, located on the A-2 parcel and A-2 Expansion area, that will work in conjunction with the existing 60,000 ac-ft A-1 FEB, STA-2, and STA-3/4 to meet State water quality standards. The proposed A-2 East Reservoir is 10,500 acres and designed to have a normal full storage water depth of approximately 23 feet.

Estimated by Tetra Tech, Inc.
Designed by Tetra Tech, Inc.
Prepared by Tetra Tech, Inc
Preparation Date 3/1/2018
Effective Date of Pricing 3/1/2018
Estimated Construction Time 2,555 Days

Description	Quantity	UOM	ProjectCost	CostOverride
Project Cost Summary Report			**1,243,356,865**	
			1,243,356,864.66	
Everglades Agricultural Area Storage Reservoir Project	**1.00**	**EA**	**1,243,356,865**	
			44,908,632.09	
CONTRACT 1 - Miami Canal Conveyance Improvements	**1.00**	**EA**	**44,908,632**	
			44,908,632.09	
09 - Channels & Canals	**1.00**	**EA**	**44,908,632**	
			44,908,632.09	
MC: Miami Canal Improvements	**1.00**	**EA**	**44,908,632**	
			23,247,406.28	
CONTRACT 2 - North New River Conveyance Improvements	**1.00**	**EA**	**23,247,406**	
			23,247,406.28	
09 - Channels & Canals	**1.00**	**EA**	**23,247,406**	
			23,247,406.28	
NNRC: North New River Canal Improvements	**1.00**	**EA**	**23,247,406**	
			156,133,466.42	
CONTRACT 3 - Slurry Walls	**1.00**	**EA**	**156,133,466**	
			156,133,466.42	
03 - Reservoirs	**1.00**	**EA**	**156,133,466**	
			52,074,635.78	
F (L): Cut-Off Wall	**1.00**	**EA**	**52,074,636**	
			44,050,938.78	
J-1 (L): Cut-Off Wall	**1.00**	**EA**	**44,050,939**	
			34,295,056.64	
K (L): Cut-Off Wall	**1.00**	**EA**	**34,295,057**	
			25,712,835.22	
L (L): Cut-Off Wall	**1.00**	**EA**	**25,712,835**	
			47,755,670.56	
CONTRACT 4 - Culverts	**1.00**	**EA**	**47,755,671**	
			47,755,670.56	
15 - Floodway Control/Diversion Structures	**1.00**	**EA**	**47,755,671**	
			47,755,670.56	

Description	Quantity	UOM	ProjectCost	CostOverride
Water Control Structures	**1.00**	**EA**	**47,755,671**	
			823,468,430.37	
CONTRACT 5 - A-2 Reservoir and A-2 STA Embankments, Canals and Control Structures (C1-C11 + S1)	**1.00**	**EA**	**823,468,430**	
			745,315,076.14	
03 - Reservoirs	**1.00**	**EA**	**745,315,076**	
			225,027,556.63	
F (L): Levee Construction	**1.00**	**EA**	**225,027,557**	
			208,039,335.54	
J-1 (L): Levee Construction	**1.00**	**EA**	**208,039,336**	
			192,350,384.18	
K (L): Levee Construction	**1.00**	**EA**	**192,350,384**	
			119,494,686.95	
L (L): Levee Construction	**1.00**	**EA**	**119,494,687**	
			403,112.84	
Environmental Controls	**1.00**	**EA**	**403,113**	
			9,547,854.99	
09 - Channels & Canals (Conveyance)	**1.00**	**EA**	**9,547,855**	
			5,073,275.67	
G: Canal Construction	**1.00**	**EA**	**5,073,276**	
			4,474,579.32	
H: Canal Construction	**1.00**	**EA**	**4,474,579**	
			337.19	
11 - Levees & Floodwalls (STA)	**181,238.00**	**EA**	**61,110,746**	
			4,613,369.27	
A: Levee Construction	**1.00**	**EA**	**4,613,369**	
			567,089.90	
B-1: Levee Construction	**1.00**	**EA**	**567,090**	
			17,937,823.22	
C: Levee Construction	**1.00**	**EA**	**17,937,823**	
			26,633,293.63	
E: Levee Construction	**1.00**	**EA**	**26,633,294**	
			2,146,869.36	

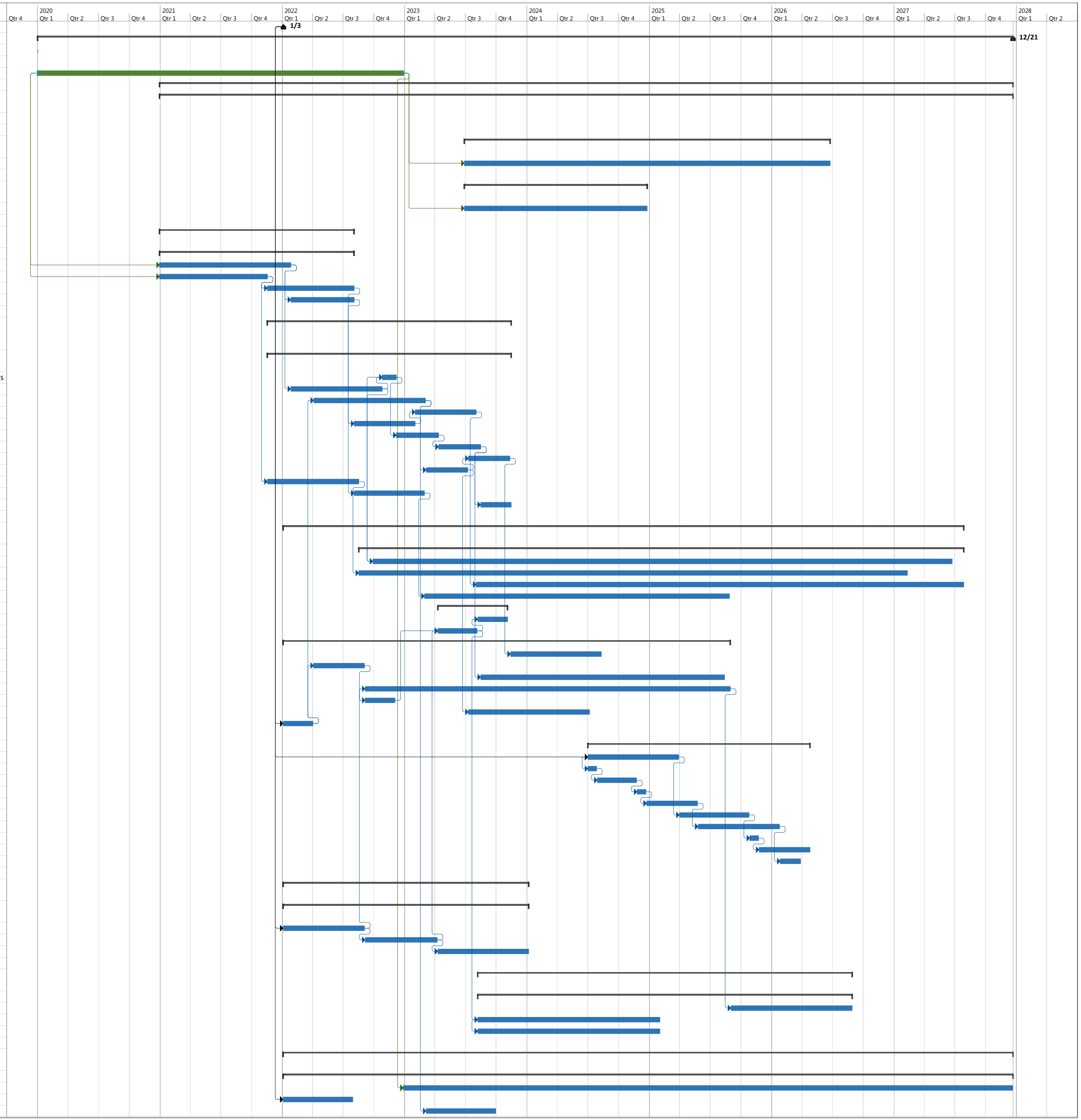
Description	Quantity	UOM	ProjectCost	CostOverride
N: Levee Construction	**1.00**	**EA**	**2,146,869**	
			9,212,300.66	
N-1: Levee Construction	**1.00**	**EA**	**9,212,301**	
14 - Recreational Facilities	**1.00**	**LS**	**7,494,753**	
			3,302,859.52	
REC Site A	**1.00**	**EA**	**3,302,860**	
			47,323.54	
REC Site B	**1.00**	**EA**	**47,324**	
			352,420.76	
REC Site C	**1.00**	**EA**	**352,421**	
			45,736.47	
REC Site D	**1.00**	**EA**	**45,736**	
			480,625.52	
REC Site E	**1.00**	**EA**	**480,626**	
			1,136,544.45	
REC Site F	**1.00**	**EA**	**1,136,544**	
			1,503,474.89	
REC Site G	**1.00**	**EA**	**1,503,475**	
			66,137.36	
REC Site H	**1.00**	**EA**	**66,137**	
			453,526.26	
REC Site I	**1.00**	**EA**	**453,526**	
			106,104.43	
REC Site J	**1.00**	**EA**	**106,104**	
			24,435,377.03	
CONTRACT 6 - Gated Spillways Construction (S-2, S-3 and S-4)	**1.00**	**EA**	**24,435,377**	
			24,435,377.03	
15 - Floodway Control/Diversion Structures	**1.00**	**EA**	**24,435,377**	
			24,435,377.03	
Water Control Structures	**1.00**	**EA**	**24,435,377**	
			11,507,664.77	
CONTRACT 7 - Bridges	**1.00**	**EA**	**11,507,665**	

Description	Quantity	UOM	ProjectCost	CostOverride
			11,507,664.77	
08 - Roads, Railroads & Bridges	**1.00**	**EA**	**11,507,665**	
			2,581,391.32	
USR B-1: Bridge (2-Lane)	**1.00**	**EA**	**2,581,391**	
			4,881,239.51	
USR B-2: Bridge (2-Lane)	**1.00**	**EA**	**4,881,240**	
			4,045,033.94	
USR B-3: Bridge (2-Lane)	**1.00**	**EA**	**4,045,034**	
			111,900,217.14	
CONTRACT 8 - Pumping Plants	**1.00**	**EA**	**111,900,217**	
			111,900,217.14	
13 - Pumping Plants	**1.00**	**EA**	**111,900,217**	
			102,099,988.42	
P-1: Pump Station (4,600 CFS)	**1.00**	**EA**	**102,099,988**	
			4,494,586.13	
G-200: Pump Station Relocation (300 CFS)	**1.00**	**EA**	**4,494,586**	
			5,305,642.58	
P-2: Pump Station for Agricultural Systems (300 CFS)	**1.00**	**EA**	**5,305,643**	

B.4 SCHEDULE

Please see the attached for the construction schedule derived based on an eight-year project life that includes three-years of project development, planning and engineering and five-years of construction with portions of the work beginning early and the final two-years of planning and the first two-years of construction overlapping. The attached schedule considers productivity estimates for excavation, civil construction works, recreation, construction contract durations, non-construction contract durations, monitoring and other mitigation measures.

ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors
1			**Original Construction Start Date (6-years)**	**1 day**	**Mon 1/3/22**	**Mon 1/3/22**	
2			**General**	**2080 days**	**Wed 1/1/20**	**Tue 12/21/27**	
3			**01 - Lands & Damages**				
6			02 - Relocations				
7			30 - Planning, Engineering & Design	156 wks	Wed 1/1/20	Tue 12/27/22	
8			**31 - Construction Management**	**1820 days**	**Wed 12/30/20**	**Tue 12/21/27**	
17			**06 - Fish and Wildlife (Monitoring & Adaptive Management)**	**1820 days**	**Wed 12/30/20**	**Tue 12/21/27**	
26							
27							
28			**CONTRACT 1 - Miami Canal Conveyance Improvements**	**780 days**	**Wed 6/28/23**	**Tue 6/23/26**	
29			MC: Canal	156 wks	Wed 6/28/23	Tue 6/23/26	7FS+26 wks
30							
31			**CONTRACT 2 - North New River Conveyance Improvements**	**390 days**	**Wed 6/28/23**	**Tue 12/24/24**	
32			NNR: Canal	78 wks	Wed 6/28/23	Tue 12/24/24	7FS+26 wks
33							
34			**CONTRACT 3 - A-2 Reservoir Levee Embankment Slurry Walls**	**415 days**	**Wed 12/30/20**	**Tue 8/2/22**	
35			**03 - Reservoirs**	**415 days**	**Wed 12/30/20**	**Tue 8/2/22**	
36			F(L): Slurry	56 wks	Wed 12/30/20	Tue 1/25/22	7SS+52 wks
37			J-1(L): Slurry	46 wks	Wed 12/30/20	Tue 11/16/21	7SS+52 wks
38			K(L): Slurry	37 wks	Wed 11/17/21	Tue 8/2/22	37
39			L(L): Slurry	27 wks	Wed 1/26/22	Tue 8/2/22	36
40							
41			**CONTRACT 4 - A-2 Reservoir and A-2 STA Culvert and Spillway (S-1, C-1 through C-11)**	**520 days**	**Wed 11/17/21**	**Tue 11/14/23**	
42			**15 - Floodway Control/Diversion Structures**	**520 days**	**Wed 11/17/21**	**Tue 11/14/23**	
43			S-1: Overflow	6 wks	Wed 10/26/22	Tue 12/6/22	44,58SS+4 wks
44			C-1: 4-Gated Box Culvert 385LF	39 wks	Wed 1/26/22	Tue 10/25/22	36
45			C-2: 2-Ungated Box Culvert 642LF	48 wks	Mon 4/4/22	Fri 3/3/23	72
46			C-3: 2-Gated Box Culvert 370LF	26 wks	Wed 2/1/23	Tue 8/1/23	47
47			C-4: 2-Gated Box Culvert 370LF	26 wks	Wed 8/3/22	Tue 1/31/23	38
48			C-5: 2-Gated Box Culvert 208LF	18 wks	Wed 12/7/22	Tue 4/11/23	43
49			C-6: 2-Gated Box Culvert 208LF	18 wks	Wed 4/12/23	Tue 8/15/23	48
50			C-7: 2-Gated Box Culvert 208LF	18 wks	Mon 7/10/23	Fri 11/10/23	51
51			C-8: 2-Gated Box Culvert 208LF	18 wks	Mon 3/6/23	Fri 7/7/23	45
52			C-9: 4-Gated Box Culvert 374LF	39 wks	Wed 11/17/21	Tue 8/16/22	37
53			C-10: 3-Gated Box Culvert 320LF	30 wks	Wed 8/3/22	Tue 2/28/23	39
54			C-11: CAP Culvert 225LF	13 wks	Wed 8/16/23	Tue 11/14/23	49
55							
56			**CONTRACT 5 - A-2 Reservoir and A-2 STA Embankments and Canals**	**1452 days**	**Mon 1/3/22**	**Tue 7/27/27**	
57			**03 - Reservoirs**	**1290 days**	**Wed 8/17/22**	**Tue 7/27/27**	
58			F(L): Levee	247 wks	Wed 9/28/22	Tue 6/22/27	44FS-4 wks
59			J-1(L): Levee	234 wks	Wed 8/17/22	Tue 2/9/27	52
60			K(L): Levee	208 wks	Wed 8/2/23	Tue 7/27/27	46
61			L(L): Levee	130 wks	Wed 3/1/23	Tue 8/26/25	53
62			**09 - Channels & Canals (Conveyance)**	**150 days**	**Mon 4/10/23**	**Fri 11/3/23**	
63			G: Canal	13 wks	Mon 8/7/23	Fri 11/3/23	64
64			H: Canal	17 wks	Mon 4/10/23	Fri 8/4/23	70,88
65			**11 - Channels & Canals (STA)**	**955 days**	**Mon 1/3/22**	**Fri 8/29/25**	
66			A: Levee	39 wks	Mon 11/13/23	Fri 8/9/24	50
67			B-1: Levee	22 wks	Mon 4/4/22	Fri 9/2/22	72
68			C: Levee	104 wks	Wed 8/16/23	Tue 8/12/25	49
69			E: Levee	156 wks	Mon 9/5/22	Fri 8/29/25	87
70			N: Levee	13 wks	Mon 9/5/22	Fri 12/2/22	67
71			N-1: Levee	52 wks	Mon 7/10/23	Fri 7/5/24	51
72			CP-1: Canal Plug/Demo G-200/ConstructC-2	13 wks	Mon 1/3/22	Fri 4/1/22	1SS
73			**14 - Recreational Facilities**	**475 days**	**Mon 7/1/24**	**Fri 4/24/26**	
74			Site A:	39 wks	Mon 7/1/24	Fri 3/28/25	1SS+130 wks
75			Site B:	4 wks	Mon 7/1/24	Fri 7/26/24	74SS
76			Site C:	17 wks	Mon 7/29/24	Fri 11/22/24	75
77			Site D:	4 wks	Mon 11/25/24	Fri 12/20/24	76
78			Site E:	22 wks	Mon 12/23/24	Fri 5/23/25	77
79			Site F:	30 wks	Mon 3/31/25	Fri 10/24/25	74
80			Site G:	35 wks	Mon 5/26/25	Fri 1/23/26	78
81			Site H:	4 wks	Mon 10/27/25	Fri 11/21/25	79
82			Site I:	22 wks	Mon 11/24/25	Fri 4/24/26	81
83			Site J:	9 wks	Mon 1/26/26	Fri 3/27/26	80
84							
85			**CONTRACT 6 - Gated Spillways Construction (S-2, S-3 and S-4)**	**525 days**	**Mon 1/3/22**	**Fri 1/5/24**	
86			**15 - Floodway Control/Diversion Structures**	**525 days**	**Mon 1/3/22**	**Fri 1/5/24**	
87			S-2: 3,000 CFS Spillway	35 wks	Mon 1/3/22	Fri 9/2/22	1SS
88			S-3: 2,300 CFS Spillway	31 wks	Mon 9/5/22	Fri 4/7/23	87
89			S-4: 4,000 CFS Spillway	39 wks	Mon 4/10/23	Fri 1/5/24	88
90							
91			**CONTRACT 7 - Bridges; U.S. 27 Bridges and L-23 Bridge (B-1, B-2 and B-3)**	**800 days**	**Mon 8/7/23**	**Fri 8/28/26**	
92			**08 - Roads, Railroads & Bridges**	**800 days**	**Mon 8/7/23**	**Fri 8/28/26**	
93			B-1: Bridge (2-Lane)	52 wks	Mon 9/1/25	Fri 8/28/26	69
94			B-2: Bridge (2-Lane)	78 wks	Mon 8/7/23	Fri 1/31/25	64
95			B-3: Bridge (2-Lane)	78 wks	Mon 8/7/23	Fri 1/31/25	94SS
96							
97			**CONTRACT 8 - A-2 Reservoir Pump Station (P-1)**	**1557 days**	**Mon 1/3/22**	**Tue 12/21/27**	
98			**13 - Pumping Plant**	**1557 days**	**Mon 1/3/22**	**Tue 12/21/27**	
99			P-1: Pump Station (4,600 CFS)	260 wks	Wed 12/28/22	Tue 12/21/27	7
100			P-2: Pump Station (300 CFS)	30 wks	Mon 1/3/22	Fri 7/29/22	1SS
101			G-200: Pump Station (300 CFS)	30 wks	Mon 3/6/23	Fri 9/29/23	45



B.5 RISK AND UNCERTAINTY ANALYSIS

The Risk Analysis was conducted according to the procedures outlined in the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 Civil Works Cost Engineering, dated September 15, 2008.
- Engineer Technical Letter (ETL) Construction Cost Estimating Guide for Civil Works, dated September 30, 2008.

B.5.1 Risk Analysis Methods

The risk register is a tool being used in the Pilot Planning Program as a means to identify, discuss and document issues early in the process. A risk register was developed by the study team to identify significant risks attributed to the shortened study period and to project success. In addition, a Cost and Schedule Risk Analysis was conducted specific to the project costs and schedule, that is separate from the study risk register and that results in contingency values that are applied to the project costs to set a total project cost. The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve the desired level of cost confidence. The risks were listed in the risk register, which is a tool commonly used in project planning and risk analysis, and evaluated by the PDT. The actual Risk Register is provided. Assumptions were made as to the likelihood and impact of each risk item, as well as the probability of occurrence and magnitude of the impact if it were to occur. A Risk model was developed for the initial construction and other co-main events using the Oracle Crystal Ball Risk Analysis software using the Monte Carlo Model in order to develop contingencies to apply to the project cost. The models were structured based on the CWWBS for the project and provide a contingency for each of the feature codes.

Risks were evaluated for the following features of work:

- 01 Lands and Damages
- 03 Reservoirs
- 06 Fish & Wildlife Facilities
- 08 Roads, Railroads, and Bridges
- 09 Channels and Canals
- 11 Levees and Floodwalls
- 13 Pumping Plant
- 14 Recreation Facilities
- 15 Floodway Control-Diversion Structures
- 18 Cultural Resource Preservation
- 30 Planning, Engineering and Design
- 31 Construction Management

After the Risk model was run, the results were reviewed and all parameters were reevaluated by the project development team as a sanity check of assumptions and inputs. Adjustments were made to the analyses accordingly and the final contingencies were established. The contingencies were applied to the recommended plan estimate in the Total Project Cost Summary in order to obtain the Fully Funded Cost.

B.5.2 Risk Analysis Results

Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation.

Risk Determination: An abbreviated Cost and Schedule Risk Analysis method was applied to determine contingencies for the alternatives estimates. To iterate, the amount of design information, when limited, directly correlates with higher than average contingency percentages. Please see attachment A for the results of the Risk Analysis.

B.6 TOTAL PROJECT COST SUMMARY

The TPCS addresses inflation through project completion (accomplished by escalation to mid-point of construction per ER 1110-2-1302, Appendix C, and Page C-2). It is based on the scope of the Recommended Plan and the official project schedule. The TPCS includes Federal and Non-Federal Costs for Lands and Damages, all construction features, PED, S&A, along with the appropriate contingencies and escalation associated with each of these activities. The TPCS is formatted according to the CWWBS and uses Civil Works Construction Cost Indexing System (CWCCIS) factors for escalation (EM 1110-2-1304) of construction costs and Office of Management and Budget (EC 11-2-18X, 20 Flow Equalization Basin 2008) factors for escalation of PED and S&A costs.

The Total Project Cost Summary was prepared using the MCACES/MII cost estimate on the Recommended Plan, as well as the contingencies set by the risk analysis and the official project schedule.

B.6.1 Total Project Cost Summary Spreadsheet

Refer to the TPCS below.

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Central Everglades Planning Project PAC Report**
PROJECT NO: 0
LOCATION: Central and Southern Florida

DISTRICT: Jacksonville District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 3/12/2018

This Estimate reflects the scope and schedule in report; Central Everglades Planning Project PAC Report

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC): 2019 Effective Price Level Date: 1 OCT 18									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **1-Oct-17** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
03	RESERVOIRS	$901,449	$306,493	34.0%	$1,207,941	2.1%	$919,951	$312,783	$1,232,734	$0	$1,232,734	12.6%	$1,036,013	$352,245	$1,388,258
06	FISH & WILDLIFE FACILITIES	$72,516	$31,907	44.0%	$104,423	0.0%	$72,516	$31,907	$104,423	$0	$104,423	29.4%	$93,808	$41,275	$135,083
08	ROADS, RAILROADS & BRIDGES	$11,508	$3,913	34.0%	$15,420	2.1%	$11,744	$3,993	$15,737	$0	$15,737	12.6%	$13,225	$4,497	$17,722
09	CHANNELS & CANALS	$193,681	$77,449	40.0%	$271,130	2.1%	$197,654	$79,038	$276,692	$0	$276,692	22.9%	$242,409	$97,730	$340,139
11	LEVEES & FLOODWALLS	$192,292	$78,497	40.8%	$270,789	2.1%	$196,238	$80,108	$276,347	$0	$276,347	24.3%	$243,411	$100,078	$343,488
13	PUMPING PLANT	$176,147	$66,315	37.6%	$242,462	2.1%	$179,761	$67,675	$247,436	$0	$247,436	19.0%	$213,420	$81,044	$294,464
14	RECREATION FACILITIES	$7,495	$2,548	34.0%	$10,043	2.1%	$7,649	$2,600	$10,249	$0	$10,249	12.6%	$8,614	$2,929	$11,542
15	FLOODWAY CONTROL & DIVERSION STRU	$212,021	$86,070	40.6%	$298,091	2.1%	$216,373	$87,837	$304,209	$0	$304,209	23.9%	$267,566	$109,432	$376,998
18	CULTURAL RESOURCE PRESERVATION	$18,065	$7,949	44.0%	$26,014	2.1%	$18,436	$8,112	$26,547	$0	$26,547	29.4%	$23,848	$10,493	$34,342
	CONSTRUCTION ESTIMATE TOTALS:	$1,785,173	$661,140	37.0%	$2,446,313	2.0%	$1,820,320	$674,053	$2,494,374	$0	$2,494,374	17.9%	$2,142,314	$799,722	$2,942,036
01	LANDS AND DAMAGES	$35,328	$15,544	44.0%	$50,872	2.1%	$36,053	$15,863	$51,916	$0	$51,916	1.0%	$36,416	$16,023	$52,439
30	PLANNING, ENGINEERING & DESIGN	$259,790	$101,874	39.2%	$361,664	3.9%	$269,806	$105,802	$375,608	$0	$375,608	13.7%	$306,346	$120,537	$426,882
31	CONSTRUCTION MANAGEMENT	$132,291	$50,126	37.9%	$182,417	3.9%	$137,391	$52,059	$189,450	$0	$189,450	46.5%	$200,165	$77,355	$277,519
	PROJECT COST TOTALS:	$2,212,581	$828,685	37.5%	$3,041,266		$2,263,571	$847,777	**$3,111,348**	$0	**$3,111,348**	18.9%	$2,685,240	$1,013,637	$3,698,877

_________________________ **CHIEF, COST ENGINEERING, xxx**

_________________________ **PROJECT MANAGER, xxx**

_________________________ **CHIEF, REAL ESTATE, xxx**

_________________________ **CHIEF, PLANNING, xxx**

_________________________ **CHIEF, ENGINEERING, xxx**

_________________________ **CHIEF, OPERATIONS, xxx**

_________________________ **CHIEF, CONSTRUCTION, xxx**

_________________________ **CHIEF, CONTRACTING,xxx**

_________________________ **CHIEF, PM-PB, xxxx**

_________________________ **CHIEF, DPM, xxx**

ESTIMATED TOTAL PROJECT COST: $3,698,877

**** TOTAL PROJECT COST SUMMARY ****

ITEMS FROM ORIGINAL CEPP AUTHROIZED PROJECT (MINUS FEB)

**** CONTRACT COST SUMMARY ****

PROJECT: Central Everglades Planning Project PAC Report
LOCATION: Central and Southern Florida
This Estimate reflects the scope and schedule in report; Central Everglades Planning Project PAC Report

DISTRICT: Jacksonville District
POC: CHIEF, COST ENGINEERING, xxx
PREPARED: 3/12/2018

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			12-Mar-18 / 1-Oct-17	Program Year (Budget EC): / Effective Price Level Date:			2019 / 1 OCT 18					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	REMAINING CEPP COSTS													
03	RESERVOIRS	$0	$0	44.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
06	FISH & WILDLIFE FACILITIES	$72,516	$31,907	44.0%	$104,423	0.0%	$72,516	$31,907	$104,423	2032Q1	29.4%	$93,808	$41,275	$135,083
08	ROADS, RAILROADS & BRIDGES	$0	$0	44.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
09	CHANNELS & CANALS	$115,977	$51,030	44.0%	$167,007	2.1%	$118,356	$52,077	$170,433	2032Q1	29.4%	$153,107	$67,367	$220,474
11	LEVEES & FLOODWALLS	$131,181	$57,720	44.0%	$188,901	2.1%	$133,873	$58,904	$192,778	2032Q1	29.4%	$173,178	$76,198	$249,377
13	PUMPING PLANT	$64,247	$28,269	44.0%	$92,516	2.1%	$65,565	$28,849	$94,414	2032Q1	29.4%	$84,816	$37,319	$122,134
14	RECREATION FACILITIES	$0	$0	44.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
15	FLOODWAY CONTROL & DIVERSION STRU	$139,830	$61,525	44.0%	$201,355	2.1%	$142,700	$62,788	$205,488	2032Q1	29.4%	$184,598	$81,223	$265,821
18	CULTURAL RESOURCE PRESERVATION	$18,065	$7,949	44.0%	$26,014	2.1%	$18,436	$8,112	$26,547	2032Q1	29.4%	$23,848	$10,493	$34,342
	CONSTRUCTION ESTIMATE TOTALS:	$541,816	$238,399	44.0%	**$780,215**		$551,446	$242,636	$794,082			$713,355	$313,876	$1,027,231
01	LANDS AND DAMAGES	$35,328	$15,544	44.0%	$50,872	2.1%	$36,053	$15,863	$51,916	2019Q3	1.0%	$36,416	$16,023	$52,439
30	PLANNING, ENGINEERING & DESIGN													
2.0%	Project Management	$10,836	$4,768	44.0%	$15,604	3.9%	$11,254	$4,952	$16,206	2019Q3	2.1%	$11,485	$5,054	$16,539
2.0%	Planning & Environmental Compliance	$10,836	$4,768	44.0%	$15,604	3.9%	$11,254	$4,952	$16,206	2019Q3	2.1%	$11,485	$5,054	$16,539
10.0%	Engineering & Design	$54,182	$23,840	44.0%	$78,022	3.9%	$56,271	$24,759	$81,030	2019Q3	2.1%	$57,427	$25,268	$82,695
2.0%	Reviews, ATRs, IEPRs, VE	$10,836	$4,768	44.0%	$15,604	3.9%	$11,254	$4,952	$16,206	2019Q3	2.1%	$11,485	$5,054	$16,539
2.0%	Life Cycle Updates (cost, schedule, risks)	$10,836	$4,768	44.0%	$15,604	3.9%	$11,254	$4,952	$16,206	2019Q3	2.1%	$11,485	$5,054	$16,539
1.0%	Contracting & Reprographics	$5,418	$2,384	44.0%	$7,802	3.9%	$5,627	$2,476	$8,103	2019Q3	2.1%	$5,743	$2,527	$8,269
3.0%	Engineering During Construction	$16,254	$7,152	44.0%	$23,406	3.9%	$16,881	$7,428	$24,309	2032Q1	73.9%	$29,364	$12,920	$42,284
2.0%	Planning During Construction	$10,836	$4,768	44.0%	$15,604	3.9%	$11,254	$4,952	$16,206	2032Q1	73.9%	$19,576	$8,613	$28,189
0.0%	Adaptive Management & Monitoring	$0	$0	44.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$5,418	$2,384	44.0%	$7,802	3.9%	$5,627	$2,476	$8,103	2019Q3	2.1%	$5,743	$2,527	$8,269
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	$40,636	$17,880	44.0%	$58,516	3.9%	$42,203	$18,569	$60,772	2032Q1	73.9%	$73,410	$32,300	$105,710
1.0%	Project Operation:	$5,418	$2,384	44.0%	$7,802	3.9%	$5,627	$2,476	$8,103	2032Q1	73.9%	$9,788	$4,307	$14,095
1.0%	Project Management	$5,418	$2,384	44.0%	$7,802	3.9%	$5,627	$2,476	$8,103	2032Q1	73.9%	$9,788	$4,307	$14,095
	CONTRACT COST TOTALS:	$764,071	$336,191		$1,100,262		$781,633	$343,918	**$1,125,551**			$1,006,550	$442,882	**$1,449,432**

NEW STORAGE RESERVOIR PROJECT COSTS **** CONTRACT COST SUMMARY ****

PROJECT: Central Everglades Planning Project PAC Report
LOCATION: Central and Southern Florida
This Estimate reflects the scope and schedule in report; Central Everglades Planning Project PAC Report

DISTRICT: Jacksonville District
POC: CHIEF, COST ENGINEERING, xxx
PREPARED: 3/12/2018

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			12-Mar-18 / 1-Oct-17	Program Year (Budget EC): / Effective Price Level Date:			2019 / 1 OCT 18					
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Mid-Point Date P	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
	EAA STORAGE RESERVOIR													
03	RESERVOIRS	$901,449	$306,493	34.0%	$1,207,941	2.1%	$919,951	$312,783	$1,232,734	2025Q1	12.6%	$1,036,013	$352,245	$1,388,258
06	FISH & WILDLIFE FACILITIES	$0	$0	34.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
08	ROADS, RAILROADS & BRIDGES	$11,508	$3,913	34.0%	$15,420	2.1%	$11,744	$3,993	$15,737	2025Q1	12.6%	$13,225	$4,497	$17,722
09	CHANNELS & CANALS	$77,704	$26,419	34.0%	$104,123	2.1%	$79,298	$26,961	$106,259	2025Q1	12.6%	$89,302	$30,363	$119,665
11	LEVEES & FLOODWALLS	$61,111	$20,778	34.0%	$81,888	2.1%	$62,365	$21,204	$83,569	2025Q1	12.6%	$70,233	$23,879	$94,112
13	PUMPING PLANT	$111,900	$38,046	34.0%	$149,946	2.1%	$114,196	$38,827	$153,022	2025Q1	12.6%	$128,604	$43,725	$172,330
14	RECREATION FACILITIES	$7,495	$2,548	34.0%	$10,043	2.1%	$7,649	$2,600	$10,249	2025Q1	12.6%	$8,614	$2,929	$11,542
15	FLOODWAY CONTROL & DIVERSION STRU	$72,191	$24,545	34.0%	$96,736	2.1%	$73,673	$25,049	$98,721	2025Q1	12.6%	$82,968	$28,209	$111,177
18	CULTURAL RESOURCE PRESERVATION	$0	$0	34.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,243,357	$422,741	34.0%	**$1,666,098**		$1,268,874	$431,417	$1,700,291			$1,428,959	$485,846	$1,914,805
01	LANDS AND DAMAGES	$0	$0	34.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$12,434	$4,227	34.0%	$16,661	3.9%	$12,913	$4,390	$17,303	2021Q1	8.5%	$14,007	$4,762	$18,769
1.0%	Planning & Environmental Compliance	$12,434	$4,227	34.0%	$16,661	3.9%	$12,913	$4,390	$17,303	2021Q1	8.5%	$14,007	$4,762	$18,769
5.0%	Engineering & Design	$62,168	$21,137	34.0%	$83,305	3.9%	$64,565	$21,952	$86,517	2021Q1	8.5%	$70,035	$23,812	$93,847
0.5%	Reviews, ATRs, IEPRs, VE	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2021Q1	8.5%	$7,003	$2,381	$9,385
0.5%	Life Cycle Updates (cost, schedule, risks)	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2021Q1	8.5%	$7,003	$2,381	$9,385
0.5%	Contracting & Reprographics	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2021Q1	8.5%	$7,003	$2,381	$9,385
0.5%	Engineering During Construction	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2025Q1	27.7%	$8,245	$2,803	$11,048
0.5%	Planning During Construction	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2025Q1	27.7%	$8,245	$2,803	$11,048
0.0%	Adaptive Management & Monitoring	$0	$0	34.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.5%	Project Operations	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2021Q1	8.5%	$7,003	$2,381	$9,385
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$62,168	$21,137	34.0%	$83,305	3.9%	$64,565	$21,952	$86,517	2025Q1	27.7%	$82,445	$28,031	$110,477
0.5%	Project Operation:	$6,217	$2,114	34.0%	$8,330	3.9%	$6,456	$2,195	$8,652	2025Q1	27.7%	$8,245	$2,803	$11,048
1.0%	Project Management	$12,434	$4,227	34.0%	$16,661	3.9%	$12,913	$4,390	$17,303	2025Q1	27.7%	$16,489	$5,606	$22,095
	CONTRACT COST TOTALS:	$1,448,511	$492,494		$1,941,004		$1,481,938	$503,859	**$1,985,797**			$1,678,690	$570,755	**$2,249,444**

ATTACHMENT A: PROJECT RISK MANAGEMENT PLAN with COST AND SCHEDULE RISK ANALYSIS REPORT

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Central Everglades Planning Project (CEPP)
Post Authorized Change Report (PACR)

Cost and Schedule Risk Analysis Report

12 March 2018

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EXECUTIVE SUMMARY

This report presents a recommendation for the total construction cost and schedule contingency for the *Central Everglades Planning Project (CEPP), Post Authorization Change Report (PACR)*. A formal risk analysis study was completed for the original CEPP authorized project. That risk analysis was used a basis for the risk analysis within this document for the new construction elements developed in the PACR.

Thus, this document only pertains to the costs, schedule and risks associated with the new elements of the PACR. The new element is the Everglades Agricultural Area (EAA) Storage Reservoir Project. The cost and schedule risk analysis involved the development of project contingencies by identifying and evaluating the impacts of project uncertainties on the construction cost and schedule and a subsequent calculation of the estimated total construction cost of the new Reservoir.

Project Delivery Team (PDT) members reviewed the existing CEPP risk register, and provided notes and comments detailing deletions, changes and additions to the risk register. The risk analysis was performed using Oracle Crystal Ball software to estimate a contingency with the use of Monte Carlo simulations in correlation with the proposed risks and uncertainties.

The contingency is based on an 80 percent (P80) confidence level, per accepted U.S. Army Corps of Engineers guidance. For the reservoir work only, the most likely baseline construction cost is estimated at $1,448,511,000 (Table ES-1). The risk analysis resulted in a contingency value of $492,493,740 which equates to approximately 34.00 percent of construction costs.

Table ES1 – Contingency Summary

Contingency on Baseline Cost Estimate	80% Confidence Project Cost
Baseline Estimated Cost (Most Likely) ->	**$1,448,511,000**
Baseline Estimated Cost Contingency Amount ->	$492,493,740
Baseline Estimated Construction Cost (80% Confidence) ->	**$1,941,004,740**

Contingency on Schedule	80% Confidence Project Schedule
Project Schedule Duration (Most Likely) ->	**97.0 Months**
Schedule Contingency Duration ->	28.1 Months
Project Schedule Duration (80% Confidence) ->	**125.1 Months**

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS
An analysis of the relative impact of the key cost drivers on the cost and schedule contingency indicates that following risks result in the most impact on the overall project contingency:

- Cost Risks:
    - CA-1: large project size / multiple – Most likely due to the large size of the project, there will be multiple smaller contracts. Coordination and sequencing may change significantly as the project progresses. Large number of crews are likely required which could max out space available for construction.
    - ET-5: estimate assumptions / like similar costs – Some large cost features were estimated using similar costs from other projects or sources. Significant assumptions had to be made by the estimators in order to develop costs for these items.
    - PM-4: funding profile – Project implementation is dependent on both the federal and local sponsors being able to meet financial obligations for the project. The cost sharing agreement between sponsors will need to be developed, and project progress would be dependent on the ability of the partners to contribute according to current assumptions.
- Schedule Risks:
    - PM-4: funding profile – As referenced in the costs risk, project implementation is dependent on both the federal and local sponsors being able to meet financial obligations for the project. The cost sharing agreement between sponsors will need to be developed, and project progress would be dependent on the ability of the partners to contribute according to current assumptions.
    - CA-1: large project size / multiple – Most likely due to the large size of the project, there will be multiple smaller contracts. Coordination and sequencing may change significantly as the project progresses. The schedule could change based on actual implementation. Large number of crews are likely required which could max out space available for construction.
    - PM-3: PED start date - fiscal year 2019 is the earliest authorization would occur. However this could change depending on next WRDAs actual issuance, which could delay the start of the PED phase.

The key recommendations from this study are the implementation of the calculated cost and schedule contingencies, along with continued study of key risk components as the project progresses to final design. This will enable the PDT to efficiently manage and maintain possible risks that could impact either costs or schedule durations.

1. PURPOSE

A cost and schedule risk analysis (CSRA) was conducted to develop a reliable and defensible contingency factor for the construction cost estimate developed for the *Central Everglades Planning Project (CEPP), Post Authorization Change Report (PACR)* project with the use of the Micro-Computer Aided Estimating System (MII). The contingency factors for both cost and schedule was calculated at the 80 percent confidence level as recommended by U.S. Army Corps of Engineers (USACE) guidance (2009). The contingency was calculated in terms of dollars for the cost analysis and in terms of months for the schedule analysis.

2. BACKGROUND`

The original CEPP project was directed at improving, quality, timing, and distribution of water flows to several key estuaries, everglades and bays throughout central and southern Florida. The proposed PACR design is directed at the same improvements, but has switched out a flow equalization basin (FEB) for a larger storage reservoir. This risk report focuses solely on the newly proposed Everglades Agricultural Area (EAA) Storage Reservoir and the risks and uncertainties for this project element.

3. REPORT SCOPE

The scope of this CSRA report is the calculation and presentation of cost and schedule contingencies at the 80 percent confidence level for the newly proposed storage reservoir, using the risk analysis processes mandated by USACE Engineer Regulation (ER) 1110-2-1150, ER 1110-2-1302, and Engineer Technical Letter 1110-2-573 (USACE 1999, 2008a, 2008b). The report presents the contingency results for cost risks for all project features. The study excluded a consideration of operation and maintenance and life cycle costs.

3.1 Project Scope

The formal process included involvement of the PDT for risk identification and the development of the risk register. The CEPP risk register was used as a starting point for this analysis, and PDT members reviewed, and made changes to the risk register to reflect risks solely attributable to the new storage reservoir.

The analysis process evaluated the Micro Computer Aided Cost Estimating System (MCACES) cost estimate, project schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL 1110-2-573) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The construction estimate and schedule for the EAA Storage Reservoir, served as the basis for the risk analysis for the construction cost estimate.

3.2 USACE Risk Analysis Process

The risk analysis process used in this study follows the USACE Headquarters requirements as well as guidance from the Cost Engineering Directory of Expertise for Civil Works. It uses probabilistic CSRA methods within the framework of the Oracle Crystal Ball software. The results of a risk analysis are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. The scope of the report includes the identification of important steps, rationale, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

The risk analysis results discussed in this report are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, a CSRA should be considered an ongoing process that is conducted concurrently and iteratively with other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to satisfying broadly defined risk analysis standards and recommended practices, this risk analysis was performed in accordance with the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Guidance USACE (2009)
- Memorandum from Major General Don T. Riley, U.S. Army Director of Civil Works (USACE 2007a)
- Engineering and Construction Bulletin 2007-17 (USACE 2007b)
- Engineer Regulation 1110-2-1150 (USACE 1999)
- Engineer Regulation 1110-2-1302 (USACE 2008a)
- Engineer Technical Letter 1110-2-573 (USACE 2008b)

4. METHODOLOGY/PROCESS

The risk analysis team received cost support from the cost engineer as well as coordination support from project management and the assigned PDT. The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve the desired level of confidence related to project cost.

Contingency is defined as an amount added to an estimate to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs or additional time. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept the risk of project overruns. The less risk that project leadership is willing to accept, the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering District guidance for CSRA generally focuses on the 80 percent level of confidence (P80) for cost contingency calculation. The use of P80 as a decision criterion is a risk-averse approach (whereas the use of P50 is considered a risk-neutral approach, and the use of levels less than 50 percent is considered a risk-seeking approach). Thus, the use of a P80 confidence level results in a greater contingency relative to that resulting from a P50 confidence level. The selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's district and/or division management.

The risk analysis process uses Monte Carlo techniques to determine probabilities and contingency. The Monte Carlo techniques are facilitated computationally by a commercially available risk analysis software package (Oracle Crystal Ball), which is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format. In functional terms, the primary steps of the risk analysis process are described in the following subsections. The results of the risk analysis are provided in Section 6.

4.1 Identification and Assessment of Risk Factors

Identification of the risk factors by the PDT is considered a qualitative process that results in the establishment of a risk register, which is used to document the results of the quantitative study of risks. Risk factors are events and conditions that may influence or drive uncertainty associated with project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate the identification of risk factors. However, the key risk factors are often unique to a project and cannot be readily derived from historical information. Therefore, input is obtained from the PDT be means of creative processes such as brainstorming, reviewing, or other facilitated risk assessment steps. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable.

For this project, a risk register had already been developed for the original authorized CEPP project. That risk register was used as the starting point for the risk register developed just for the storage reservoir component under current development. A new PDT coordinated to revise the risk register to be appropriate to the components being currently estimated. The PDT members that reviewed and commented on the new risk register are as follows:

Table 1 – Risk Register PDT

Name	Firm	Role
Scott Vose	J-Tech	Risk Analyst
Shawn Waldeck	J-Tech	Senior Engineer
Raymond Sciortino	J-Tech	Project Engineer
Georgia Vince	J-Tech	Project Manager
Stuart McGahee	J-Tech	Cost Estimator
Dennis Barnett	J-Tech	Environmental Planner
Mike Albert	SFWMD	Project Manager
Jack Ismalon	SFWMD	Principal Cost Estimator

Informal meetings and calls could also occur throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment. The risk register document developed for this project can be seen in Attachment A.

4.2 Quantification of Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions) as required for use in the Crystal Ball software.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering and risk analysis team members with lesser input from the other functions and disciplines. The quantification process uses an iterative approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable
- Nature of the probability density function used to approximate risk factor uncertainty
- Mathematical correlations between risk factors
- Affected cost estimate and schedule elements

The resulting product from the PDT discussions is captured within a risk register for both cost and schedule risk concerns. The risk register documents the PDT's risk concerns, discussions related to those concerns, and potential impacts on the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event. The risk register has been updated since the initial PDT meeting to incorporate risks at the current point of the project.

4.3 Analysis of Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. Monte Carlo simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT and the market research. Contingencies are calculated by applying only the moderate- and high-level risks identified for each option (i.e., low-level risks are typically not considered but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate in this study, the contingency was calculated as the difference between the P80 cost forecast and the base cost estimate. Standard deviation was used as the feature-specific measure of risk for contingency allocation purposes. This approach resulted in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

Schedule contingency was analyzed only on the total duration of construction from the current proposed schedule. Based on the guidance, only critical path and near critical path tasks are considered uncertain for the purposes of contingency analysis (USACE 2009).

5. KEY ASSUMPTIONS

The CSRA for the EAA Storage Reservoir was based on the following key assumptions:

- The project is currently at a draft stage, and has not been reviewed by USACE cost staff.
- Neither life cycle nor operation and maintenance costs are included in the risk study. This study is based solely on the initial construction of the project.
- The current MCACES costs are as follows:

Table 2 – Current MCACES Construction Costs

WBS	Contract / WBS / Item Description	MCACES Cost
	Contract 1	
09	Miami Canal Improvements	$44,908,632
	Contract 2	
09	North New River Canal Improvements	$23,247,406
	Contract 3	
03	Reservoir – Slurry Walls	$156,133,466
	Contract 4	
15	Water Control Structures (SW1, C1 through C11)	$47,755,671
	Contract 5	
03	Reservoir – Levee Construction	$745,315,076
09	Canal Construction (G and H)	$9,547,855
11	Levee Construction (A, B-1, C, E, N & N1)	$61,110,746
14	Recreation Facilities	$7,494,753
	Contract 6	
15	Gated Spillways	$24,435,377
	Contract 7	
08	Bridges	$11,507,665
	Contract 8	
13	Pumping Plants	$111,900,217
	MCACES Total:	**$1,243,356,865**

- The cost estimate is based on local labor, material, and fuel costs. The construction schedule is based on estimated productivities of the construction activities estimated within the cost estimate, and is assumed to be 8-years, including upfront PED durations.
- The risk analysis also includes costs for feature accounts Planning, Engineering and Design (PED), and Construction Management (CM). It is currently assumed the PED is 10% of total construction costs, and CM is 6.5%.

Table 3 – PED and CM Costs

WBS	Contract / WBS / Item Description	MCACES Cost
30	Planning, Engineering and Design (10%)	$124,335,686
31	Construction Management (6.5%)	$80,818,196
	MCACES Total	$205,153,883
	Total Cost for Risk Analysis (Rounded)	**$1,448,511,000**

- The recommended contingency is based on an 80 percent confidence level, per accepted USACE Civil Works guidance.
- Only the high and moderate risk levels as determined by the PDT in the risk register are included in the risk analysis. The low risk levels are excluded based on the assumption that they would have a negligible impact in determining the contingency.

6. RISK ANALYSIS RESULTS

The CSRA results are provided in the following subsections. In addition to the contingency calculations, the results of sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The risk register developed for this project is provided in Attachment A. The complete risk register includes low-level risks, as well as additional information regarding the nature and impacts of each risk.

A risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include the following:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls
- Communicating risk management issues
- Providing a mechanism for eliciting feedback and project control input
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans

6.2 Cost Contingency Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 2 provides the construction cost contingency calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P10, P50, and P95 confidence levels are also provided for illustrative purposes only.

Table 4 – Construction Cost Contingency Summary

Confidence Level	Baseline Total Project Cost	Contingency	Total Project Cost with Contingency	Contingency
10%	$1,448,511,000	$289,702,200	$1,738,213,200	20.0%
50%	$1,448,511,000	$405,583,080	$1,854,094,080	28.0%
80%	**$1,448,511,000**	**$492,493,740**	**$1,941,004,740**	**34.0%**
95%	$1,448,511,000	$579,404,400	$2,027,915,400	40.0%

6.2.1 Cost Risks Sensitivity Analysis Results

A sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. From this analysis, the key cost drivers can be identified and used to support the development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project life cycle.

The cost sensitivity analysis for this project shows the rank of the risks from the highest impact on the cost contingency to the lowest (Figure 1).

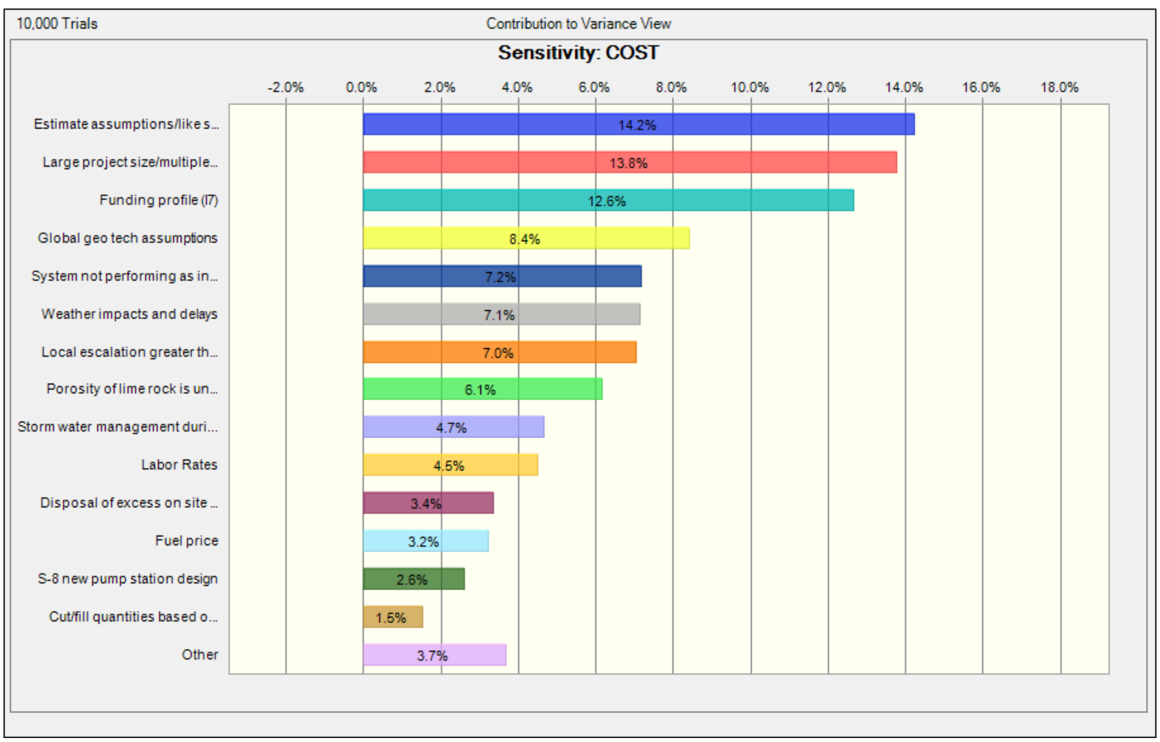

Figure 1 – Sensitivity Analysis (Cost)

6.3 Schedule Contingency Sensitivity Analysis

In the same methodology as the cost contingency, the estimated schedule duration contingency was estimated at the P80 level. Table 3 shows the resulting schedule contingency at the P80 level and includes the P10, P50, and P95 confidence levels for illustrative purposes.

Table 5 – Construction Schedule Contingency Summary

Confidence Level	Baseline Schedule Duration	Contingency	Total Schedule Duration	Contingency
10%	97.0 months	12.6 months	109.6 months	13.0%
50%	97.0 months	22.3 months	119.3 months	23.0%
80%	**97.0 months**	**28.1 months**	**125.1 months**	**29.0%**
95%	97.0 months	34.9 months	131.9 months	36.0%

6.3.1 Schedule Risks Sensitivity Analysis Results

The cost sensitivity analysis for this project shows the rank of the risks from the highest impact on the schedule contingency to the lowest (Figure 2).

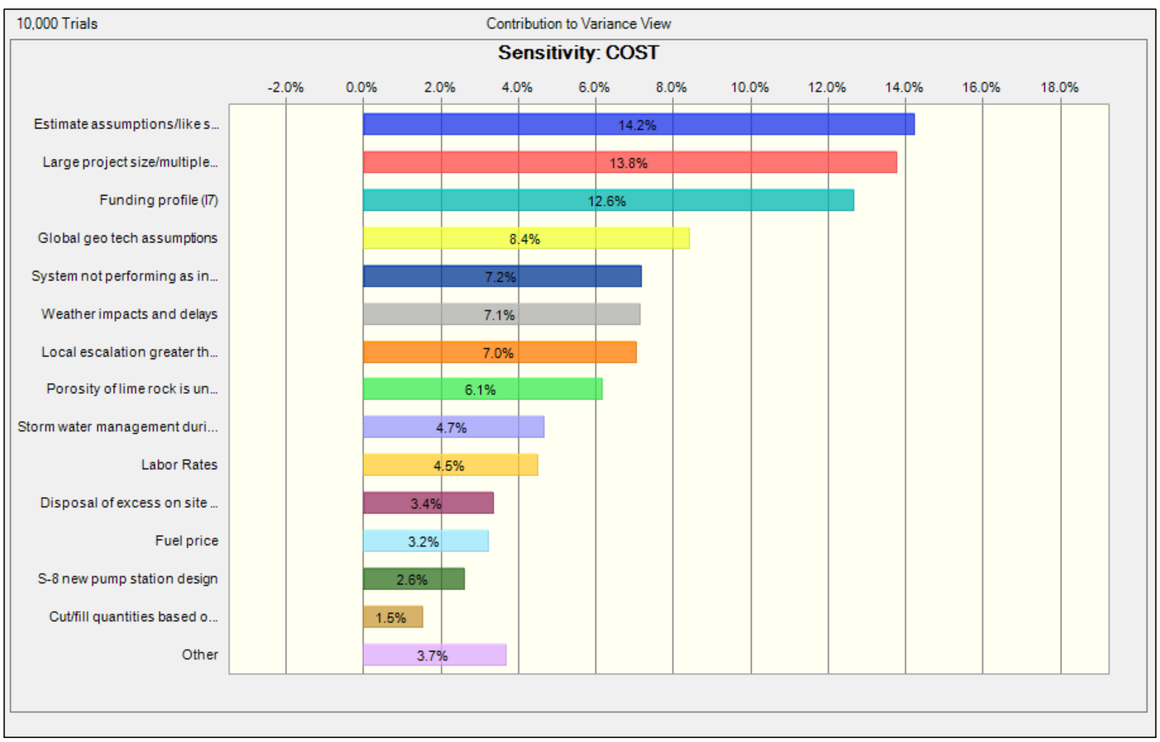

Figure 2 – Sensitivity Analysis (Schedule)

7. Major Findings, Observations and Recommendations

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

The following sections discuss the risk items that are the most impactful to the contingency development for both cost and schedule. All risk items that generate over ten (12.0) percent of the contingency, as shown in the sensitivity analysis, for both cost and schedule are discussed here. Further information on all risk items and their corresponding PDT discussions can be found in Attachment A, and full cost and schedule contingency probability range summaries can be found in Tables 5 and 6.

7.1 Cost Risks

- CA-1: large project size/multiple projects - Most likely due to the large size of the project, there will be multiple smaller contracts. Coordination and sequencing may change significantly as the project progresses. Large number of crews are likely required which could max out space available for construction.
- PM-4: funding profile – Project implementation is dependent on both the federal and local sponsors being able to meet financial obligations for the project. The cost sharing agreement between sponsors will need to be developed, and project progress would be dependent on the ability of the partners to contribute according to current assumptions.
- ET-5: estimate assumptions / like similar costs – Some large cost features were estimated using similar costs from other projects or sources. Significant assumptions had to be made by the estimators in order to develop costs for these items.

Table 6 – Project Cost Contingency Summary

Confidence Level	Baseline Total Project Cost	Contingency	Total Project Cost with Contingency	Contingency
0%	$1,448,511,000	$72,425,550	$1,520,936,550	5.0%
5%	$1,448,511,000	$260,731,980	$1,709,242,980	18.0%
10%	$1,448,511,000	$289,702,200	$1,738,213,200	20.0%
15%	$1,448,511,000	$318,672,420	$1,767,183,420	22.0%
20%	$1,448,511,000	$333,157,530	$1,781,668,530	23.0%
25%	$1,448,511,000	$347,642,640	$1,796,153,640	24.0%
30%	$1,448,511,000	$362,127,750	$1,810,638,750	25.0%
35%	$1,448,511,000	$376,612,860	$1,825,123,860	26.0%
40%	$1,448,511,000	$391,097,970	$1,839,608,970	27.0%
45%	$1,448,511,000	$405,583,080	$1,854,094,080	28.0%
50%	$1,448,511,000	$405,583,080	$1,854,094,080	28.0%
55%	$1,448,511,000	$420,068,190	$1,868,579,190	29.0%
60%	$1,448,511,000	$434,553,300	$1,883,064,300	30.0%
65%	$1,448,511,000	$449,038,410	$1,897,549,410	31.0%
70%	$1,448,511,000	$463,523,520	$1,912,034,520	32.0%
75%	$1,448,511,000	$478,008,630	$1,926,519,630	33.0%
80%	$1,448,511,000	$492,493,740	$1,941,004,740	34.0%
85%	$1,448,511,000	$521,463,960	$1,969,974,960	36.0%
90%	$1,448,511,000	$535,949,070	$1,984,460,070	37.0%
95%	$1,448,511,000	$579,404,400	$2,027,915,400	40.0%
100%	$1,448,511,000	$811,166,160	$2,259,677,160	56.0%

7.2 Schedule Risks

- CA-1: large project size / multiple – Most likely due to the large size of the project, there will be multiple smaller contracts. Coordination and sequencing may change significantly as the project progresses. The schedule could change based on actual implementation.
- PM-4: funding profile – As referenced in the costs risk, project implementation is dependent on both the federal and local sponsors being able to meet financial obligations for the project. The cost sharing agreement between sponsors will need to be developed, and project progress would be dependent on the ability of the partners to contribute according to current assumptions.
- PM-3: PED start date - fiscal year 2019 is the earliest authorization would occur. However this could change depending on next WRDAs actual issuance, which could delay the start of the PED phase.

Table 7 – Project Schedule Duration Contingency Summary

Confidence Level	Baseline Schedule Duration	Contingency (Duration)	Baseline Schedule Duration with Contingency	Contingency
0%	97.0 Months	-4.9 Months	92.2 Months	-5.0%
5%	97.0 Months	10.7 Months	107.7 Months	11.0%
10%	97.0 Months	12.6 Months	109.6 Months	13.0%
15%	97.0 Months	14.6 Months	111.6 Months	15.0%
20%	97.0 Months	16.5 Months	113.5 Months	17.0%
25%	97.0 Months	17.5 Months	114.5 Months	18.0%
30%	97.0 Months	18.4 Months	115.4 Months	19.0%
35%	97.0 Months	19.4 Months	116.4 Months	20.0%
40%	97.0 Months	20.4 Months	117.4 Months	21.0%
45%	97.0 Months	21.3 Months	118.3 Months	22.0%
50%	97.0 Months	22.3 Months	119.3 Months	23.0%
55%	97.0 Months	23.3 Months	120.3 Months	24.0%
60%	97.0 Months	24.3 Months	121.3 Months	25.0%
65%	97.0 Months	25.2 Months	122.2 Months	26.0%
70%	97.0 Months	26.2 Months	123.2 Months	27.0%
75%	97.0 Months	27.2 Months	124.2 Months	28.0%
80%	97.0 Months	28.1 Months	125.1 Months	29.0%
85%	97.0 Months	30.1 Months	127.1 Months	31.0%
90%	97.0 Months	32.0 Months	129.0 Months	33.0%
95%	97.0 Months	34.9 Months	131.9 Months	36.0%
100%	97.0 Months	52.4 Months	149.4 Months	54.0%

7.3 Mitigation Recommendations

Risk management is an all-encompassing, iterative, life cycle process of project management. According to *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project" (PMI 2008). Risk identification and risk analysis are processes within the knowledge area of risk management. Their output pertinent to this effort includes the risk register, risk quantification (risk analysis model), the contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not be a substitute for a formal risk management and response plan.

The CSRA study serves as a "road map" towards project improvements and reduced risks over time. The PDT should include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and updates of the risk analysis throughout the design stages is important in ensuring all cost and schedule estimates remain within approved budgets and timelines.

7.3.1 Risk Management

Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

7.3.2 Risk Analysis Updates

Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

7.3.3 Specific Risks

Further iterative project and risk study is important throughout the project life-cycle in order to efficiently manage and maintain a reasonable cost and schedule. The results of the CSRA sensitivity analysis indicate that the following risk factors have the most significant impact on the cost and schedule contingencies and thus mitigation recommendations are discussed for these items:

- ET-5: estimate assumptions / like similar costs (cost)
- PM-4: funding profile (cost and schedule)
- CA-1: large project size / multiple projects (cost and schedule)
- PM-3: PED start date (schedule)

A primary driver of the cost contingency level is the level of detail currently in the cost estimate. Some key features, such as the pump stations, bridges and spillways need to be analyzed in more detail. More supporting documentation, and or more detail in the estimating process, would lead to less risk for the estimate. This should occur as the project progresses, and therefore upon further iterations of the cost estimate and risk analysis, it is likely the size of this risk will lessen.

The funding profile risk is one that the PDT, primarily project managers and contracting staff, must monitor. The contracting plan has not been finalized, which is leading to some of the current risk for this item. Also, ensuring all stakeholders can meet the funding schedules is another significant risk given a project of this scale. So, project management must be on top of this from the beginning to ensure all parties are aware of their funding responsibilities, and developing a reasonable contracting plan to meet the needs of the project.

The large project size and/or multiple project risks is another one risk the project management staff must stay aware of. Other projects could put staff and funding on hold, and therefore delaying key milestones of this project which could put a burden on the funding stream. The large size of this project will bring inherent risks to the schedule and construction costs simply due to the overall scale. This may be out of the PDT's realm of influence, but still must be noted and monitored as the project progresses. Contracts may need to be spaced differently, or modified to include additional smaller contracts to meet needs. This could all add significant costs if not monitored and incorporated correctly into the cost estimates.

Lastly, the PDT should stress to identify and resolve any other risks or concerns that may have cost or schedule implications. Further analysis could lead to new risks that have not been previously analyzed, and therefore should be brought to the PDT's attention.

8. REFERENCES

PMI (Project Management Institute). 2008. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide). 4th edition.*

USACE (U.S. Army Corps of Engineers) 1999. *Engineering and Design for Civil Works Projects*. Engineer Regulation 1110-2-1150. Department of the Army, Washington, D.C. August 31.

USACE. 2007a. Memorandum from Major General Don T. Riley, U.S. Army Director of Civil Works, July 3.

USACE. 2007b. *Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs*. Engineering and Construction Bulletin 2007-17. September 10.

USACE. 2008a. *Civil Works Cost Engineering*. Engineer Regulation 1110-2-1302. Department of the Army, Washington, D.C. September 15.

USACE. 2008b. *Construction Cost Estimating Guide for Civil Works*. Engineer Technical Letter 1110-2-573. Department of the Army, Washington, D.C. September 30.

USACE. 2009. *Cost and Schedule Risk Analysis Guidance*. Directory of Expertise for Civil Works, Cost Engineering, USACE, Department of the Army, Walla Walla, WA. May 17.

ATTACHMENT A

Project Delivery Team Risk Register

EAA Storage Reservoir Project

Risk Matrix

Likelihood of Occurrence	Negligible	Marginal	Significant	Critical	Crisis
	Impact or Consequence of Occurrence				
Certain	Moderate	Moderate	High	High	High
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	Moderate

Overall Project Scope

Project Scope Narrative: The study area for the Central Everglades Planning Project (CEPP) encompasses the Northern Estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), Lake Okeechobee, a portion of the EAA, the Water Conservation Areas (WCAs), Everglades National Park (ENP), the Southern Estuaries (Florida Bay and Biscayne Bay), and the Lower East Coast. The purpose of CEPP is to improve the quantity, quality, timing and distribution of water flows to the Central Everglades.

SEE ASSUMPTIONS TAB FOR COST VALUE RANGES DEVELOPMNENT

Negligible--- *Less than*		**$7,620,290**		**3 Months**
Marginal ---*between*	**$7,620,291**	**###########**	**3 Months**	**and 5 Months**
Significant ---*between*	**$30,481,161**	**###########**	**5 Months**	**and 10 Months**
Critical--- *between*	**$45,721,741**	**###########**	**10 Months**	**and 19 Months**
Crisis ---*Over*	**$76,202,901**		**19 Months**	

Risk No.	Risk/Opportunity Event	Concerns	PDT Risk Conclusions, Justification	Project Cost: Likelihood*	Project Cost: Impact*	Project Cost: Risk Level*	Project Cost: Rough Order Impact ($)	Project Schedule: Likelihood*	Project Schedule: Impact*	Project Schedule: Risk Level*	Project Schedule: Rough Order Impact (mo)	Variance Distribution	Correlation to Other(s)	Responsibility/POC	Affected Project Component
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM MGMT														
PM1	Planning process review revisions	The CEPP PACR, developed under the Sect 203 process, will require review and subsequent issuance of an EIS.	The concern is during development of the CEPP PACR EIS delays could be encountered post-submission to the ASA.	Very Likely	Marginal	MODERATE		Likely	Significant	HIGH				Cost Engineering	Project Cost & Schedule
PM2	Multiple overlapping projects	There are multiple overlapping projects and accounting for costs and benefits may be overlapping. Overall system needs to work together to provide benefits.	There are numerous projects within the area that may have different purposes and overlapping features. This may cause accounting and authorization issues due to cost share and project purposes.	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH					
PM3	PED start date	PED phase will most likely not start until next WRDA is passed.	FY 2019 is probably the earliest authorization would occur. However this could change depending on the next WRDAs actual issuance.	Very Likely	Negligible	LOW		Very Likely	Critical	HIGH					
PM4	Funding profile	Project implementation is dependent on both the federal and sponsor being able to meet finacial obligation to meet the project.	Equal contributions or cost share from the sponsor and from USACE will be needed for future work. Progress could very based on actual financial contributions in funding the project.	Likely	Marginal	MODERATE		Likely	Significant	HIGH					
PM6	Local escalation greater than national average	When dealing with large multiple year projects there are concerns for localized inflation above CWCCIS.	The concern is that due to funding restrictions and multiple contracts that inflation in CWCCIS will be outpaced in future years. This is the possibility that inflation exceeds the CWCCIS tables in future years.	Unlikely	Crisis	HIGH		Likely	Negligible	LOW					
	CONTRACT ACQUISITION RISKS														
CA1	Large project size/multiple projects	Most likely due to the large size of the project the project will be broken up into smalindividual contracts. Labor availability is a high risk due to size of project.	Coordination and sequencing may change significantly due to acquisition approach. Some thought has been put into contract acquisition into base case estimate. However schedule and cost could change based on actual implementation. Also, large number of crews likely required could max out space available.	Likely	Significant	HIGH		Likely	Significant	HIGH					
CA2	Borrow/placement conflicts with multiple contracts	Concern for scoping of projects to ensure that the backfiland excavation and structure modifications are in the same contract.	L6 - L5 must be completed together along with modifications to S-8 and Miami back fill are all required to be completed in series. This could effect construction cost and schedule.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW					
	TECHNICAL RISKS														
TL1	Life cycle cost analysis on pump stations	Life cycle cost analysis during design may show that electrical pumping is more beneficial.	This could lead to increased unit cost for pump station costs due to infrastructure requirements.	Unlikely	Marginal	LOW		Very Unlikely	Negligible	LOW					
TL2	Internal water conveyance	There are existing AG canals in the proposed location of the reservoir along with roads bordering each side of the canal that may cause issues.	There is the possibility of piping through the proposed location of the perimeter levee.	Very Likely	Marginal	MODERATE		Very Likely	Marginal	MODERATE					
TL4	Seepage	Seepage from deeper storage can be significant and is based on limited geotechnical data in the A-2 footprint.	Unknown geotechnical data. There is concern that there could be a need for additional work to mitigate seepage impacts from the A-2 reservoir.	Likely	Significant	HIGH		Likely	Marginal	MODERATE					
TL5	S-8 flood control operations	S-8 needs to provide flood control the entire time until downstream work is complete.	A plan and appropriate costs have been incorporated in the features effected by the operation of the S-8 pump station. This includes the gated culverts down stream of the pump station including diversion canals. If any additional work is needed to ensure flood protection it wilcause additional cost and could lengthen the schedule.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE					

TL6	S-8 new pump station design	The current plan is unclear on the status of S-8 Pump Station. This could require actions ranging form full replacment to minor modifications.	The Engineering appendix does not provided sufficient information to determine what the new design of the S-8 pump station. It is likely that the pump station will need additional work to ensure that the pumps are capable of handling the flood waters. this could range from a new pump station to a rehab of the existing pump station.	Likely	Crisis	HIGH		Likely	Negligible	LOW					
TL16	Sizing of new pump	The new pump is currently assumed at 4500 CFS.	There is an uncertainty that additionalseepage pumpins will be required. This may require monitoring and flexibility of sizing of pump station.	Likely	Negligible	LOW		Likely	Negligible	LOW					
TL20	Global geo tech assumptions	The team used global assumptions for the material strata for entire project although past experience shows that these can vary significantly throughout the region.	Any localized variance in the material type could have an impact in the cost of excavation, seepage ananlysis results.	Likely	Significant	HIGH		Likely	Negligible	LOW					
TL21	Disposal of excess on site material	Currently there is no design for location or technique of onsite disposal of excess material.	There is likely the chance that additional work will be required to usefuly dispose of the material on site. This could range from spreading across areas to increasing the size of earthen features.	Very Likely	Significant	HIGH		Very Likely	Negligible	LOW					
TL22	Levee stabilization approach	Currently the estimate has seeding as the means of stabilization for the side slope of the levees.	Possibility exists that seeding may not be adequate to ensure the stabilization of the levee. In that case the levee might need to be covered in sod.	Unlikely	Significant	MODERATE		Unlikely	Negligible	LOW					
TL23	System not performing as intended	There is a technical risk that the system may not perform as expected and that some additional work may be required	Some minor reformulation, rework or changes may be required due to unforseen issues. This will need to be monitored to ensure the system performs as intended and changes are efficently incorperated into the project	Likely	Critical	HIGH		Unlikely	Negligible	LOW					
TL24	Conveyance improvements	Concern that project will potentially require more land than currently assumed.	There is a very small likelihood of occurrence, for the project needing more land. But if required, could be significant impact to cost.	Very Unlikely	Significant	LOW		Very Unlikely	Marginal	LOW					
	LANDS AND DAMAGES RISKS														
LD1	Project Area HTRW	There is the possibility that the Farm Land may have HTRWin the area.	There is likely an area or areas that will need additional work to ensure that the area is free of hazardous material prior to starting the construction of the reservoir.	Very Likely	Marginal	MODERATE		Very Likely	Negligible	LOW					
LD2	Miami canal historic status	There is a section of the Miami Canal that is considered historical.	It is listed as a national historical location and is known that portions of the Miami Canal are considered historical and consideration will be needed and documented.	Likely	Negligible	LOW		Likely	Negligible	LOW					
LD3	Land ownership	Most the land is currently owned by the state and leased for AG use. Approximately 500 ac of private land is needed for the CEPP PACR A-2 expansion area.	There is minimal risk that the land will be an issue, it is mostly state owned and leased to the farmers. Acreage needed from private owner acquisitions on the A-2 expansion lands are close to complete. The land is currently owned and should be considered a positive effect.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW					
LD4	Coordination of termination of lease for lands	The risk is that there will be a delay between the lease being canceled and the start of construction.	There is concern that some species will establish in the site after the land is abandoned by the farmer and the start of construction. These could be an impact if they are protected species or if too much vegetation is established in the area. It is felt that the schedule of progress willallow for proper timing of termination of leases and not allow this to happen.	Very Unlikely	Significant	LOW		Likely	Negligible	LOW					
	REGULATORY AND ENVIRONMENTAL RISKS														
REG1	Endangered species on levees and construction sites	Endangered species known to be in area- Snakes, Birds, etc.	Normal endangered species clauses should be included in construction contract to include nesting seasons, work windows, and monitoring plans. This has been taken into account in the cost estimate.	Very Likely	Negligible	LOW		Likely	Negligible	LOW					
REG2	Water quality legal issues project wide	Water quality in system has been challenged before.	It is assumed that this will be resolved and water quality will be acceptable prior to the construction of CEPP. Legal action or delays could significantly delay the project if this is not resolved the project will not move forward, this issue must be resolved prior to authorization of the project.	Very Unlikely	Negligible	LOW		Unlikely	Crisis	HIGH					
REG3	Cultural resources	Due to the nature of the area historical artifacts may be found during excavation.	During excavation there is the possibility of encountering cultural resources. Due to the small qty of top soil and the current usage of the land as agricultural may decrease the likelihood in this area. Although culturally sensitive material has been found in the area previously.	Very Likely	Negligible	LOW		Very Likely	Negligible	LOW					
REG15	Costs for cultural resources	Cultural Resource preservation.	Ensure adequate costs for cultural resource preservation are added to estimate.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW					
	CONSTRUCTION RISKS														
CO1	Fuel price	Due to the large quantity of hauling that will take place on the job there is a chance that fuel prices increasing could impact the job.	It is unknown at this time what the future of fuel prices wildo this will be studied and determined what different increases in how fuel prices willeffect the job.	Likely	Significant	HIGH		Likely	Negligible	LOW					
CO2	Cut/fill quantities based on implementation	Cut/Filquantities could vary from estimate.	The concern is that you will need off site borrow or to create an excavation pit to ensure that all features have sufficient material. Additional processing of onsite materials as needed. This could also change based on implementation.	Very Likely	Marginal	MODERATE		Very Likely	Negligible	LOW					

CO3	Access roads used for construction	A1 FEB is assumed available for access to A2 construction.	This concern has been mitigated. The A-1 FEB construction is complete and haul roads are available for accessing the A-2 site. Additional haul roads will be need for reservoir construction and have been included in estimate.	Unlikely	Significant	MODERATE		Unlikely	Negligible	LOW					
CO4	Storm water management during construction	The concern is that there will be water influx to the area during a storm.	There is the possibility that the water will need to be pumped or allowed to dry. There is concern that during the process of scheduling the work there will be delays that adversely impact the operations of the features. Lessons learned from preious work also showed that rising groundwater and surface water due to storms is a high risk.	Likely	Significant	HIGH		Likely	Significant	HIGH					
CO9	Pre-construction survey of canals	Currently it is unknown what the state of the muck layer in the canals.	It is known from work in the de-comp model that a significant amount of muck is present in some or all of the canals. It is likely that a preconstruction survey will need to be completed prior to construction to ensure that the quantities are verified.	Likely	Negligible	LOW		Likely	Negligible	LOW					
CO11	Weather impacts and delays	Extended wet weather and/or large storm events could impact the project.	Wet weather, large storms (hurricanes), flooding, and other weather risks are likely to occur during the construction. Contractor will likely prepare for typical weather impacts, but large events could cause significant delays and rework.	Likely	Significant	HIGH		Likely	Significant	HIGH					
	ESTIMATE AND SCHEDULE RISKS														
ET4	Labor Rates	Local wage rate assumptions could vary from assumed and impact the estimate	Generally wage rates are low in the area however skiled workers generally can command higher wages similar to those in other areas. Wage rates in estiamte are based on local market research and are current.	Likely	Marginal	MODERATE		Likely	Negligible	LOW					
ET5	Estimate assumptions/like similar	That features were estimated using plans from similar structures with minimal design for the CEPP feature.The assumption that local like similar features would be adequate to captrue the necessary scope to construct the feature.	This concern has been somewhat addressed for the CEPP PACR A-2 features. A detailed MCASES and BODR level design have been prepared for th the A-2 Reservoir and STA. An independent Cost/Risk Analysis has been performed by Legis Consultancy. However, significant uncertainty exists for procurement, permit and production rates utilized for project planning.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE					
ET6	Delays in fabrication equipment	Due to the number of specialty fabricated gates, pumps and motors there could be an impact to the project.	When dealing with specialty materials (gates pumps etc.) there is always concern that the raw materials may not be available. The risk is either that a premium wilhave to be paid for the material or equipment or a delay to the delivery schedule of the material or equipment wilcause a delay to the project.	Unlikely	Negligible	LOW		Unlikely	Negligible	LOW					
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)													
PR2	Close out of other projects	Project dependencies may require successful and timely completion of predecessor projects.	Prioritization and closeout of other projects could effect the start and funding for this project. These effects could substantially change the proejct formulation and execution schedule. This risk will be noted but not modeled.	Likely	Marginal	MODERATE		Likely	Significant	HIGH					
PR3	Political or public opposition to project	There are many different agencies, orginizations, and stakeholders in the project vicininity that could oppose portions of the project or its impacts real or perceived.	Litigatoin, delays or fundamental projet changes could result. This risk will be noted but not modeled.	Likely	Marginal	MODERATE		Likely	Significant	HIGH					

*Likelihood, Impact, and Risk Level to be verified through market research and analysis (conducted by cost engineer).

1. Risk/Opportunity identified with reference to the Risk Identification Checklist and through deliberation and study of the PDT.
2. Discussions and Concerns elaborates on Risk/Opportunity Events and includes any assumptions or findings (should contain information pertinent to eventual study and analysis of event's impact to project).
3. Likelihood is a measure of the probability of the event occurring -- **Very Unlikely**, **Unlikely**, **Moderately Likely**, **Likely**, **Very Likely.** The likelihood of the event will be the same for both Cost and Schedule, regardless of impact.
4. Impact is a measure of the event's effect on project objectives with relation to scope, cost, and/or schedule -- **Negligible**, **Marginal**, **Significant**, **Critical**, or **Crisis.** Impacts on Project Cost may vary in severity from impacts on Project Schedule.
5. Risk Level is the resultant of Likelihood and Impact **Low**, **Moderate**, or **High**. Refer to the matrix located at top of page.
6. Variance Distribution refers to the behavior of the individual risk item with respect to its potential effects on Project Cost and Schedule. For example, an item with clearly defined parameters and a solid most likely scenario would probably follow a triangular or normal distribution. A risk item for which the PDT has little data or probability of modeling with respect to effects on cost or schedule (i.e. "anyone's guess") would probably follow a uniform or discrete uniform distribution.
7. The responsibility or POC is the entity responsible as the Subject Matter Expert (SME) for action, monitoring, or information on the PDT for the identified risk or opportunity.
8. Correlation recognizes those risk events that may be related to one another. Care should be given to ensure the risks are handled correctly without a "double counting."
9. Affected Project Component identifies the specific item of the project to which the risk directly or strongly correlates.
10. Project Implications identifies whether or not the risk item affects project cost, project schedule, or both. The PDT is responsible for conducting studies for both Project Cost and for Project Schedule.
11. Results of the risk identification process are studied and further developed by the Cost Engineer, then analyzed through the Monte Carlo Analysis Method for Cost (Contingency) and Schedule (Escalation) Growth.

ATTACHMENT B

Market Research

(Available Upon Request)

ATTACHMENT B: PROJECT QUANTITY TAKEOFFS AND ASSUMPTIONS

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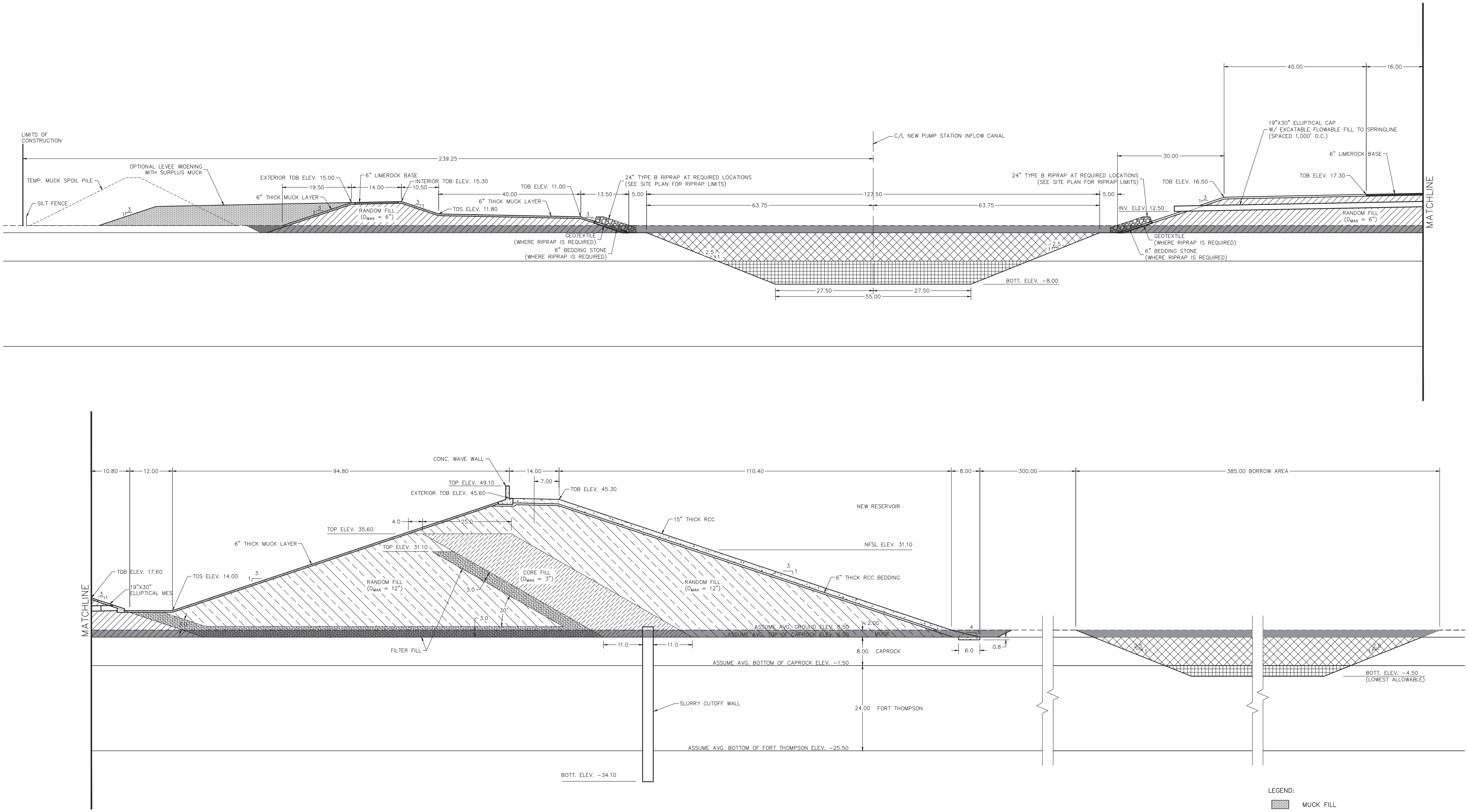
Appendix B

Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Contract 3: A-2 Reservoir Levee Embankment Slurry Walls

Feature of Work:	TYPICAL LEVEE SECTION F(L): NEW PUMP STATION INFLOW CANAL (ADJACENT TO A-2 RESERVOIR)
Scope Given:	Levee Section F(L) is utilized as a typical section: 31,140 LF (5.90 MI) running West to East, along the North of A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

TYPICAL SECTION F(L)

NOT TO SCALE

SECTION F(L)

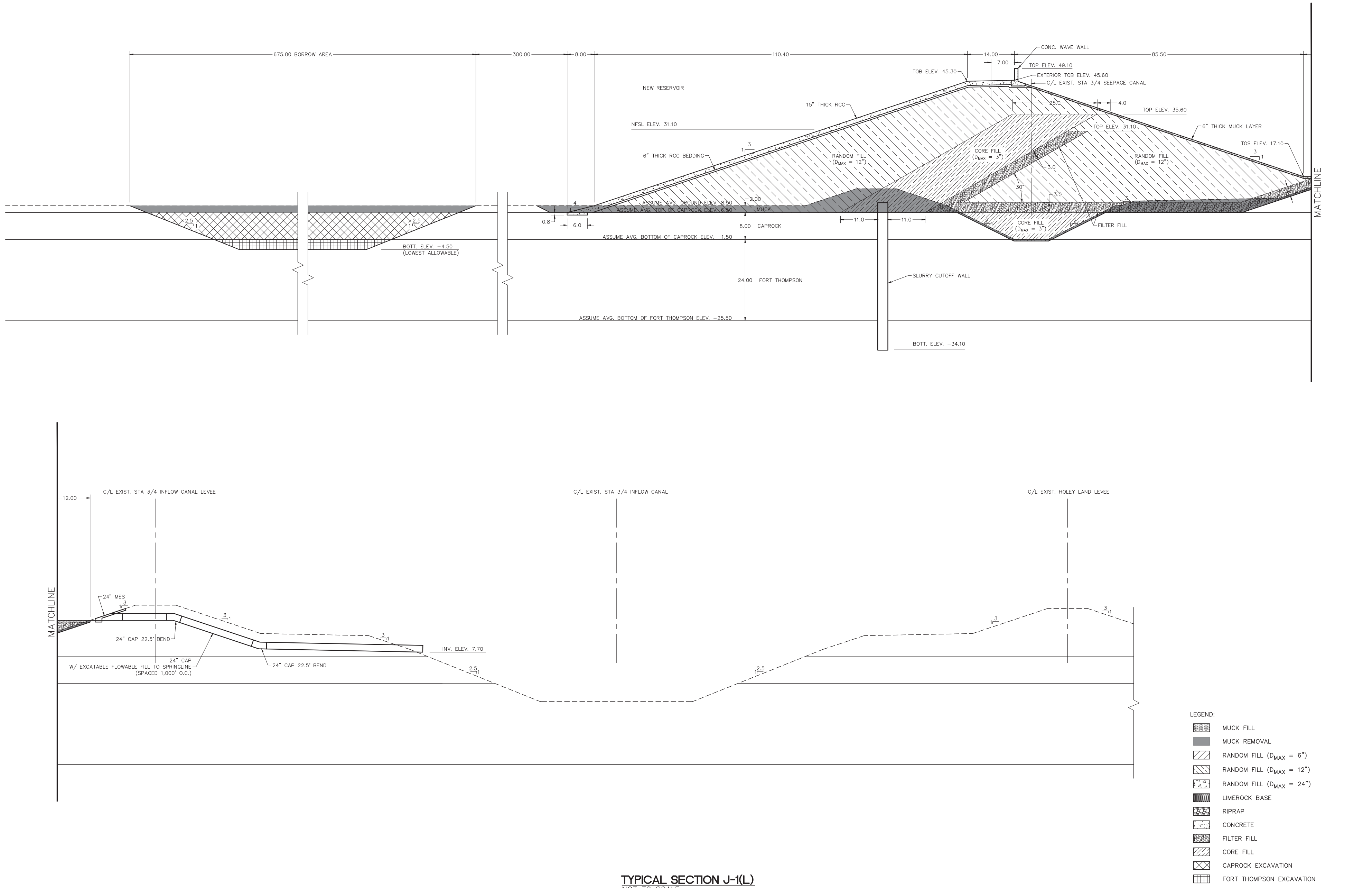
NEW PUMP STATION INFLOW CANAL (ADJACENT TO A-2 RESERVOIR)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		289	31,126			207		
Clearing & Grubbing		1070	31,140			765		
Muck Cut - north side	348.50		31,126	401,753				2,226,121
Muck Cut - south side	823.50		31,126	949,335				
Caprock Cut (PS inflow canal)	860.00		31,126	991,412				
Ft. Thompson Cut (PS inflow canal)	463.13		31,126	533,893				1,525,305
Muck Cut (reservoir/borrow area)	759.05		31,126	875,034				
Caprock Cut (reservoir/borrow area)	2836.19		31,126	3,269,573				
Ft. Thompson Cut (reservoir/borrow area)	981.07		31,126	1,130,984				4,400,557
Muck Temp. Stockpile - north side	418.20		31,126	482,103			578,524	
Muck Temp. Stockpile - south side	1899.06		31,126	2,189,242			2,627,091	3,205,614
Muck Fill (along side slopes w/ no riprap)	151.63		29,041	163,086			195,703	
Muck Fill (along side slopes w/ riprap)	142.25		2,085	10,985			13,182	208,885
6" Limerock Base	14.00		31,126	16,144			20,180	
Random Fill (Dmax = 6")	1342.69		31,126	1,547,864			1,934,830	
Random Fill (Dmax = 12")	3498.52		31,126	4,033,109			5,041,386	
Random Fill (Dmax = 24")	0.00		31,126	-			-	
Core Fill, Bentonite Enriched (Dmax = 3")	718.78		31,126	828,617			1,035,771	
Slurry Cutoff Wall	130.80		31,126	150,787	1,357,082 SF			
Filter Fill (ASTM C33 Course Sand)	508.32		31,126	585,993			732,491	########
6" Thick RCC Bedding	68.33		31,126	78,769			98,461	
15" Thick RCC	173.53		31,126	200,044	480,105			
Conc. Wave Wall	9.03		31,126	10,409				
24" Type B Riprap (at bends)	45.08		2,085	3,481			4,351	
6" Bedding Stone (at bends)	9.38		2,085	724			905	5,256
Geotextile for Riprap (at bends)		28	2,085		6,583			

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
19X30" Elliptical CAP w/ flowable fill to springline	2,336			
19X30" Elliptical Mitered End Section (MES)		32	1,920	SF

Section F(L) Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	2,226,121	CY	Muck Cut
19x30 CAP	2,336	LF	19x30 CAP
MES	1,920	SF	19x30 MES
TRENCHING	31,126	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	1,357,082 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	3,205,614	CY	Muck Stockpile
Drill and Blast Caprock	4,260,986	CY	Sum of Caprocks
Excavate Caprock to Stockpile	5,326,232	CY	x1.25
Handling	5,326,232	CY	x1.25
Drill and Blast Ft. Thompson	1,664,876	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	2,081,096	CY	x1.25
Handling	2,081,096	CY	x1.25
Process Limerock, Sand, Riprap, Bedding Stone	856,388	CY	Sum of listed items
Place Random Fill, Lime Rock, Bedding	8,864,024	CY	Sum of listed items
Fill/Compact Random Fill	8,864,024	CY	
Borrow, clay, till	828,617	CY	Core Fill, Bentonite
Load/Haul Riprap+Bedding	5,256	CY	Riprap + Bedding
Fill and Compact Base	905	CY	Bedding Stone
Place Riprap	4,351	CY	Type B Riprap
Geotextile Fabric	6,583	SY	Geotextile
RCC Material	480,105	SY	15" Thick RCC
Concrete Barrier	31,126	LF	Conc. Wave Wall
Bank Topsoil Placement	208,885	CY	Muck Fill
Fine Grading	207	Acre	Hydroseeding
Drainage Geotextiles	6,583	SY	Geotextile
Riprap	4,351	CY	Riprap
Seeding	207	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION J-1(L): A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST. A-1 FEB SEEPAGE CANAL)
Scope Given:	Levee Section J-1(L) is utilized as a typical section: 26,342 LF (4.99 MI) running West to East, along the South of A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION J-1(L)

NOT TO SCALE

SECTION J-1(L)

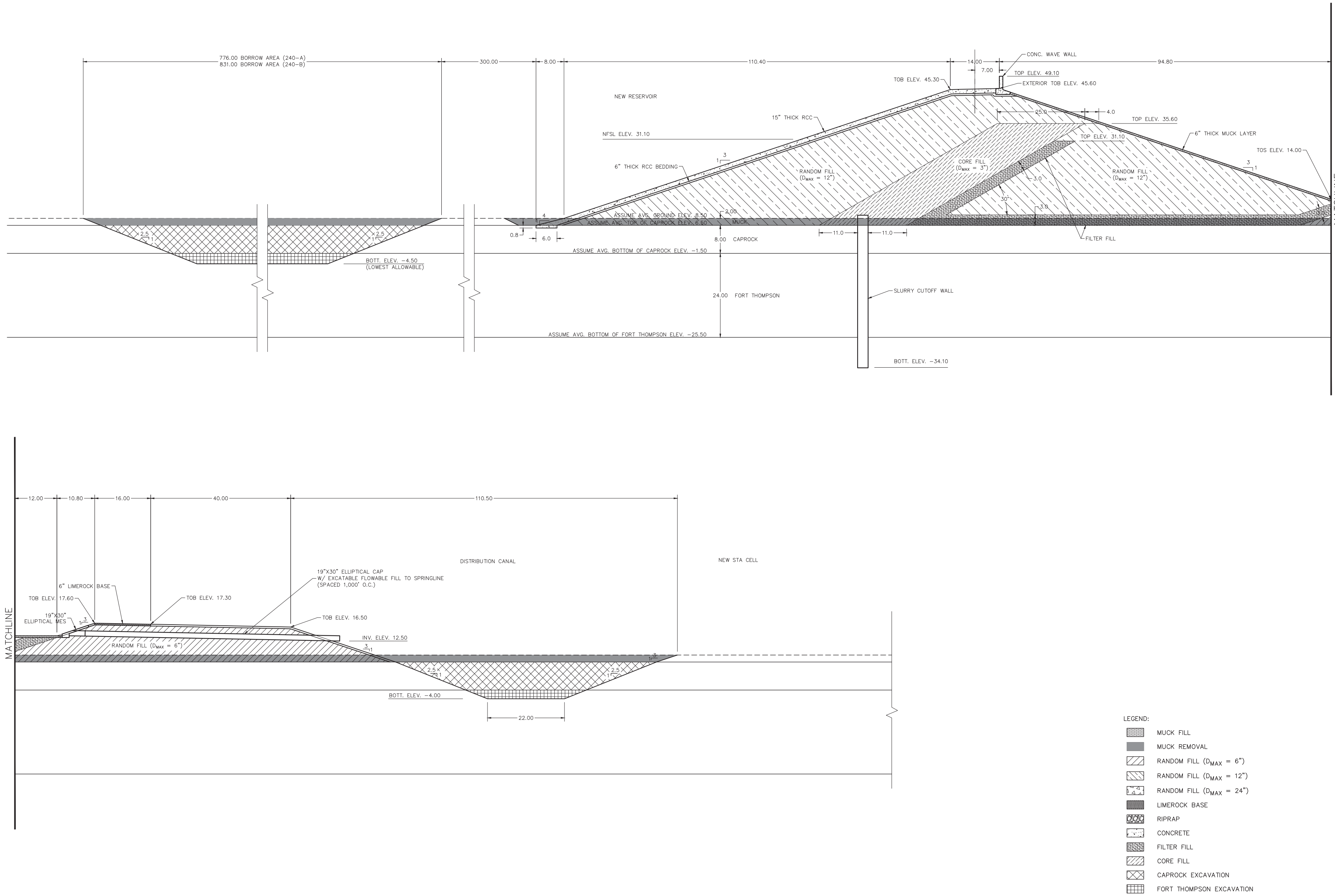
A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST A-1 FEB SEEPAGE CANAL)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		99	25,937			59		
Clearing & Grubbing		950	25,937			566		
Muck Cut - dam	573.42		25,937	550,856				
Muck Cut (reservoir/borrow area)	1338.54		25,937	1,285,865				1,836,721
Caprock Cut (reservoir/borrow area)	5154.17		25,937	4,951,333				
Ft. Thompson Cut (reservoir/borrow area)	1850.31		25,937	1,777,496				6,728,829
Muck Temp. Stockpile	2294.36		25,937	2,204,065			2,644,878	
Muck Fill (no reduction for MESs & culverts)	49.41		25,937	47,467			56,960	
Random Fill for Dam (Dmax = 24")	0.00		25,937	-			-	
Core Fill, Bentonite Enriched (Dmax = 3")	947.20		25,937	909,927			1,137,409	
Slurry Cutoff Wall	130.80		25,937	125,653	1,130,873 SF			
Random Fill for Dam (Dmax = 12")	3403.58		25,937	3,269,637			4,087,047	
Filter Fill (ASTM C33 Course Sand)	481.93		25,937	462,963			578,704	
Drain Fill	0.00		25,937	-			-	
Random Fill (Dmax = 6") (no reduction for culverts)	0.00		25,937	-			-	5,803,159
15" RCC	173.53		25,937	166,699	400,077			
6" RCC Bedding	68.33		25,937	65,639			82,049	
Conc. Wave Wall	9.03		25,937	8,674				

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
24" CAP	2,158			
24" Mitered End Sect. w/ flowable fill to springline		26	1,560	SF
24" CAP 22.5 Deg. Bends		52		

Section J-1(L) Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	1,836,721	CY	Muck Cut
24 CAP	2,158	LF	24" CAP
24 CAP bends	52	EA	24" CAP 22.5 Deg Bends
MES	1,560	SF	24 MES
TRENCHING	25,937	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	1,130,873 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	2,644,878	CY	Muck Stockpile
Drill and Blast Caprock	4,951,333	CY	Sum of Caprocks
Excavate Caprock to Stockpile	6,189,166	CY	x1.25
Handling	6,189,166	CY	x1.25
Drill and Blast Ft. Thompson	1,777,496	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	2,221,871	CY	x1.25
Handling	2,221,871	CY	x1.25
Process Sand, Bedding Stone	660,752	CY	Sum of listed items
Place Random Fill, Core, Filter	5,803,159	CY	Sum of listed items
Fill/Compact Random Fill	5,803,159	CY	
Borrow, clay, till	909,927	CY	Core Fill, Bentonite
RCC Material	480,105	SY	15" Thick RCC
Concrete Barrier	31,126	LF	Conc. Wave Wall
Bank Topsoil Placement	208,885	CY	Muck Fill
Fine Grading	207	Acre	Hydroseeding
Drainage Geotextiles	6,583	SY	Geotextile
Riprap	4,351	CY	Riprap
Seeding	207	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION K(L): A-2 EAST RESERVOIR DAM EMBANKMENT (NEXT TO NEW STA CELLS)
Scope Given:	Levee Section K(L) is utilized as a typical section: 20,508 LF (3.88 MI) running North to South, between CELL 3 EAV/CELL 4 EAV and A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION K(L)
NOT TO SCALE

SECTION K(L)

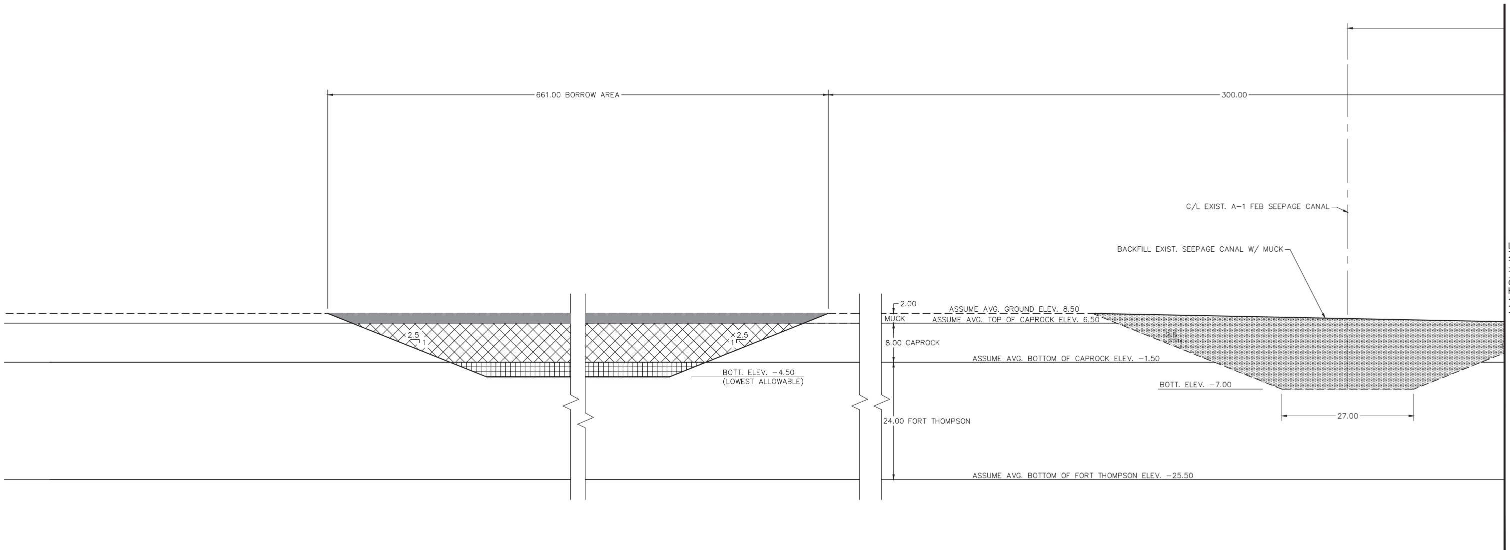
A-2 EAST RESERVOIR DAM EMBANKMENT (NEXT TO NEW STA CELLS)

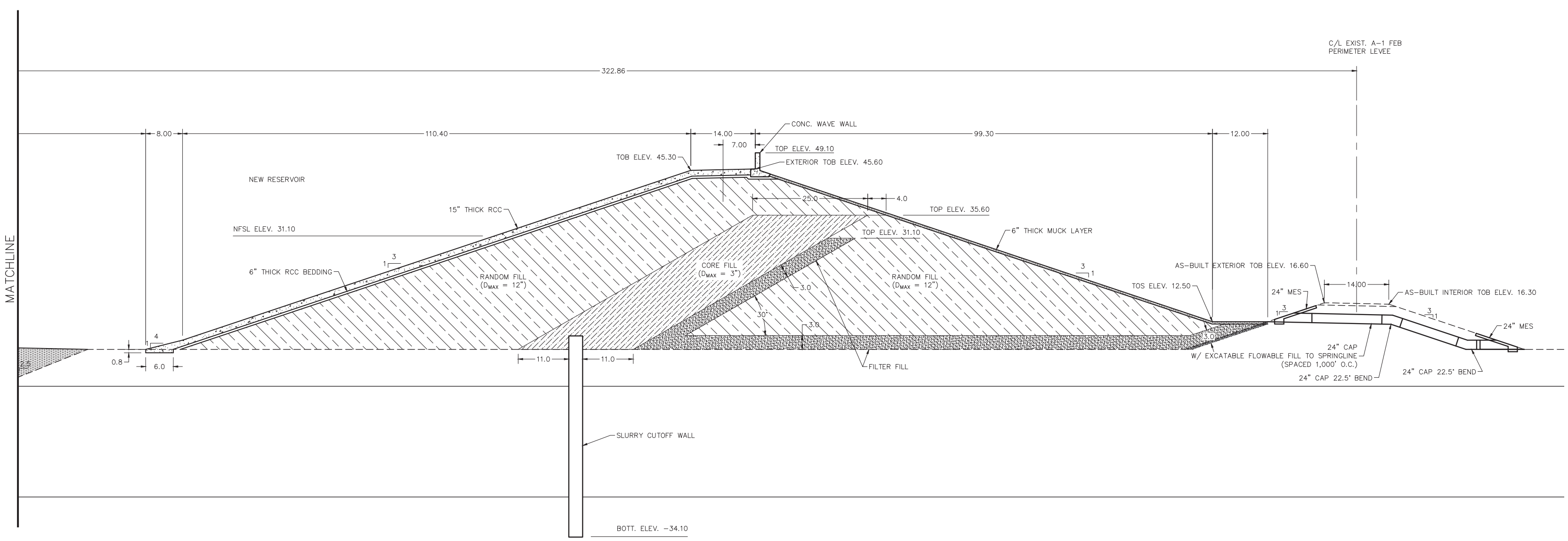
Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		192	20,508			90		
Clearing & Grubbing		1230	20,508			579		
Muck Cut - dam & canal	841.00		20,508	638,786				1,809,142
Caprock Cut (canal)	436.00		20,508	331,166				
Ft. Thompson Cut (canal)	70.63		20,508	53,644				384,810
Muck Cut (reservoir/borrow area)	1540.84		20,508	1,170,356				
Caprock Cut (reservoir/borrow area)	5963.37		20,508	4,529,514				
Ft. Thompson Cut (reservoir/borrow area)	2153.77		20,508	1,635,904				6,165,418
Muck Temp. Stockpile	2858.21		20,508	2,170,971			2,605,165	
Muck Fill (no reduction for MESs & culverts)	95.36		20,508	72,434			86,921	
6" Limrock Base	8.00		20,508	6,078			7,597	
Random Fill (Dmax = 6") (no reduction for culverts)	865.08		20,508	657,078			821,347	
Random Fill (Dma x= 12") (no reduction for culverts)	3498.52		20,508	2,657,318			3,321,648	
Random Fill (Dmax = 24")	0.00		20,508	-			-	########
Core Fill, Bentonite Enriched (Dmax = 3")	718.78		20,508	545,956			682,445	
Slurry Cutoff Wall	130.80		20,508	99,350	894,149 SF			
Filter Fill (ASTM C33 Course Sand)	508.32		20,508	386,097			482,621	
15" RCC	173.53		20,508	131,804	395,412			
6" RCC Bedding	68.33		20,508	51,899			64,873	
Conc. Wave Wall	9.03		20,508	6,858				

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
19X30" Elliptical CAP w/ flowable fill to springline	1,533			
19X30" Elliptical Mitered End Section (MES)		21	1,260	SF

Section K(L) Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	1,809,142	CY	Muck Cut
19x30 CAP	1,533	LF	19x30 CAP
MES	1,260	SF	19x30 MES
TRENCHING	20,508	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	894,149 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	2,605,165	CY	Muck Stockpile
Drill and Blast Caprock	4,860,680	CY	Sum of Caprocks
Excavate Caprock to Stockpile	6,075,850	CY	x1.25
Handling	6,075,850	CY	x1.25
Drill and Blast Ft. Thompson	1,689,548	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	2,111,935	CY	x1.25
Handling	2,111,935	CY	x1.25
Process Limerock, Filter Fill, Bedding Stone	555,092	CY	Sum of listed items
Place Random Fill, Core, Filter, Limerock	5,380,532	CY	Sum of listed items
Fill/Compact Random Fill	5,380,532	CY	
Borrow, clay, till	545,956	CY	Core Fill, Bentonite
RCC Material	395,412	SY	15" Thick RCC
Concrete Barrier	20,508	LF	Conc. Wave Wall
Bank Topsoil Placement	86,921	CY	Muck Fill
Fine Grading	90	Acre	Hydroseeding
Seeding	90	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION L(L): A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST. A-1 FEB PERIMETER LEVEE)
Scope Given:	Levee Section L(L) is utilized as a typical section: 15,376 LF (2.91 MI) running South to North, between A-2 Reservoir and A-1 FEB.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	





LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

TYPICAL SECTION L(L)

NOT TO SCALE

SECTION L(L)

A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST. A-1 FEB PERIMETER LEVEE)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		113	15,376			40		
Clearing & Grubbing		830	15,376			293		
Muck Cut - dam	9.07		15,376	5,165				
Muck Cut (reservoir/borrow area)	1311.81		15,376	747,052				752,217
Caprock Cut (reservoir/borrow area)	5047.24		15,376	2,874,312				
Ft. Thompson Cut (reservoir/borrow area)	1810.22		15,376	1,030,885				3,905,197
Muck Temp. Stockpile	1585.06		15,376	902,661			1,083,193	
Muck Fill (dam)	56.68		15,376	32,281			38,737	
Muck Fill (A-1 FEB seepage canal)	914.63		15,376	520,862			625,034	663,771
Random Fill for Dam (Dmax = 24")	0.00		15,376	-			-	
Core Fill, Bentonite Enriched (Dmax = 3")	718.78		15,376	409,334			511,667	
Slurry Cutoff Wall	130.80		15,376	74,488	670,394 SF			
Random Fill for Dam (Dmax=12")	3523.75		15,376	2,006,713			2,508,391	
Filter Fill (ASTM C33 Course Sand)	521.09		15,376	296,751			370,938	########
15" RCC	173.53		15,376	98,821	296,462			
6" RCC Bedding	68.33		15,376	38,911			48,639	
Conc. Wave Wall	9.03		15,376	5,142				

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
24" CAP	480			
24" Mitered End Sect. w/ flowable fill to springline		32	1,920	SF
24" CAP 22.5 Deg. Bends		32		

Slurry Wall Quotes

Information dervied from cost estimate provided by Thrift Contractor

Estimate Version - 12c

PROJECT IDENTIFICATION
PRE BID EVALUATION AND POST BID ANALYSIS

Printed 3/11/2018 23:50

A. PROJECT NAME: Textra Tech EAA | Proj Num: 07428 | New Proj Date:

PreBid Eval:

Location (City) : Canal Point | State: FL | Bid Date: 03/09/18 | Post Bid Anal:

Engineer : | Est. Value: | Market Seg:

Contact : | Phone

Owner : | Margin % | Structure Type: CSM

Project Bid To : Owner Gen. Contractor

B. PROJECT DESCRIPTION:

Dia.	Num	LF Rock	LF Soil	Unit Price	Dia	Num	LF Rock	LF Soil	Unit Price
0	**14988**	**92176.2**	**4581157.14**		**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**		**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**		**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**		**0**	**0**	**0**	**0**	

Method : This is for estimate only prices are based on knowledge from HHD projects.

Quoted Price $136,840,734

Cost Labor	$37,199,423
Internal Equip & Fuel	$40,011,575
Subcontractors	$5,760,000
Rental Equip	$3,817,605
Concrete	$5,647,508
Rebar	$0
Materials	$12,933,584
Trucking	$130,800
Administrative	$1,318,756
Total Cost	$106,819,250
Margin	$30,021,484
GM %	21.94%

ESTIMATE/PRICING SUMMARY SHEET

Textra Tech EAA

Proj Num: 07428

Printed 3/11/18 3:58 PM

METHOD STATEMENT

PRODUCTION RATE

MAIN EQUIPMENT

START DATE

RISK ASSESMENT

QUOTED BY

ESTIMATOR 0

Bid based on ____ (Enter LF, CY, Num, Comb)

TAKEOFF SUMMARY							PAY QUANTITY SUMMARY					
Diam	Num	LF Rock	LF Soil	Tot LF	CY	Perm Csg	Num	LF Rock	LF Soil	Tot LF	CY	Perm Csg
0	14988	92176.2	4581157.14	0	360554.03	752955.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
0	0	0	0	0	0.00	0.00	0	0	0	0	0	0
OTA	14988	92176.2	4581157.14	0	360554.03	752955.00	0	0	0	0		

COST ESTIMATE SUMMARY	Mob	Site OH	CSM	Predrill	Earthwk	Total	PRICING SUMMARY MARKUP	SELL PRICE
DIRECT LABOR	$121,861	$8,599,075	$19,647,326	$8,387,853	$443,307	$37,199,423	1.400	$52,079,192
INTERNAL EQUIP	$21,075	$1,047,000	$22,056,000	$16,530,000	$357,500	$40,011,575	1.250	$50,014,469
SUBCONTRACTORS	$305,000	$0	$4,255,000	$0	$1,200,000	$5,760,000	1.150	$6,624,000
RENTAL EQUIP	$48,357	$1,051,429	$777,614	$1,418,552	$521,652	$3,817,605	1.350	$5,153,766
CONCRETE	$0	$0	$5,647,508	$0	$0	$5,647,508	1.150	$6,494,634
REBAR	$0	$0	$0	$0	$0	$0	1.150	$0
OTHER MATERIALS	$68,849	$497,799	$10,078,508	$2,205,843	$82,586	$12,933,584	1.150	$14,873,622
TRUCKING	$91,500	$0	$0	$39,300	$0	$130,800	1.150	$150,420
ADMIN	$8,208	$139,941	$780,774	$357,269	$32,563	$1,318,756	1.100	$1,450,632
VARIABLE COST	$496,293	$10,697,504	$46,735,941	$26,336,405	$2,522,460	$86,788,603	34.59%	
FIXED COST	$521,914	$1,689,168	$21,539,405	$4,020,965	$1,836,801	$29,608,253		
						$0		
TOTAL COST	$664,850	$11,335,244	$63,242,731	$28,938,817	$2,637,608	$106,819,250	1.281	$136,840,734 MSRP

Information dervied from cost estimate provided by Thrift Contractor

ESTIMATE DETAIL SUMMARY				Textra Tech EAA			Proj Num:	07428
	3/11/18 11:50 PM					Printed	3/11/18 11:50 PM	
	ESTIMATE PHASE	Mob	Site OH	CSM	Predrill	Earthwk	Total	$0
DIRECT LABOR								Selling
	Management	$12,000	$480,000	$0	$0	$0	$492,000	Price
	Safety Manager	$9,600	$768,000	$0	$0	$0	$777,600	
	Supervision	$27,600	$768,000	$1,104,000	$920,000	$0	$2,819,600	
	Operator - ST	$16,238	$0	$1,299,072	$1,082,560	$0	$2,397,870	
	Operator - OT	$5,563	$0	$890,016	$741,680	$0	$1,637,259	
	Laborers - ST	$0	$1,280,640	$5,616,288	$1,707,200	$285,246	$8,889,374	
	Laborers - OT	$0	$918,720	$3,963,144	$1,213,600	$50,593	$6,146,057	
	Payroll Burden	$22,720	$1,348,915	$4,119,206	$1,812,813	$107,468	$7,411,123	
	Bauer Labor	$0	$1,800,000	$900,000	$0	$0	$2,700,000	Direct
	Per Diem	$7,980	$294,000	$411,600	$238,000	$0	$951,580	Labor
	Hotel	$20,160	$940,800	$1,344,000	$672,000	$0	$2,976,960	$37,199,423
		$121,861	$8,599,075	$19,647,326	$8,387,853	$443,307		
CCC TOOLS AND EQUIPMENT								
	Primary Equipment	$0	$0	$5,760,000	$9,600,000	$0	$15,360,000	
	Internal Equipment	$9,000	$486,000	$9,372,000	$340,000	$40,625	$10,247,625	
	CCC Toolings	$0	$120,000	$1,800,000	$2,180,000	$32,500	$4,132,500	
	Gasoline	$6,300	$315,000	$378,000	$105,000	$17,063	$821,363	Internal
	Diesel Fuel	$5,198	$113,400	$4,271,400	$3,874,500	$240,581	$8,505,079	Equip.
	Lubricants	$578	$12,600	$474,600	$430,500	$26,731	$945,009	$40,011,575
		$21,075	$1,047,000	$22,056,000	$16,530,000	$357,500		
SUBCONTRACTORS								Subcontractor
605	Subcontractors	$305,000	$0	$4,255,000	$0	$1,200,000	$5,760,000	$5,760,000
RENTAL EQUIPMENT & SUBCONTRACTORS								
	Lump Sum & Misc. Rental	$0	$0	$90,000	$36,000	$0	$126,000	Rental
	Term Rental Equipment	$48,357	$1,051,429	$687,614	$1,382,552	$521,652	$3,691,605	Equip.
		$48,357	$1,051,429	$777,614	$1,418,552	$521,652		$3,817,605
	$ / Work Day	*$16,543*	*$8,915*	*$38,947*	*$26,336*	*$7,761*		
						TOTAL VARIABLE COSTS		$86,788,603
MATERIALS								
	Ready Mix	$0	$0	$0	$0	$0	$0	
	Grout	$0	$0	$0	$0	$0	$0	Cementious
	Cement/Slag	$0	$0	$5,078,694	$0	$0	$5,078,694	Materials
	Bentonite	$0	$0	$568,814	$0	$0	$568,814	$5,647,508
	Reinforcing	$0	$0	$0	$0	$0	$0	
	Rebar Spacers	$0	$0	$0	$0	$0	$0	Rebar
	Re-bar Fabrication	$0	$0	$0	$0	$0	$0	$0
	Other Materials	$0	$48,150	$8,147,697	$963,000	$17,548	$9,176,395	
	Casing	$0	$0	$0	$288,900	$0	$288,900	
	Culvert	$0	$0	$0	$0	$0	$0	
	Mineral Drill Mud	$0	$0	$0	$0	$0	$0	
	Polymer Drill Mud	$0	$0	$0	$0	$0	$0	
	Auger Teeth & Rollers	$0	$0	$0	$180,000	$7,500	$187,500	
	Shop Labor	$25,000	$0	$360,000	$25,000	$10,000	$420,000	
	Shop Materials	$25,000	$0	$90,000	$25,000	$10,000	$150,000	
	Equipment Repair Parts	$180	$9,720	$302,640	$198,800	$813	$512,153	
	Safety Supplies	$300	$120,000	$12,000	$20,000	$3,250	$155,550	
	Slurry & Water Systems	$0	$0	$50,000	$0	$0	$50,000	
	Slings & Rigging	$1,500	$0	$60,000	$50,000	$0	$111,500	
	Site Office Costs	$1,500	$60,000	$60,000	$150,000	$0	$271,500	
	Office Supplies	$90	$30,000	$3,600	$3,000	$975	$37,665	
	Phone & Utilities	$429	$71,429	$8,571	$7,143	$0	$87,571	
	Empl. Hiring Costs	$0	$2,500	$0	$0	$0	$2,500	
	Miscellaneous Purchases	$12,600	$156,000	$504,000	$170,000	$32,500	$875,100	
	Welding Supplies	$2,250	$0	$480,000	$125,000	$0	$607,250	Other
								Materials
		$68,849	$497,799	$15,726,016	$2,205,843	$82,586		$12,933,584
TRUCKING								
	Hired Trucking	$91,500	$0	$0	$39,300	$0	$130,800	
	CCC Trucking						$0	Trucking
		$91,500	$0	$0	$39,300	$0		$130,800
TOTAL CONTRACT ADMIN.								
	Bonding	$0	$0	$0	$0	$0	$0	
	Legal Services	$0	$0	$0	$0	$0	$0	
	Liability Insurance	$8,208	$139,941	$780,774	$357,269	$32,563	$1,318,756	Admin
							$0	Costs
		$8,208	$139,941	$780,774	$357,269	$32,563		$1,318,756
	JOB COST BY PHASE	$664,850	$11,335,244	$63,242,731	$28,938,817	$2,637,608	$106,819,250	

Added by J-Tech

Cost / SF Wall	$0.16	$2.65	$14.79	$6.77	$0.62
	Mob	Overhead	CSM Wall	Predrill	Earthwork

Wall Total Combined $24.37 per SF

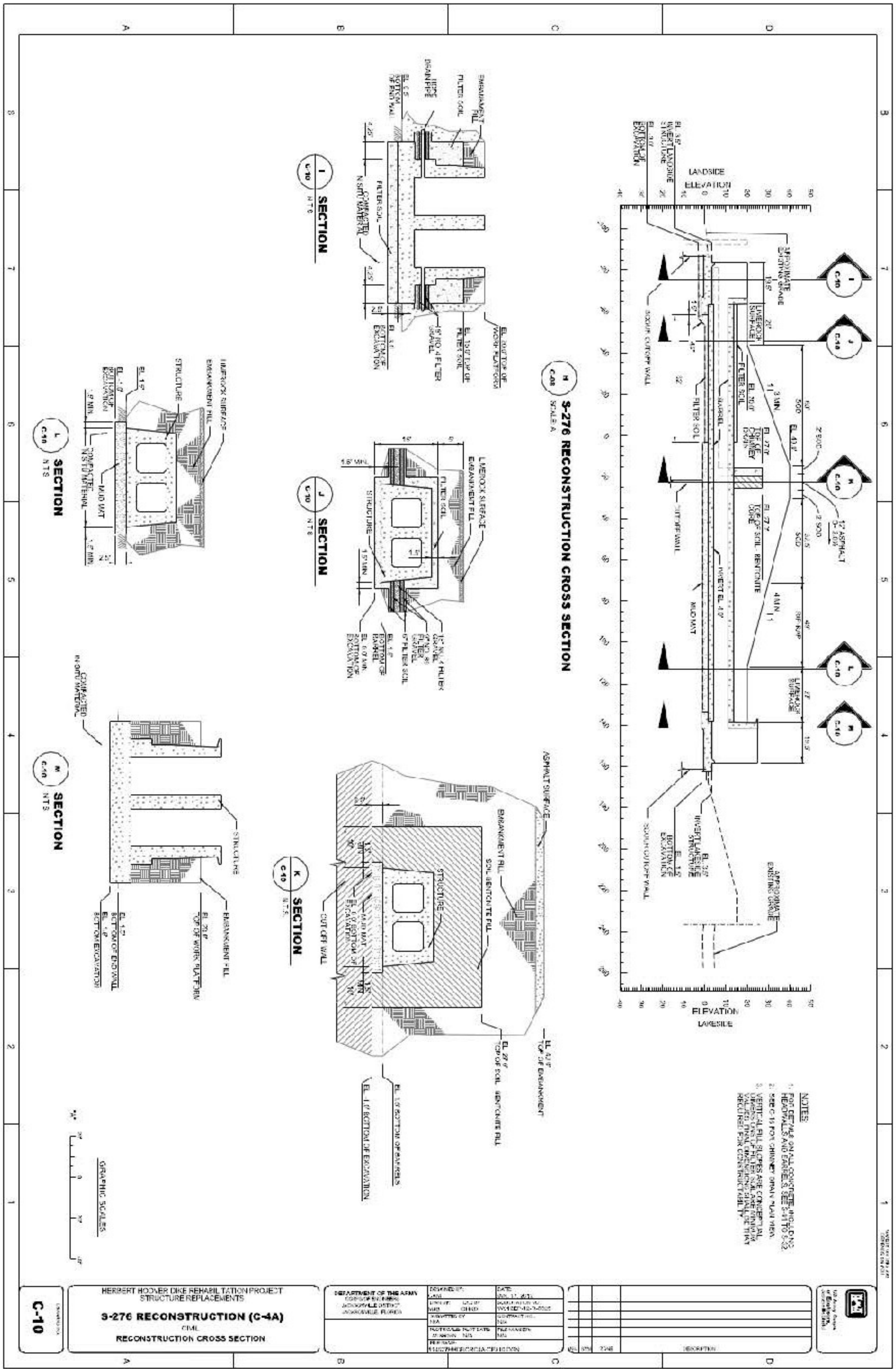
Earth Work $28.38 per LF Wall

Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Contract 4: A-2 Reservoir and A-2 STA Spillway and Culverts (S-1, and C-1 through C-11)

Feature of Work:	STRUCTURE C-1: 385 LF TRIPLE GATED 12'Wx12'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Scope Given:	385 LF triple gated 12'x12' box culvert w/ endwalls (Inv. Elev. -8.00) w/ 12'x24' control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-1 is a gated box culvert which allows for inflow to the A-2 Reservoir from the Reservoir Inflow-Outlow Canal or for outflow to the A-2 Reservoir Inflow-Outflow Canal from the A-2 Reservoir, depending on the stages in the A-2 Reservoir and the A-2 Reservoir Inflow-Outflow Canal.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277 but will be a quadruple culvert. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-1



Feature of Work:	STRUCTURE C-1: 385 LF TRIPLE GATED 12'Wx12'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	225.3	FT	Assume 20' from top of excavation
Length	=	425.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	1,300.7	LF	Sheetpile perimeter
Area	=	95,766.7	SF	

Culvert excavation

Length	=	385.0	FT						
Total Depth	=	15.5	FT	Invert Elev. Minus Foundation Depth					
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick					
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick					
Thickness of Fort Thompson	=	5.5	FT	Top @-1.5 - 24ft thick					
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	123.3	FT	Assumes 40' endwalls both ways					
Top Width	=	185.3	FT						
Cross Section	=	2,392.2	SF						
Cross Section Organic	=	362.7	SF						
Cross Section of Cap Rock	=	1,290.7	SF						
Cross Section of Fort Thompson	=	738.8	SF						
Organic Cut Volume	=	139,626.7	CF	=	5,171.4	BCY	=		LCY
Cap Rock Cut Volume	=	496,906.7	CF	=	18,404.0	BCY	=		LCY
Fort Thompson Cut Volume	=	284,450.8	CF	=	10,535.2	BCY	=		LCY
EXCAVATION		TOTAL		=	34,110.5	BCY	=	42,638.2	LCY

Concrete Culvert Concrete

Culvert Pipes	3	Width	12	Height	12		
Length	=	385.0	FT				
Foundation Concrete Bottom Width	=	43.3	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	50,050.0	CF	=	1,853.7	CY	
Vertical Concrete Height	=	12.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	33,880.0	CF	=	1,254.8	CY	
Elevated Concrete							
Top Width	=	43.3	FT				
Thickness	=	2.0	FT				
Volume	=	33,366.7	CF	=	1,235.8	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same		
Foundation						
Length	=	20.0	FT			
Depth	=	2.0	FT			
Width	=	43.3	FT			
Volume	=	3,466.7	CF	=	128.4	CY

Culvert Endwall						
Height	=	26.0 FT			Assume x2 (Culvert Height + 1')	
Thickness	=	1.5 FT				
Width	=	43.3 FT				
Openings	=	432.0 SF				
Volume	=	2,084.0 CF	=	77.2 CY		
Needle Beam						
Height	=	2.5 FT				
Width	=	12.0 FT				
Depth	=	3.0 FT				
Volume		540.0 CF	=	20.0 CY		
Exterior Walls						
Edge Wall Height	=	26.0 FT				
Edge Wall Length	=	20.0 FT			total each side	
Edge Wall Thickness	=	2.0 FT				
Interior Wall Height		26.0 FT				
Interior Wall Length		14.0 FT				
Inteiror Wall Thickness		1.7 FT				
Volume	=	6,586.7 CF	=	244.0 CY		
CONCRETE	TOTAL		=	4,813.9 CY		
Steel Rebar					Assumed 1.2% volume of concrete	Culvert referenced as an example used approx. 0.8% steel per volume
STEEL REBAR	TOTAL		=	57.8 CY	Rebar	
				381.8 TONS		

Sheetpile Endwalls

Number	=	2.0 EA			x2 Endwalls per opening (HW/TW)	
Width	=	80.0 FT			40 ft off each side of culvert	
Length	=	30.0 FT			Assume PZ27 sheetpile, 30' long sheets	
Sheetpile Area	=	4,800.0 SF		30' Long Sheets, 160' Span	PZ-27	
Concrete Cap	=	4.0 SF			Assume 2'x2' cap with PZ27 sheets	
Concrete Volume	=	640.0 CF	=	23.7 CY	Concrete	

MISC METALS

Structure Railing	=	122.2 LF			Per each end
Endwall Railing	=	82.0 LF			Per each end
TOTAL RAILING	=	408.3 LF			3'6" Tall Steel Railing
Ladders	=	2.0 EACH			
height	=	25.5 FT EA	=	51.0 FT TOTAL	
Grating	=	72.0 SF per Gate			Approx. 6' long, width of each bay
TOTAL Grating	=	432.0 SF			Steel Grating

NEW GATES

Number of gates	=	3.0 EA			x1 per Culvert Pipe
Height	=	13.0 FT			Assumed 1' greater than Culvert Height
Width	=	11.0 FT			Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	12,712.7 LB EA			Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		38,138.0 LB	=	19.1 TONS	
Mechanical Components	=	3.0 EA			All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	144.0 LF			

Gate Seal Length	=	144.0 LF		Gate perimeter x # of gates

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

Assume same on both sides

Number of placements	=	2.0 EA			1 each side
Length	=	127.5 FT			Assume width of new canal
Width	=	123.3 FT			Assume same as bottom width of excavation
thickness	=	4.0 FT			Assumed
Volume	=	62,900.0 CF/EA	=	2,329.6 CY/EA	
RIPRAP		TOTAL	=	4,659.3 CY	Riprap
Geotextile Filter Fabric	=	17,000.0 SF			Fabric

Boat Barrier

Number	=	2.0 EA	
Piles for Buoys	=	3.0 EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	172.0 FT/EA	
Total Length	=	344.0 FT	Buoy style barrier
Total Piles	=	6.0 EA	

SWPPP

Floating Silt Boom	=	980.0 FT	Assumed
Silt Fence	=	6,492.0 FT	Assumed

Control Building

Size	=	288.0 SF			12x24
Electrical	=	NEEDED			
Communications	=	NEEDED			
Modular Precast Concrete Structure					
Exterior Walls					
Height	=	12.0 FT			
Perimeter Length	=	72.0 FT			
Thickness	=	4.0 IN			
Volume	=	288.0	=	10.7 CY	
Interior Wall					
Height	=	12.0 FT			
Length	=	12.0 FT			
Thickness	=	4.0 IN			
Volume	=	48.0	=	1.8 CY	
Floor Slab					
Thickness	=	6.0 IN			
Area	=	288.0 SF			
Volume	=	144.0 CF	=	5.3 CY	
Roof					
Thickness	=	5.0 IN			
Area	=	288.0 SF			
Volume	=	120.0 CF	=	4.4 CY	
Fuel Pad	=	96.0 CF			Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6 CY			

CONCRETE	TOTAL		=	25.8	CY

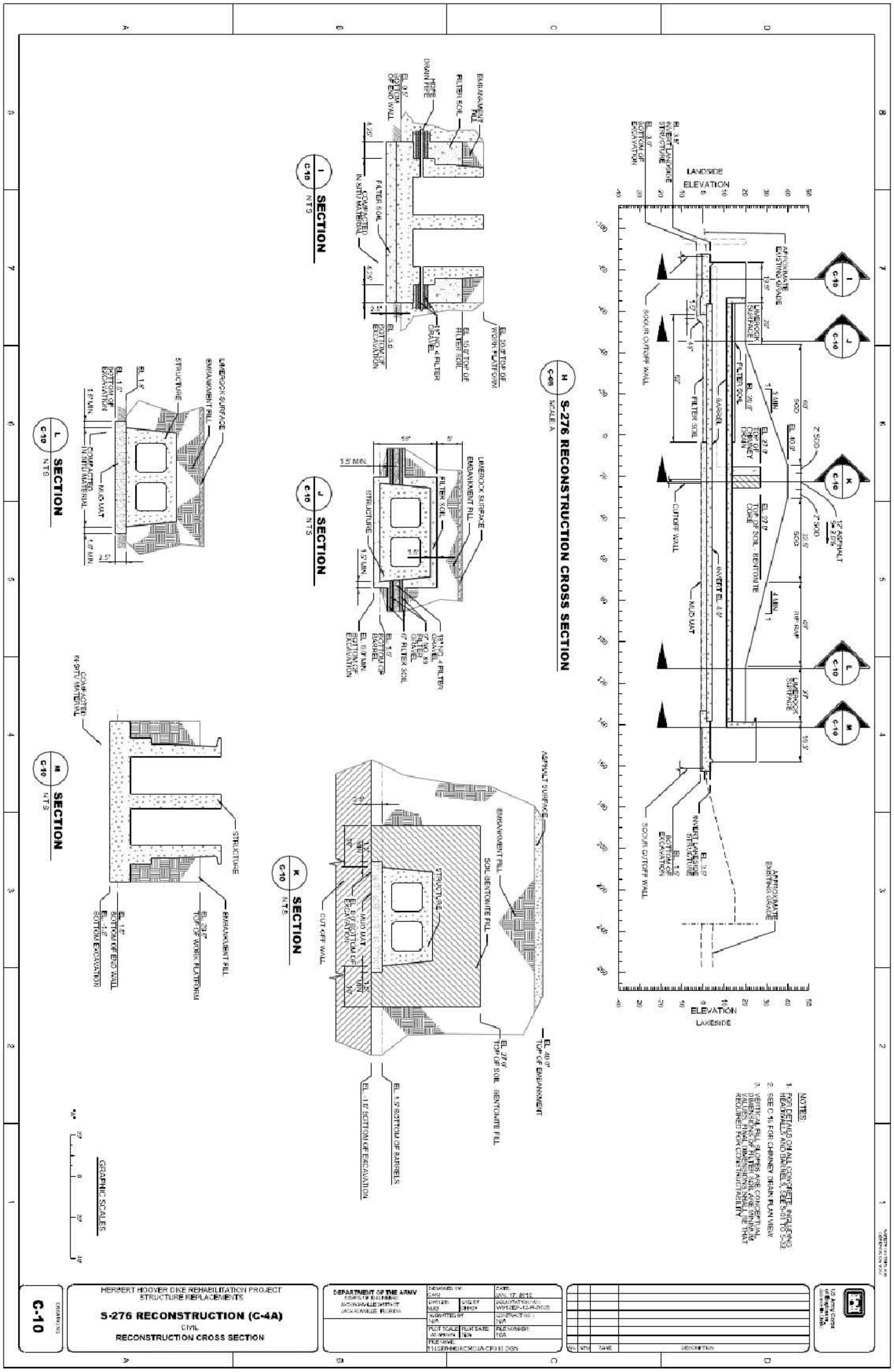
Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	1,300.7	LF	
Coffer dam:	95,766.7	SF	
Excavation:	34,110.5	CY	
Concrete:	4,813.9	CY	
Steel Rebar:	57.8	CY (?)	
Steel Rebar:	381.8	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	408.3	LF	
Grate:	432.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	3	EA	11'x13' w/ mechanical components
Seals:	144.0	LF	
Backfill:	42,638.2	LCY	
Rip-rap:	4,659.3	CY	
Geofabric:	17,000.0	SF	
Boat Barrier:	344.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-2: 642 LF DOUBLE 15'Wx6'H BOX CULVERT WITH ENDWALLS (UNGATED), 12'x24' CONTROL BUILDING
Scope Given:	642 LF double gated 6'x15' box culvert w/ endwalls (Inv. Elev. -14.50) w/ 12'x24' control building and HW/TW monitoring stations w/ walkways (by-pass required for construction). Structure C-2 is a gated box culvert which allows for the treated discharge from the A-2 STA to flow to the Miami Canal south of Spillway G-373.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power. – Assume sheet pile will need to be driven around inlet structure on the canal side. Sheet pile depth 50 ft, set back from excavation of 25 ft, with pumping ongoing during construction.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Construction will be performed after the canal plugs are installed up and downstream of the proposed culvert location. Dewatering will be needed. Dewatering pumps used as needed throughout construction. Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-2



Feature of Work:	STRUCTURE C-2: 642 LF DOUBLE 15’Wx6’H BOX CULVERT WITH ENDWALLS (UNGATED), 12’x24’ CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	259.7	FT	Assume 20' from top of excavation
Length	=	682.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	1,883.3	LF	Sheetpile perimeter
Area	=	177,092.7	SF	

Culvert excavation

Length	=	642.0	FT						
Total Depth	=	26.0	FT	Invert Elev. Minus Foundation Depth					
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick					
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick					
Thickness of Fort Thompson	=	16.0	FT	Top @-1.5 - 24ft thick					
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	115.7	FT	Assumes 40' endwalls both ways					
Top Width	=	219.7	FT						
Cross Section	=	4,359.3	SF						
Cross Section Organic	=	431.3	SF						
Cross Section of Cap Rock	=	1,565.3	SF						
Cross Section of Fort Thompson	=	2,362.7	SF						
Organic Cut Volume	=	276,916.0	CF	=	10,256.1	BCY	=		LCY
Cap Rock Cut Volume	=	1,004,944.0	CF	=	37,220.1	BCY	=		LCY
Fort Thompson Cut Volume	=	1,516,832.0	CF	=	56,179.0	BCY	=		LCY
EXCAVATION	TOTAL			=	103,655.3	BCY	=	129,569.1	LCY

Concrete Culvert Concrete

Culvert Pipes	2	Width	15		Height	6	
Length	=	642.0	FT				
Foundation Concrete Bottom Width	=	35.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	68,694.0	CF	=	2,544.2	CY	
Vertical Concrete Height	=	6.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	20,544.0	CF	=	760.9	CY	
Elevated Concrete							
Top Width	=	35.7	FT				
Thickness	=	2.0	FT				
Volume	=	45,796.0	CF	=	1,696.1	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same		
Foundation						
Length	=	20.0	FT			
Depth	=	2.0	FT			
Width	=	35.7	FT			
Volume	=	2,853.3	CF	=	105.7	CY

Culvert Endwall							
Height	=	14.0	FT				Assume x2 (Culvert Height + 1')
Thickness	=	1.5	FT				
Width	=	35.7	FT				
Openings	=	180.0	SF				
Volume	=	958.0	CF	=	35.5	CY	
Needle Beam							
Height	=	2.5	FT				
Width	=	15.0	FT				
Depth	=	3.0	FT				
Volume		450.0	CF	=	16.7	CY	
Exterior Walls							
Edge Wall Height	=	14.0	FT				
Edge Wall Length	=	20.0	FT				total each side
Edge Wall Thickness	=	2.0	FT				
Interior Wall Height		14.0	FT				
Interior Wall Length		14.0	FT				
Inteiror Wall Thickness		1.7	FT				
Volume	=	2,893.3	CF	=	107.2	CY	
CONCRETE		TOTAL		=	5,266.2	CY	
Steel Rebar							Assumed 1.2% volume of concrete
STEEL REBAR		TOTAL		=	63.2	CY	Rebar
					417.7	TONS	

Culvert referenced as an example used approx. 0.8% steel per volume

Sheetpile Endwalls

Number	=	2.0	EA				x2 Endwalls per opening (HW/TW)
Width	=	80.0	FT				40 ft off each side of culvert
Height	=	30.0	FT				Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0	SF		30' Long Sheets, 160' Span		PZ-27
Concrete Cap	=	4.0	SF				Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0	CF	=	23.7	CY	Concrete

MISC METALS

Structure Railing	=	106.8	LF				Per each end
Endwall Railing	=	82.0	LF				Per each end
TOTAL RAILING	=	377.7	LF				3'6" Tall Steel Railing
Ladders	=	2.0	EACH				
height	=	25.5	FT EA	=	51.0	FT TOTAL	
Grating	=	90.0	SF per Gate				Approx. 6' long, width of each bay
TOTAL Grating	=	360.0	SF				Steel Grating

NEW GATES

No gates at this structure

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides				
number of placements	=	2.0	EA	1 each side
Length	=	127.5	FT	Assume width of new canal
Width	=	2.0	FT	Assume same as bottom width of excavation

thickness	=	4.0	FT			Assumed	
Volume	=	1,020.0	CF/EA	=	37.8	CY/EA	
RIPRAP		TOTAL		=	75.6	CY	Riprap
Geotextile Filter Fabric	=	1,530.0	SF		Fabric		

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	167.0	FT/EA	
Total Length	=	334.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF			12x24	
Electrical	=	NEEDED					
Communications	=	NEEDED					
Modular Precast Concrete Structure							
Exterior Walls							
Height	=	12.0	FT				
Perimeter Length	=	72.0	FT				
Thickness	=	4.0	IN				
Volume	=	288.0		=	10.7	CY	
Interior Wall							
Height	=	12.0	FT				
Length	=	12.0	FT				
Thickness	=	4.0	IN				
Volume	=	48.0		=	1.8	CY	
Floor Slab							
Thickness	=	6.0	IN				
Area	=	288.0	SF				
Volume	=	144.0	CF	=	5.3	CY	
Roof							
Thickness	=	5.0	IN				
Area	=	288.0	SF				
Volume	=	120.0	CF	=	4.4	CY	
Fuel Pad	=	96.0	CF			Assume 8'x12'x12" thick reinforced concrete slab on grade pad	
	=	3.6	CY				
CONCRETE		TOTAL		=	25.8	CY	
Total Doors	=	2.0	EA				
Size	=	4'-0" x 7'-0"					
Conduit Boxes	=	1.0	EA/DOOR				
Lock Boxes	=	1.0	EA/DOOR				
Fire Extinguishers	=	2.0	EA				
26" x 26" Exhaust Hoods	=	1.0	EA				

30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	1,883.3	LF	
Coffer dam:	177,092.7	SF	
Excavation:	103,655.3	CY	
Concrete:	5,266.2	CY	
Steel Rebar:	63.2	CY (?)	
Steel Rebar:	417.7	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	377.7	LF	
Grate:	360.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	0	EA	
Seals:	0.0	LF	
Backfill:	129,569.1	LCY	
Rip-rap:	75.6	CY	
Geofabric:	1,530.0	SF	
Boat Barrier:	334.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

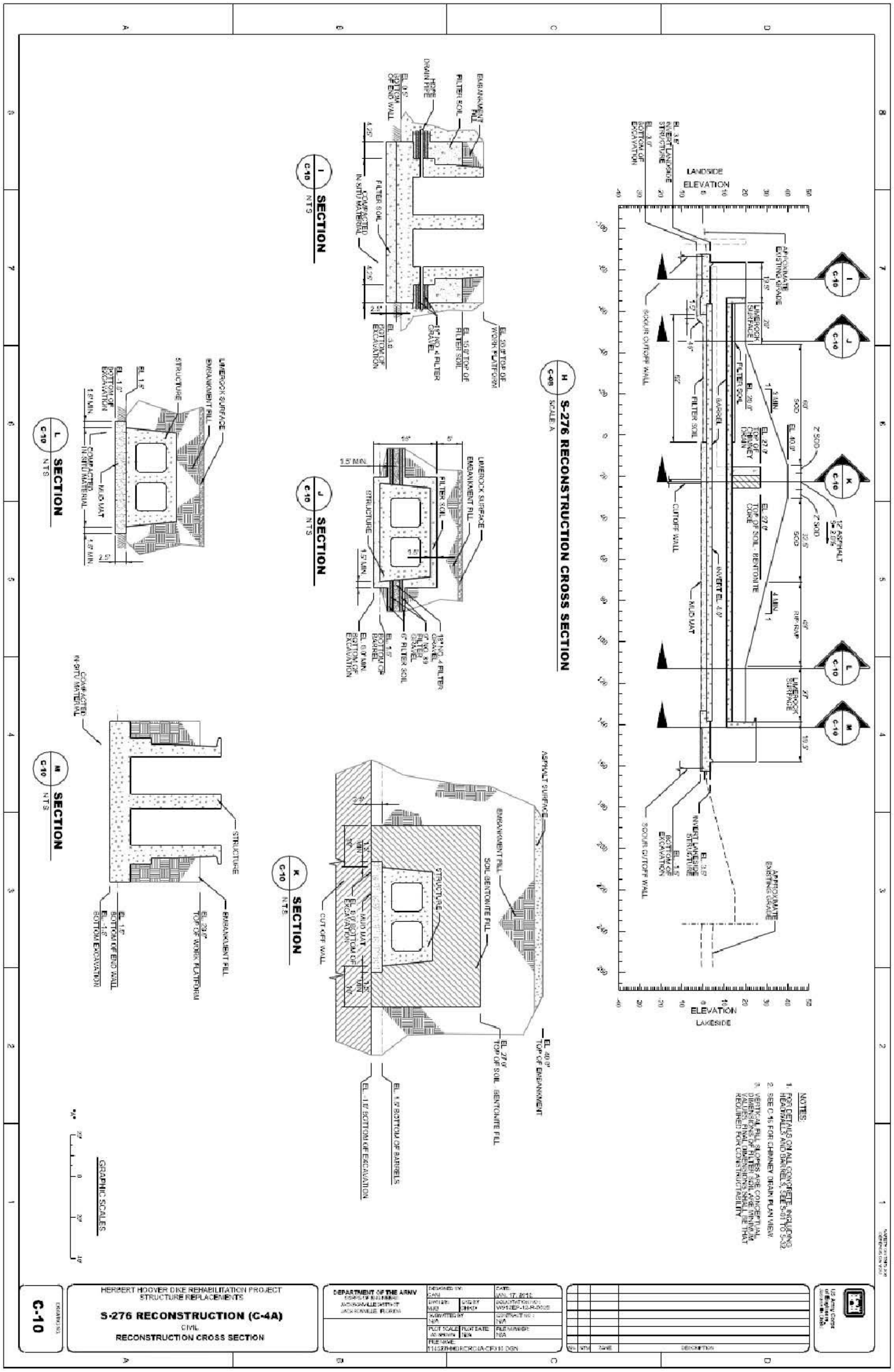
836.98

1,865.76

932.88

Feature of Work:	STRUCTURE C-3: 370 LF DOUBLE GATED 7’Wx7’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING
Scope Given:	370 LF double gated 7’x7’ box culvert w/ endwalls (Inv. Elev. -4.00) w/ 12’x24’ control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-3 is a gated box culvert which allows for water from the A-2 Reservoir to flow to Cell 3 of the A-2 STA.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-3



Feature of Work:	STRUCTURE C-3: 370 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	197.7	FT	Assume 20' from top of excavation
Length	=	410.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	1,215.3	LF	Sheetpile perimeter
Area	=	81,043.3	SF	

Culvert excavation

Length	=	370.0	FT							
Total Depth	=	14.5	FT	Invert Elev. Minus Foundation Depth						
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick						
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick						
Thickness of Fort Thompson	=	4.5	FT	Top @-1.5 - 24ft thick						
Slope1	=	2.0	:1							
Slope2	=	2.0	:1							
Bottom Width	=	99.7	FT	Assumes 40' endwalls both ways						
Top Width	=	157.7	FT							
Cross Section	=	1,865.7	SF							
Cross Section Organic	=	307.3	SF							
Cross Section of Cap Rock	=	1,069.3	SF							
Cross Section of Fort Thompson	=	489.0	SF							
Organic Cut Volume	=	113,713.3	CF		=	4,211.6	BCY	=		LCY
Cap Rock Cut Volume	=	395,653.3	CF		=	14,653.8	BCY	=		LCY
Fort Thompson Cut Volume	=	180,930.0	CF		=	6,701.1	BCY	=		LCY
EXCAVATION		TOTAL			=	25,566.5	BCY	=	31,958.2	LCY

Concrete Culvert Concrete

Culvert Pipes	2		Width	7		Height	7
Length	=	370.0	FT				
Foundation Concrete Bottom Width	=	19.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	21,830.0	CF	=	808.5	CY	
Vertical Concrete Height	=	7.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	13,813.3	CF	=	511.6	CY	
Elevated Concrete							
Top Width	=	19.7	FT				
Thickness	=	2.0	FT				
Volume	=	14,553.3	CF	=	539.0	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same		
Foundation						
Length	=	20.0	FT			
Depth	=	2.0	FT			
Width	=	19.7	FT			
Volume	=	1,573.3	CF	=	58.3	CY

Culvert Endwall							
Height	=	16.0	FT				Assume x2 (Culvert Height + 1')
Thickness	=	1.5	FT				
Width	=	19.7	FT				
Openings	=	98.0	SF				
Volume	=	650.0	CF	=	24.1	CY	
Needle Beam							
Height	=	2.5	FT				
Width	=	7.0	FT				
Depth	=	3.0	FT				
Volume		210.0	CF	=	7.8	CY	
Exterior Walls							
Edge Wall Height	=	16.0	FT				
Edge Wall Length	=	20.0	FT				total each side
Edge Wall Thickness	=	2.0	FT				
Interior Wall Height		16.0	FT				
Interior Wall Length		14.0	FT				
Inteiror Wall Thickness		1.7	FT				
Volume	=	3,306.7	CF	=	122.5	CY	
CONCRETE	TOTAL			=	2,071.7	CY	
Steel Rebar							Assumed 1.2% volume of concrete
STEEL REBAR	TOTAL			=	24.9	CY	Rebar
					164.3	TONS	

Culvert referenced as an example used approx. 0.8% steel per volume

Sheetpile Endwalls

Number	=	2.0	EA				x2 Endwalls per opening (HW/TW)
Width	=	80.0	FT				40 ft off each side of culvert
Length	=	30.0	FT				Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0	SF		30' Long Sheets, 160' Span		PZ-27
Concrete Cap	=	4.0	SF				Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0	CF	=	23.7	CY	Concrete

MISC METALS

Structure Railing	=	74.8	LF				Per each end
Endwall Railing	=	82.0	LF				Per each end
TOTAL RAILING	=	313.7	LF				3'6" Tall Steel Railing
Ladders	=	2.0	EACH				
height	=	25.5	FT EA	=	51.0	FT TOTAL	
Grating	=	42.0	SF per Gate				Approx. 6' long, width of each bay
TOTAL Grating	=	168.0	SF				Steel Grating

NEW GATES

Number of gates	=	2.0	EA				x1 per Culvert Pipe
Height	=	8.0	FT				Assumed 1' greater than Culvert Height
Width	=	6.0	FT				Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	4,267.2	LB EA				Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		8,534.4	LB	=	4.3	TONS	
Mechanical Components	=	2.0	EA				All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	56.0	LF				

Gate Seal Length	=	56.0 LF		Gate perimeter x # of gates

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides					
number of placements	=	2.0 EA			1 each side
Length	=	127.5 FT			Assume width of new canal
Width	=	99.7 FT			Assume same as bottom width of excavation
thickness	=	4.0 FT			Assumed
Volume	=	50,830.0 CF/EA	=	1,882.6 CY/EA	
RIPRAP		TOTAL	=	3,765.2 CY	Riprap
Geotextile Filter Fabric	=	13,982.5 SF			Fabric

Boat Barrier

Number	=	2.0 EA	
Piles for Buoys	=	3.0 EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	156.0 FT/EA	
Total Length	=	312.0 FT	Buoy style barrier
Total Piles	=	6.0 EA	

SWPPP

Floating Silt Boom	=	980.0 FT	Assumed
Silt Fence	=	6,492.0 FT	Assumed

Control Building

Size	=	288.0 SF			12x24
Electrical	=	NEEDED			
Communications	=	NEEDED			
Modular Precast Concrete Structure					
Exterior Walls					
Height	=	12.0 FT			
Perimeter Length	=	72.0 FT			
Thickness	=	4.0 IN			
Volume	=	288.0	=	10.7 CY	
Interior Wall					
Height	=	12.0 FT			
Length	=	12.0 FT			
Thickness	=	4.0 IN			
Volume	=	48.0	=	1.8 CY	
Floor Slab					
Thickness	=	6.0 IN			
Area	=	288.0 SF			
Volume	=	144.0 CF	=	5.3 CY	
Roof					
Thickness	=	5.0 IN			
Area	=	288.0 SF			
Volume	=	120.0 CF	=	4.4 CY	
Fuel Pad	=	96.0 CF			Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6 CY			

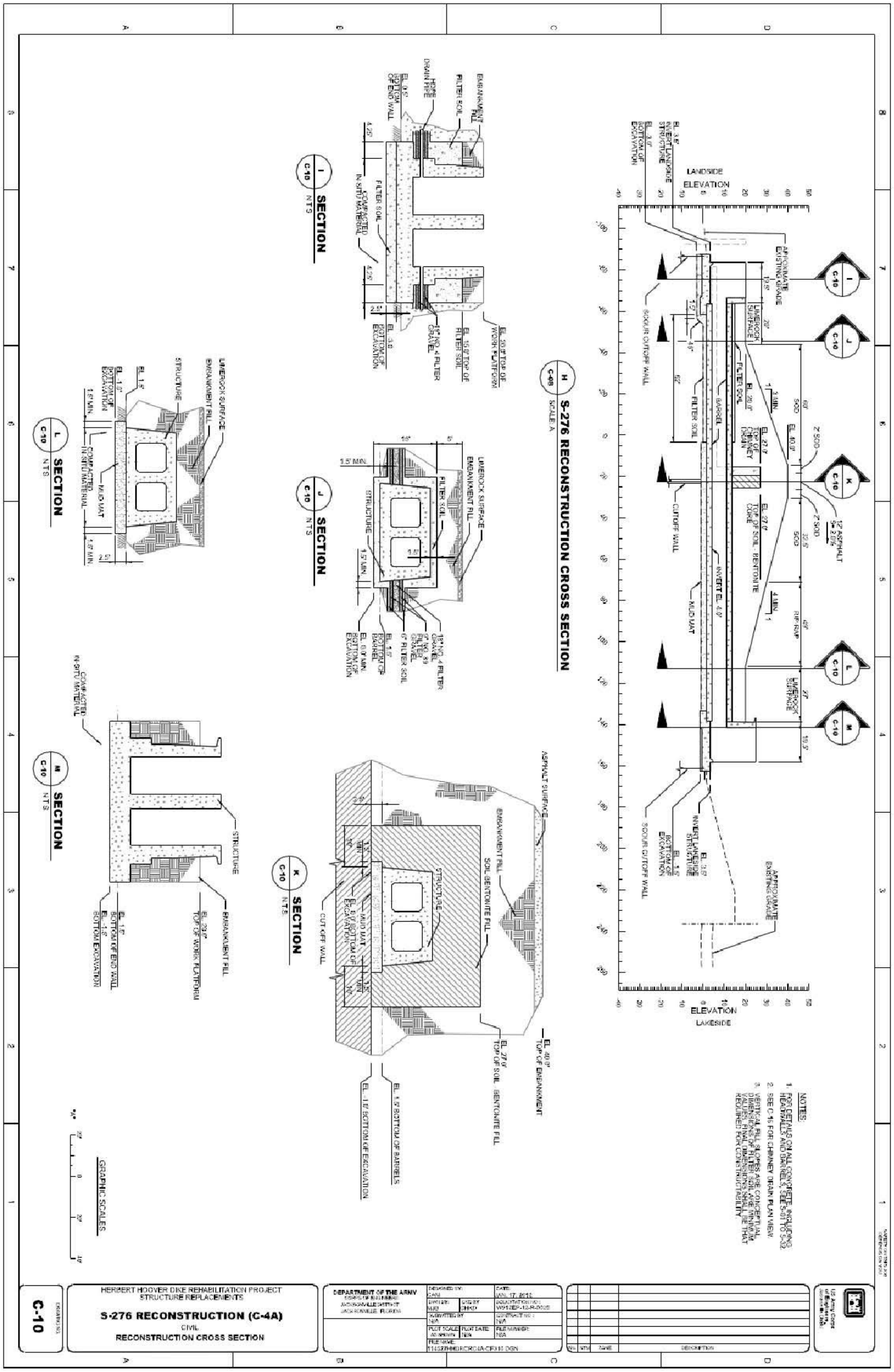
CONCRETE	TOTAL		=	25.8	CY
Total Doors	=	2.0	EA		
Size	=	4'-0" x 7'-0"			
Conduit Boxes	=	1.0	EA/DOOR		
Lock Boxes	=	1.0	EA/DOOR		
Fire Extinguishers	=	2.0	EA		
26" x 26" Exhaust Hoods	=	1.0	EA		
30" x 30" Exhaust Hoods	=	1.0	EA		
30" x 30"Intake Hoods	=	2.0	EA		
18" x 18" Intake Air Hood	=	1.0	EA		
18" x 18" Exhaust Hood	=	1.0	EA		
20" Exhaust Fan	=	1.0	EA		Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA		Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON		
Gravel Pad	=	216.0	CF		Assume 50% greater area than building, 6" thick
	=	8.0	CY		
Filter Fabric		472.0	SF		

Quantities Summary

Coffer dam:	1,215.3	LF	
Coffer dam:	81,043.3	SF	
Excavation:	25,566.5	CY	
Concrete:	2,071.7	CY	
Steel Rebar:	24.9	CY (?)	
Steel Rebar:	164.3	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	313.7	LF	
Grate:	168.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	2.0	EA	6' x 8' w/ mechanical components
Seals:	56.0	LF	
Backfill:	31,958.2	LCY	
Rip-rap:	3,765.2	CY	
Geofabric:	13,982.5	SF	
Boat Barrier:	312.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-4: 370 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Scope Given:	370 LF double gated 7'x7' box culvert w/ endwalls (Inv. Elev. -4.00) w/ 12'x24' control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-4 is a gated box culvert which allows for water from the A-2 Reservoir to flow to Cell 4 of the A-2 STA.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-4



Feature of Work:	STRUCTURE C-4: 370 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	197.7	FT	Assume 20' from top of excavation
Length	=	410.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	1,215.3	LF	Sheetpile perimeter
Area	=	81,043.3	SF	

Culvert excavation

Length	=	370.0	FT							
Total Depth	=	14.5	FT	Invert Elev. Minus Foundation Depth						
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick						
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick						
Thickness of Fort Thompson	=	4.5	FT	Top @-1.5 - 24ft thick						
Slope1	=	2.0	:1							
Slope2	=	2.0	:1							
Bottom Width	=	99.7	FT	Assumes 40' endwalls both ways						
Top Width	=	157.7	FT							
Cross Section	=	1,865.7	SF							
Cross Section Organic	=	307.3	SF							
Cross Section of Cap Rock	=	1,069.3	SF							
Cross Section of Fort Thompson	=	489.0	SF							
Organic Cut Volume	=	113,713.3	CF		=	4,211.6	BCY	=		LCY
Cap Rock Cut Volume	=	395,653.3	CF		=	14,653.8	BCY	=		LCY
Fort Thompson Cut Volume	=	180,930.0	CF		=	6,701.1	BCY	=		LCY
EXCAVATION		TOTAL			=	25,566.5	BCY	=	31,958.2	LCY

Concrete Culvert Concrete

Culvert Pipes	2		Width	7		Height	7
Length	=	370.0	FT				
Foundation Concrete Bottom Width	=	19.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	21,830.0	CF	=	808.5	CY	
Vertical Concrete Height	=	7.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	13,813.3	CF	=	511.6	CY	
Elevated Concrete							
Top Width	=	19.7	FT				
Thickness	=	2.0	FT				
Volume	=	14,553.3	CF	=	539.0	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same			
Foundation							
Length	=	20.0	FT				
Depth	=	2.0	FT				
Width	=	19.7	FT				
Volume	=	1,573.3	CF	=	58.3	CY	

Culvert Endwall						
Height	=	16.0	FT			Assume x2 (Culvert Height + 1')
Thickness	=	1.5	FT			
Width	=	19.7	FT			
Openings	=	98.0	SF			
Volume	=	650.0	CF	=	24.1	CY
Needle Beam						
Height	=	2.5	FT			
Width	=	7.0	FT			
Depth	=	3.0	FT			
Volume		210.0	CF	=	7.8	CY
Exterior Walls						
Edge Wall Height	=	16.0	FT			
Edge Wall Length	=	20.0	FT			total each side
Edge Wall Thickness	=	2.0	FT			
Interior Wall Height		16.0	FT			
Interior Wall Length		14.0	FT			
Inteiror Wall Thickness		1.7	FT			
Volume	=	3,306.7	CF	=	122.5	CY
CONCRETE	TOTAL			=	2,071.7	CY
Steel Rebar						Assumed 1.2% volume of concrete
STEEL REBAR	TOTAL			=	24.9	CY Rebar
					164.3	TONS

Culvert referenced as an example used approx. 0.8% steel per volume

Sheetpile Endwalls

Number	=	2.0	EA			x2 Endwalls per opening (HW/TW)
Width	=	80.0	FT			40 ft off each side of culvert
Length	=	30.0	FT			Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0	SF		30' Long Sheets, 160' Span	PZ-27
Concrete Cap	=	4.0	SF			Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0	CF	=	23.7	CY Concrete

MISC METALS

Structure Railing	=	74.8	LF			Per each end
Endwall Railing	=	82.0	LF			Per each end
TOTAL RAILING	=	313.7	LF			3'6" Tall Steel Railing
Ladders	=	2.0	EACH			
height	=	25.5	FT EA	=	51.0	FT TOTAL
Grating	=	42.0	SF per Gate			Approx. 6' long, width of each bay
TOTAL Grating	=	168.0	SF			Steel Grating

NEW GATES

Number of gates	=	2.0	EA			x1 per Culvert Pipe
Height	=	8.0	FT			Assumed 1' greater than Culvert Height
Width	=	6.0	FT			Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	4,267.2	LB EA			Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		8,534.4	LB	=	4.3	TONS
Mechanical Components	=	2.0	EA			All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	56.0	LF			

Gate Seal Length	=	56.0	LF		Gate perimeter x # of gates	

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides							
number of placements	=	2.0	EA		1 each side		
Length	=	127.5	FT		Assume width of new canal		
Width	=	99.7	FT		Assume same as bottom width of excavation		
thickness	=	4.0	FT		Assumed		
Volume	=	50,830.0	CF/EA	=	1,882.6	CY/EA	
RIPRAP		TOTAL		=	3,765.2	CY	Riprap
Geotextile Filter Fabric	=	13,982.5	SF		Fabric		

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	156.0	FT/EA	
Total Length	=	312.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF		12x24		
Electrical	=	NEEDED					
Communications	=	NEEDED					
Modular Precast Concrete Structure							
Exterior Walls							
Height	=	12.0	FT				
Perimeter Length	=	72.0	FT				
Thickness	=	4.0	IN				
Volume	=	288.0		=	10.7	CY	
Interior Wall							
Height	=	12.0	FT				
Length	=	12.0	FT				
Thickness	=	4.0	IN				
Volume	=	48.0		=	1.8	CY	
Floor Slab							
Thickness	=	6.0	IN				
Area	=	288.0	SF				
Volume	=	144.0	CF	=	5.3	CY	
Roof							
Thickness	=	5.0	IN				
Area	=	288.0	SF				
Volume	=	120.0	CF	=	4.4	CY	
Fuel Pad	=	96.0	CF		Assume 8'x12'x12" thick reinforced concrete slab on grade pad		
	=	3.6	CY				

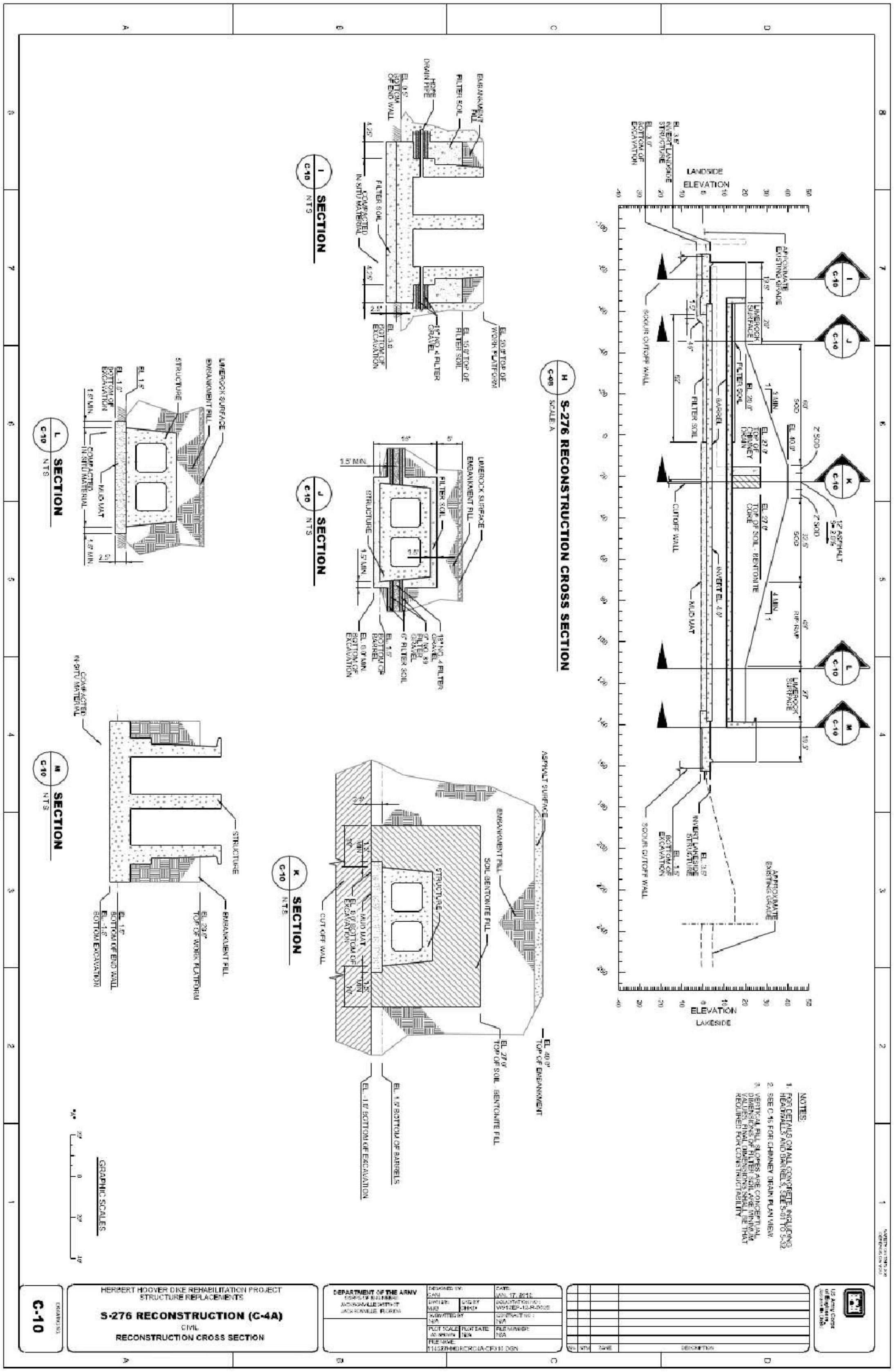
CONCRETE	TOTAL		=	25.8	CY
Total Doors	=	2.0	EA		
Size	=	4'-0" x 7'-0"			
Conduit Boxes	=	1.0	EA/DOOR		
Lock Boxes	=	1.0	EA/DOOR		
Fire Extinguishers	=	2.0	EA		
26" x 26" Exhaust Hoods	=	1.0	EA		
30" x 30" Exhaust Hoods	=	1.0	EA		
30" x 30"Intake Hoods	=	2.0	EA		
18" x 18" Intake Air Hood	=	1.0	EA		
18" x 18" Exhaust Hood	=	1.0	EA		
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP	
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP	
Generator Fuel Tank	=	1,000.0	GALLON		
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick	
	=	8.0	CY		
Filter Fabric		472.0	SF		

Quantities Summary

Coffer dam:	1,215.3	LF	
Coffer dam:	81,043.3	SF	
Excavation:	25,566.5	CY	
Concrete:	2,071.7	CY	
Steel Rebar:	24.9	CY (?)	
Steel Rebar:	164.3	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	313.7	LF	
Grate:	168.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	2.0	EA	6' x 8' w/ mechanical components
Seals:	56.0	LF	
Backfill:	31,958.2	LCY	
Rip-rap:	3,765.2	CY	
Geofabric:	13,982.5	SF	
Boat Barrier:	312.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-5: 208 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Scope Given:	208 LF double gated 7'x7' box culvert w/ endwalls (Inv. Elev. -4.00) w/ 12'x24' control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-5 is a gated box culvert which allows for water from Cell 3 to flow to Cell 1 of the A-2 STA.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-5



Feature of Work:	STRUCTURE C-5: 208 LF DOUBLE GATED 7’Wx7’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	197.7	FT	Assume 20' from top of excavation
Length	=	248.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	891.3	LF	Sheetpile perimeter
Area	=	49,021.3	SF	

Culvert excavation

Length	=	208.0	FT							
Total Depth	=	14.5	FT	Invert Elev. Minus Foundation Depth						
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick						
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick						
Thickness of Fort Thompson	=	4.5	FT	Top @-1.5 - 24ft thick						
Slope1	=	2.0	:1							
Slope2	=	2.0	:1							
Bottom Width	=	99.7	FT	Assumes 40' endwalls both ways						
Top Width	=	157.7	FT							
Cross Section	=	1,865.7	SF							
Cross Section Organic	=	307.3	SF							
Cross Section of Cap Rock	=	1,069.3	SF							
Cross Section of Fort Thompson	=	489.0	SF							
Organic Cut Volume	=	63,925.3	CF		=	2,367.6	BCY	=		LCY
Cap Rock Cut Volume	=	222,421.3	CF		=	8,237.8	BCY	=		LCY
Fort Thompson Cut Volume	=	101,712.0	CF		=	3,767.1	BCY	=		LCY
EXCAVATION		TOTAL			=	14,372.5	BCY	=	17,965.7	LCY

Concrete Culvert Concrete

Culvert Pipes	2		Width	7		Height	7
Length	=	208.0	FT				
Foundation Concrete Bottom Width	=	19.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	12,272.0	CF	=	454.5	CY	
Vertical Concrete Height	=	7.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	7,765.3	CF	=	287.6	CY	
Elevated Concrete							
Top Width	=	19.7	FT				
Thickness	=	2.0	FT				
Volume	=	8,181.3	CF	=	303.0	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same		
Foundation						
Length	=	20.0	FT			
Depth	=	2.0	FT			
Width	=	19.7	FT			
Volume	=	1,573.3	CF	=	58.3	CY

Culvert Endwall						
Height	=	16.0 FT			Assume x2 (Culvert Height + 1')	
Thickness	=	1.5 FT				
Width	=	19.7 FT				
Openings	=	98.0 SF				
Volume	=	650.0 CF	=	24.1 CY		
Needle Beam						
Height	=	2.5 FT				
Width	=	7.0 FT				
Depth	=	3.0 FT				
Volume		210.0 CF	=	7.8 CY		
Exterior Walls						
Edge Wall Height	=	16.0 FT				
Edge Wall Length	=	20.0 FT			total each side	
Edge Wall Thickness	=	2.0 FT				
Interior Wall Height		16.0 FT				
Interior Wall Length		14.0 FT				
Inteiror Wall Thickness		1.7 FT				
Volume	=	3,306.7 CF	=	122.5 CY		
CONCRETE	TOTAL		=	1,257.7 CY		
Steel Rebar					Assumed 1.2% volume of concrete	Culvert referenced as an example used approx. 0.8% steel per volume
STEEL REBAR	TOTAL		=	15.1 CY	Rebar	
				99.8 TONS		

Sheetpile Endwalls

Number	=	2.0 EA			x2 Endwalls per opening (HW/TW)	
Width	=	80.0 FT			40 ft off each side of culvert	
Length	=	30.0 FT			Assume PZ27 sheetpile, 30' long sheets	
Sheetpile Area	=	4,800.0 SF			30' Long Sheets, 160' Span	PZ-27
Concrete Cap	=	4.0 SF			Assume 2'x2' cap with PZ27 sheets	
Concrete Volume	=	640.0 CF	=	23.7 CY		Concrete

MISC METALS

Structure Railing	=	74.8 LF			Per each end
Endwall Railing	=	82.0 LF			Per each end
TOTAL RAILING	=	313.7 LF			3'6" Tall Steel Railing
Ladders	=	2.0 EACH			
height	=	25.5 FT EA	=	51.0 FT TOTAL	
Grating	=	42.0 SF per Gate			Approx. 6' long, width of each bay
TOTAL Grating	=	168.0 SF			Steel Grating

NEW GATES

Number of gates	=	2.0 EA			x1 per Culvert Pipe
Height	=	8.0 FT			Assumed 1' greater than Culvert Height
Width	=	6.0 FT			Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	4,267.2 LB EA			Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		8,534.4 LB	=	4.3 TONS	
Mechanical Components	=	2.0 EA			All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	56.0 LF			

Gate Seal Length	=	56.0 LF			Gate perimeter x # of gates	

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides						
number of placements	=	2.0 EA			1 each side	
Length	=	127.5 FT			Assume width of new canal	
Width	=	99.7 FT			Assume same as bottom width of excavation	
thickness	=	4.0 FT			Assumed	
Volume	=	50,830.0 CF/EA	=	1,882.6	CY/EA	
RIPRAP		TOTAL	=	3,765.2	CY	Riprap
Geotextile Filter Fabric	=	13,982.5 SF			Fabric	

Boat Barrier

Number	=	2.0 EA	
Piles for Buoys	=	3.0 EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	156.0 FT/EA	
Total Length	=	312.0 FT	Buoy style barrier
Total Piles	=	6.0 EA	

SWPPP

Floating Silt Boom	=	980.0 FT	Assumed
Silt Fence	=	6,492.0 FT	Assumed

Control Building

Size	=	288.0 SF			12x24
Electrical	=	NEEDED			
Communications	=	NEEDED			
Modular Precast Concrete Structure					
Exterior Walls					
Height	=	12.0 FT			
Perimeter Length	=	72.0 FT			
Thickness	=	4.0 IN			
Volume	=	288.0	=	10.7	CY
Interior Wall					
Height	=	12.0 FT			
Length	=	12.0 FT			
Thickness	=	4.0 IN			
Volume	=	48.0	=	1.8	CY
Floor Slab					
Thickness	=	6.0 IN			
Area	=	288.0 SF			
Volume	=	144.0 CF	=	5.3	CY
Roof					
Thickness	=	5.0 IN			
Area	=	288.0 SF			
Volume	=	120.0 CF	=	4.4	CY
Fuel Pad	=	96.0 CF			Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6 CY			

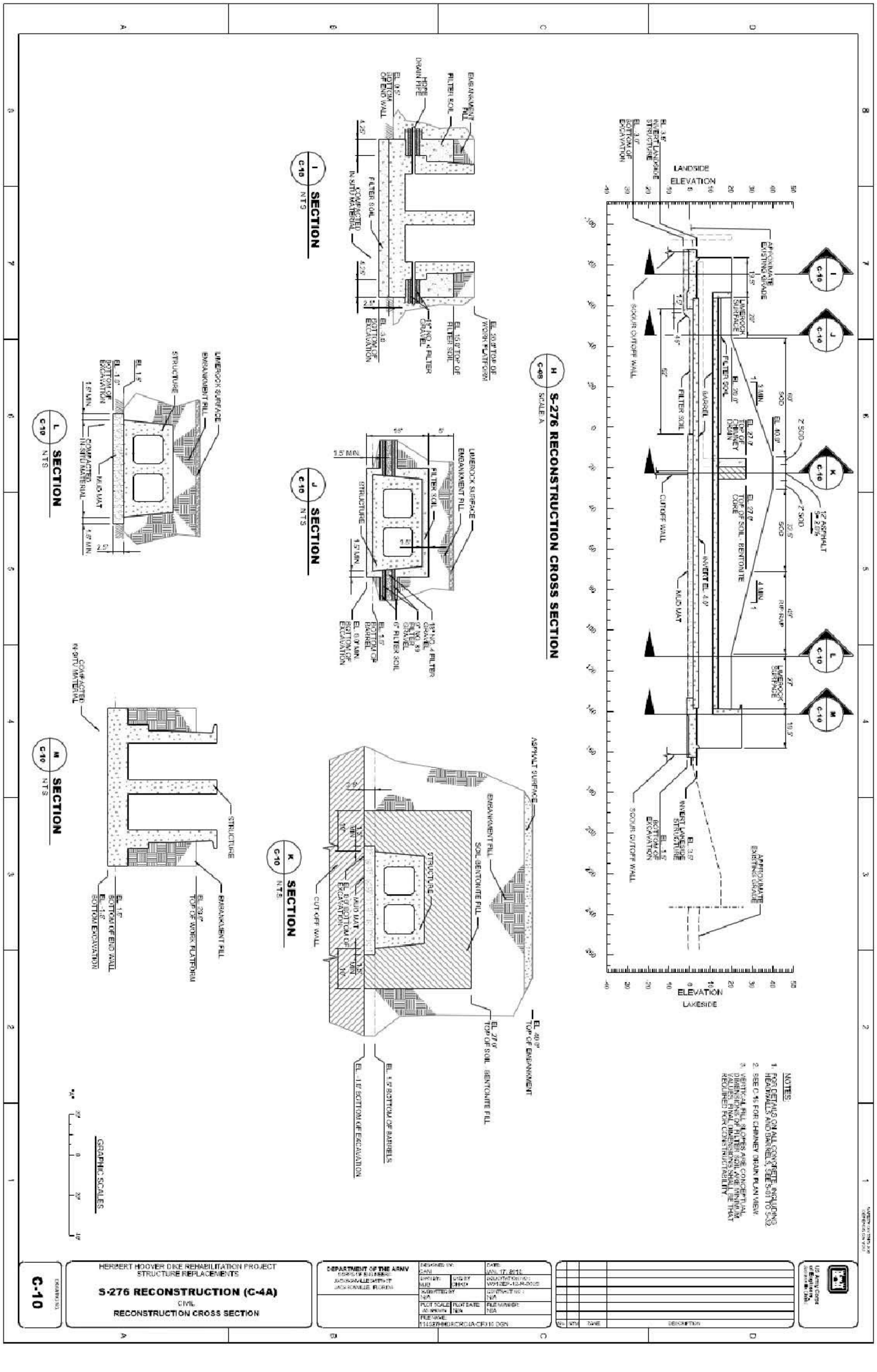
CONCRETE	TOTAL	=	25.8	CY	
Total Doors	=	2.0	EA		
Size	=	4'-0" x 7'-0"			
Conduit Boxes	=	1.0	EA/DOOR		
Lock Boxes	=	1.0	EA/DOOR		
Fire Extinguishers	=	2.0	EA		
26" x 26" Exhaust Hoods	=	1.0	EA		
30" x 30" Exhaust Hoods	=	1.0	EA		
30" x 30"Intake Hoods	=	2.0	EA		
18" x 18" Intake Air Hood	=	1.0	EA		
18" x 18" Exhaust Hood	=	1.0	EA		
20" Exhaust Fan	=	1.0	EA		Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA		Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON		
Gravel Pad	=	216.0	CF		Assume 50% greater area than building, 6" thick
	=	8.0	CY		
Filter Fabric		472.0	SF		

Quantities Summary

Coffer dam:	891.3	LF	
Coffer dam:	49,021.3	SF	
Excavation:	14,372.5	CY	
Concrete:	1,257.7	CY	
Steel Rebar:	15.1	CY (?)	
Steel Rebar:	99.8	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	313.7	LF	
Grate:	168.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	2.0	EA	6' x 8' w/ mechanical components
Seals:	56.0	LF	
Backfill:	17,965.7	LCY	
Rip-rap:	3,765.2	CY	
Geofabric:	13,982.5	SF	
Boat Barrier:	312.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-6: 208 LF DOUBLE GATED 7’Wx7’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING
Scope Given:	208 LF double gated 7’x7’ box culvert w/ endwalls (Inv. Elev. -4.00) w/ 12’x24’ control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-6 is a gated box culvert which allows for water from Cell 4 to flow to Cell 2 of the A-2 STA.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-6



Feature of Work:	STRUCTURE C-6: 208 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING

Quantity Take Off:

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	197.7	FT	Assume 20' from top of excavation
Length	=	248.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	891.3	LF	Sheetpile perimeter
Area	=	49,021.3	SF	

Culvert excavation

Length	=	208.0	FT							
Total Depth	=	14.5	FT	Invert Elev. Minus Foundation Depth						
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick						
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick						
Thickness of Fort Thompson	=	4.5	FT	Top @-1.5 - 24ft thick						
Slope1	=	2.0	:1							
Slope2	=	2.0	:1							
Bottom Width	=	99.7	FT	Assumes 40' endwalls both ways						
Top Width	=	157.7	FT							
Cross Section	=	1,865.7	SF							
Cross Section Organic	=	307.3	SF							
Cross Section of Cap Rock	=	1,069.3	SF							
Cross Section of Fort Thompson	=	489.0	SF							
Organic Cut Volume	=	63,925.3	CF		=	2,367.6	BCY	=		LCY
Cap Rock Cut Volume	=	222,421.3	CF		=	8,237.8	BCY	=		LCY
Fort Thompson Cut Volume	=	101,712.0	CF		=	3,767.1	BCY	=		LCY
EXCAVATION		TOTAL			=	14,372.5	BCY	=	17,965.7	LCY

Concrete Culvert Concrete

Culvert Pipes	2		Width	7		Height	7
Length	=	208.0	FT				
Foundation Concrete Bottom Width	=	19.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	12,272.0	CF	=	454.5	CY	
Vertical Concrete Height	=	7.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	7,765.3	CF	=	287.6	CY	
Elevated Concrete							
Top Width	=	19.7	FT				
Thickness	=	2.0	FT				
Volume	=	8,181.3	CF	=	303.0	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same		
Foundation						
Length	=	20.0	FT			
Depth	=	2.0	FT			
Width	=	19.7	FT			
Volume	=	1,573.3	CF	=	58.3	CY

Culvert Endwall							
Height	=	16.0	FT				Assume x2 (Culvert Height + 1')
Thickness	=	1.5	FT				
Width	=	19.7	FT				
Openings	=	98.0	SF				
Volume	=	650.0	CF	=	24.1	CY	
Needle Beam							
Height	=	2.5	FT				
Width	=	7.0	FT				
Depth	=	3.0	FT				
Volume		210.0	CF	=	7.8	CY	
Exterior Walls							
Edge Wall Height	=	16.0	FT				
Edge Wall Length	=	20.0	FT				total each side
Edge Wall Thickness	=	2.0	FT				
Interior Wall Height		16.0	FT				
Interior Wall Length		14.0	FT				
Inteiror Wall Thickness		1.7	FT				
Volume	=	3,306.7	CF	=	122.5	CY	
CONCRETE		TOTAL		=	1,257.7	CY	
Steel Rebar							Assumed 1.2% volume of concrete
STEEL REBAR		TOTAL		=	15.1	CY	Rebar
					99.8	TONS	

Culvert referenced as an example used approx. 0.8% steel per volume

Sheetpile Endwalls

Number	=	2.0	EA				x2 Endwalls per opening (HW/TW)
Width	=	80.0	FT				40 ft off each side of culvert
Length	=	30.0	FT				Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0	SF		30' Long Sheets, 160' Span		PZ-27
Concrete Cap	=	4.0	SF				Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0	CF	=	23.7	CY	Concrete

MISC METALS

Structure Railing	=	74.8	LF				Per each end
Endwall Railing	=	82.0	LF				Per each end
TOTAL RAILING	=	313.7	LF				3'6" Tall Steel Railing
Ladders	=	2.0	EACH				
height	=	25.5	FT EA	=	51.0	FT TOTAL	
Grating	=	42.0	SF per Gate				Approx. 6' long, width of each bay
TOTAL Grating	=	168.0	SF				Steel Grating

NEW GATES

Number of gates	=	2.0	EA				x1 per Culvert Pipe
Height	=	8.0	FT				Assumed 1' greater than Culvert Height
Width	=	6.0	FT				Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	4,267.2	LB EA				Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		8,534.4	LB	=	4.3	TONS	
Mechanical Components	=	2.0	EA				All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	56.0	LF				

Gate Seal Length	=	56.0	LF			Gate perimeter x # of gates	

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides								
number of placements	=	2.0	EA			1 each side		
Length	=	127.5	FT			Assume width of new canal		
Width	=	99.7	FT			Assume same as bottom width of excavation		
thickness	=	4.0	FT			Assumed		
Volume	=	50,830.0	CF/EA	=	1,882.6	CY/EA		
RIPRAP		TOTAL		=	3,765.2	CY		Riprap
Geotextile Filter Fabric	=	13,982.5	SF		Fabric			

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	156.0	FT/EA	
Total Length	=	312.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF			12x24
Electrical	=	NEEDED				
Communications	=	NEEDED				
Modular Precast Concrete Structure						
Exterior Walls						
Height	=	12.0	FT			
Perimeter Length	=	72.0	FT			
Thickness	=	4.0	IN			
Volume	=	288.0		=	10.7	CY
Interior Wall						
Height	=	12.0	FT			
Length	=	12.0	FT			
Thickness	=	4.0	IN			
Volume	=	48.0		=	1.8	CY
Floor Slab						
Thickness	=	6.0	IN			
Area	=	288.0	SF			
Volume	=	144.0	CF	=	5.3	CY
Roof						
Thickness	=	5.0	IN			
Area	=	288.0	SF			
Volume	=	120.0	CF	=	4.4	CY
Fuel Pad	=	96.0	CF			Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6	CY			

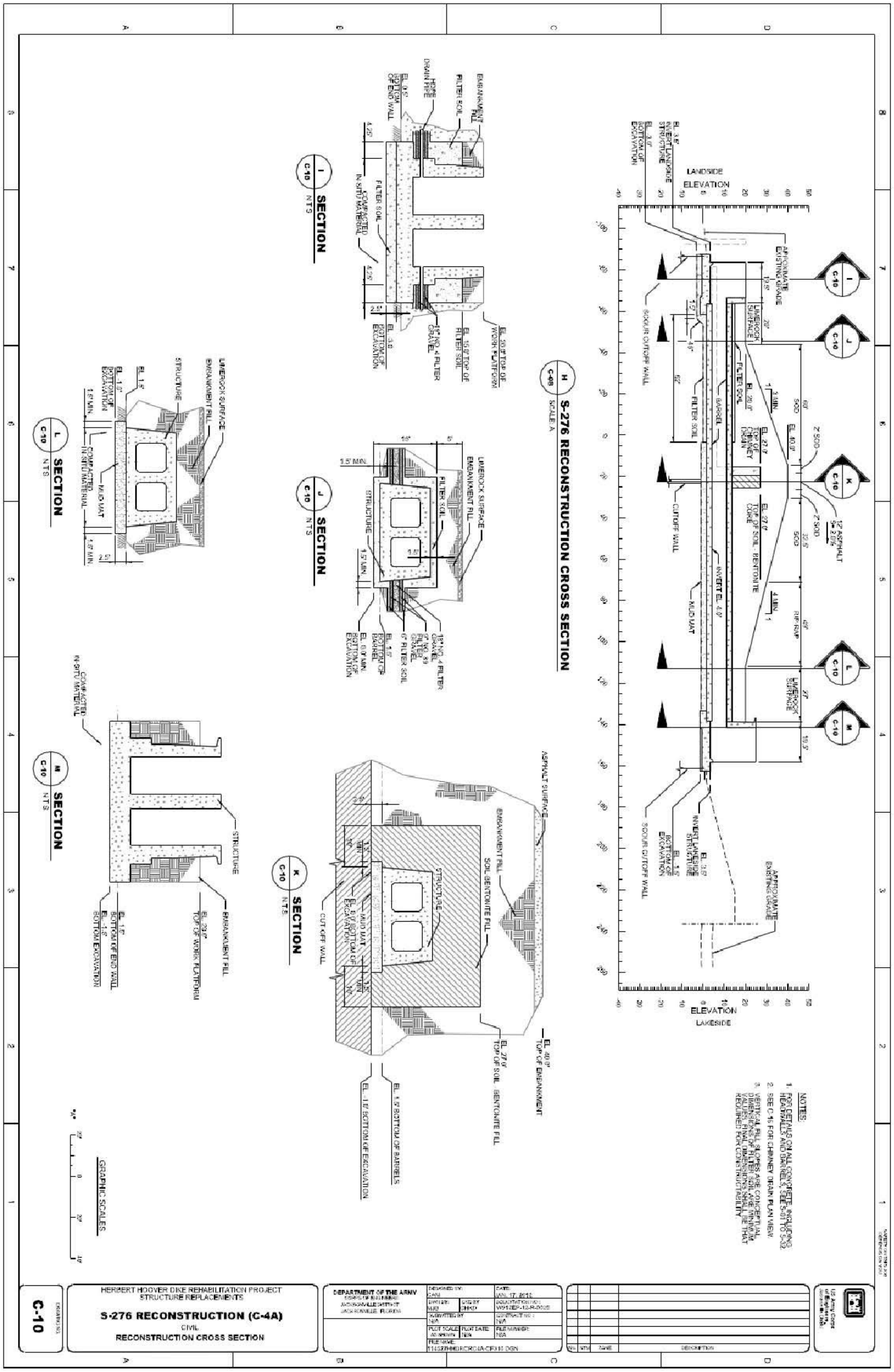
CONCRETE	TOTAL	=	25.8	CY	
Total Doors	=	2.0	EA		
Size	=	4'-0" x 7'-0"			
Conduit Boxes	=	1.0	EA/DOOR		
Lock Boxes	=	1.0	EA/DOOR		
Fire Extinguishers	=	2.0	EA		
26" x 26" Exhaust Hoods	=	1.0	EA		
30" x 30" Exhaust Hoods	=	1.0	EA		
30" x 30"Intake Hoods	=	2.0	EA		
18" x 18" Intake Air Hood	=	1.0	EA		
18" x 18" Exhaust Hood	=	1.0	EA		
20" Exhaust Fan	=	1.0	EA		Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA		Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON		
Gravel Pad	=	216.0	CF		Assume 50% greater area than building, 6" thick
	=	8.0	CY		
Filter Fabric		472.0	SF		

Quantities Summary

Coffer dam:	891.3	LF	
Coffer dam:	49,021.3	SF	
Excavation:	14,372.5	CY	
Concrete:	1,257.7	CY	
Steel Rebar:	15.1	CY (?)	
Steel Rebar:	99.8	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	313.7	LF	
Grate:	168.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	2.0	EA	6' x 8' w/ mechanical components
Seals:	56.0	LF	
Backfill:	17,965.7	LCY	
Rip-rap:	3,765.2	CY	
Geofabric:	13,982.5	SF	
Boat Barrier:	312.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-7: 208 LF DOUBLE GATED 7’Wx7’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING
Scope Given:	208 LF double gated 7’x7’ box culvert w/ endwalls (Inv. Elev. -4.00) w/ 12’x24’ control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-7 is a gated box culvert which allows for water in the Collection Canal within Cell 1 to flow to the Discharge Canal of the A-2 STA.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-7



Feature of Work:	STRUCTURE C-7: 208 LF DOUBLE GATED 7’Wx7’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	197.7	FT	Assume 20' from top of excavation
Length	=	248.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	891.3	LF	Sheetpile perimeter
Area	=	49,021.3	SF	

Culvert excavation

Length	=	208.0	FT							
Total Depth	=	14.5	FT		Invert Elev. Minus Foundation Depth					
Thickness of Organic	=	2.0	FT		Top @8.5 - 2ft thick					
Thickness of Cap Rock	=	8.0	FT		Top @6.5 - 8ft thick					
Thickness of Fort Thompson	=	4.5	FT		Top @-1.5 - 24ft thick					
Slope1	=	2.0	:1							
Slope2	=	2.0	:1							
Bottom Width	=	99.7	FT		Assumes 40' endwalls both ways					
Top Width	=	157.7	FT							
Cross Section	=	1,865.7	SF							
Cross Section Organic	=	307.3	SF							
Cross Section of Cap Rock	=	1,069.3	SF							
Cross Section of Fort Thompson	=	489.0	SF							
Organic Cut Volume	=	63,925.3	CF	=	2,367.6	BCY	=		LCY	
Cap Rock Cut Volume	=	222,421.3	CF	=	8,237.8	BCY	=		LCY	
Fort Thompson Cut Volume	=	101,712.0	CF	=	3,767.1	BCY	=		LCY	
EXCAVATION		TOTAL		=	14,372.5	BCY	=	17,965.7	LCY	

Concrete Culvert Concrete

Culvert Pipes	2		Width	7		Height	7
Length	=	208.0	FT				
Foundation Concrete Bottom Width	=	19.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	12,272.0	CF	=	454.5	CY	
Vertical Concrete Height	=	7.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	7,765.3	CF	=	287.6	CY	
Elevated Concrete							
Top Width	=	19.7	FT				
Thickness	=	2.0	FT				
Volume	=	8,181.3	CF	=	303.0	CY	

Inlet and Outlet Works

Number	=	2.0	EA		Assumed intake and outlet are the same	
Foundation						
Length	=	20.0	FT			
Depth	=	2.0	FT			
Width	=	19.7	FT			
Volume	=	1,573.3	CF	=	58.3	CY

Culvert Endwall						
Height	=	16.0 FT				Assume x2 (Culvert Height + 1')
Thickness	=	1.5 FT				
Width	=	19.7 FT				
Openings	=	98.0 SF				
Volume	=	650.0 CF	=	24.1	CY	
Needle Beam						
Height	=	2.5 FT				
Width	=	7.0 FT				
Depth	=	3.0 FT				
Volume		210.0 CF	=	7.8	CY	
Exterior Walls						
Edge Wall Height	=	16.0 FT				
Edge Wall Length	=	20.0 FT				total each side
Edge Wall Thickness	=	2.0 FT				
Interior Wall Height		16.0 FT				
Interior Wall Length		14.0 FT				
Inteiror Wall Thickness		1.7 FT				
Volume	=	3,306.7 CF	=	122.5	CY	
CONCRETE		TOTAL	=	1,257.7	CY	
Steel Rebar						Assumed 1.2% volume of concrete
STEEL REBAR		TOTAL	=	15.1	CY	Rebar
				99.8	TONS	

Culvert referenced as an example used approx. 0.8% steel per volume

Sheetpile Endwalls

Number	=	2.0 EA				x2 Endwalls per opening (HW/TW)
Width	=	80.0 FT				40 ft off each side of culvert
Length	=	30.0 FT				Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0 SF		30' Long Sheets, 160' Span		PZ-27
Concrete Cap	=	4.0 SF				Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0 CF	=	23.7	CY	Concrete

MISC METALS

Structure Railing	=	74.8 LF				Per each end
Endwall Railing	=	82.0 LF				Per each end
TOTAL RAILING	=	313.7 LF				3'6" Tall Steel Railing
Ladders	=	2.0 EACH				
height	=	25.5 FT EA	=	51.0	FT TOTAL	
Grating	=	42.0 SF per Gate				Approx. 6' long, width of each bay
TOTAL Grating	=	168.0 SF				Steel Grating

NEW GATES

Number of gates	=	2.0 EA				x1 per Culvert Pipe
Height	=	8.0 FT				Assumed 1' greater than Culvert Height
Width	=	6.0 FT				Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	4,267.2 LB EA				Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		8,534.4 LB	=	4.3	TONS	
Mechanical Components	=	2.0 EA				All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	56.0 LF				

Gate Seal Length	=	56.0	LF		Gate perimeter x # of gates		

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides							
number of placements	=	2.0	EA		1 each side		
Length	=	127.5	FT		Assume width of new canal		
Width	=	99.7	FT		Assume same as bottom width of excavation		
thickness	=	4.0	FT		Assumed		
Volume	=	50,830.0	CF/EA	=	1,882.6	CY/EA	
RIPRAP		TOTAL		=	3,765.2	CY	Riprap
Geotextile Filter Fabric	=	13,982.5	SF		Fabric		

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	156.0	FT/EA	
Total Length	=	312.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF		12x24	
Electrical	=	NEEDED				
Communications	=	NEEDED				
Modular Precast Concrete Structure						
Exterior Walls						
Height	=	12.0	FT			
Perimeter Length	=	72.0	FT			
Thickness	=	4.0	IN			
Volume	=	288.0		=	10.7	CY
Interior Wall						
Height	=	12.0	FT			
Length	=	12.0	FT			
Thickness	=	4.0	IN			
Volume	=	48.0		=	1.8	CY
Floor Slab						
Thickness	=	6.0	IN			
Area	=	288.0	SF			
Volume	=	144.0	CF	=	5.3	CY
Roof						
Thickness	=	5.0	IN			
Area	=	288.0	SF			
Volume	=	120.0	CF	=	4.4	CY
Fuel Pad	=	96.0	CF		Assume 8'x12'x12" thick reinforced concrete slab on grade pad	
	=	3.6	CY			

CONCRETE	TOTAL	=	25.8	CY

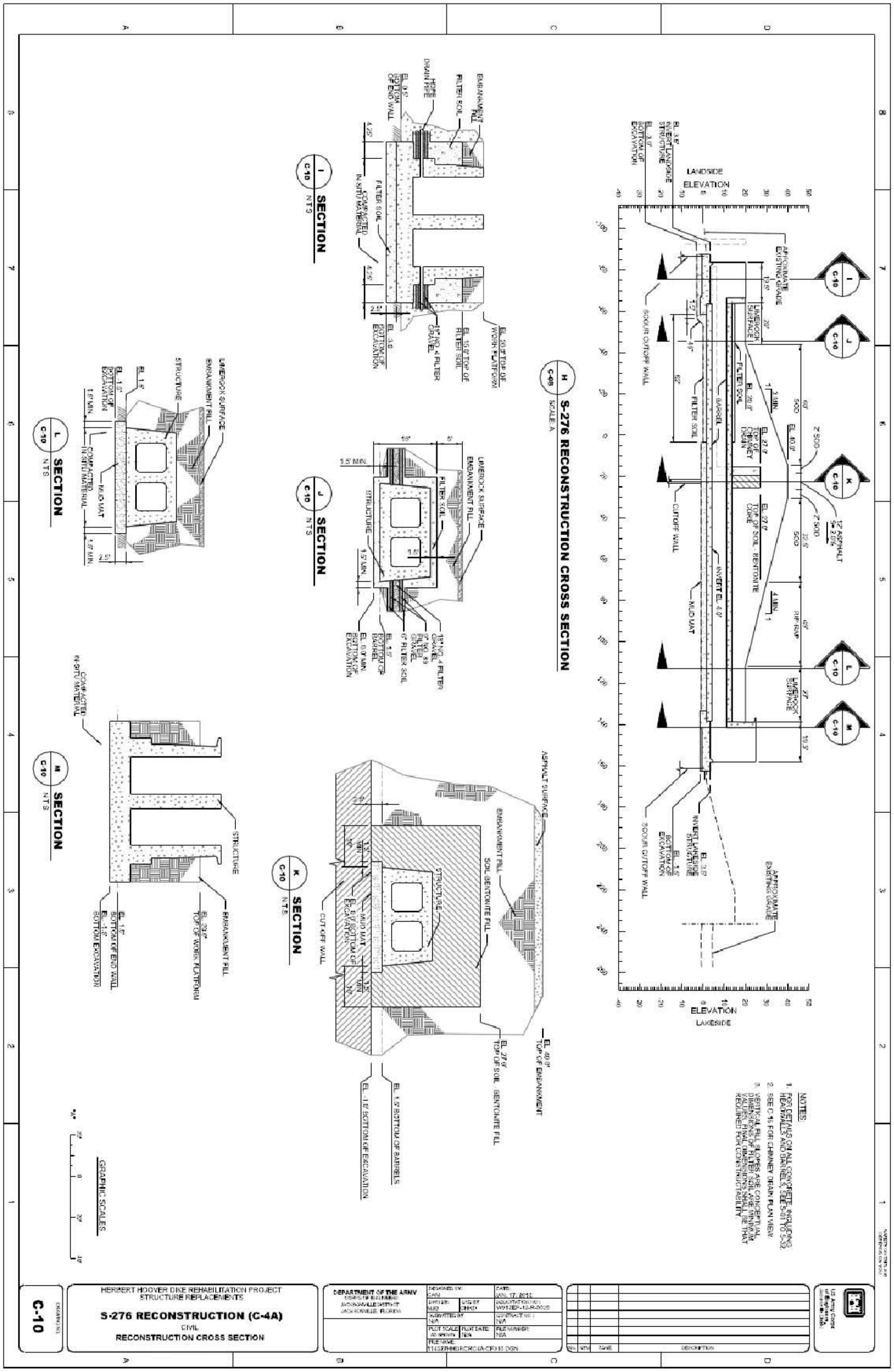
Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	891.3	LF	
Coffer dam:	49,021.3	SF	
Excavation:	14,372.5	CY	
Concrete:	1,257.7	CY	
Steel Rebar:	15.1	CY (?)	
Steel Rebar:	99.8	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	313.7	LF	
Grate:	168.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	2.0	EA	6' x 8' w/ mechanical components
Seals:	56.0	LF	
Backfill:	17,965.7	LCY	
Rip-rap:	3,765.2	CY	
Geofabric:	13,982.5	SF	
Boat Barrier:	312.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-8: 208 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Scope Given:	208 LF double gated 7'x7' box culvert w/ endwalls (Inv. Elev. -4.00) w/ 12'x24' control building and HW/TW monitoring stations w/ walkways (by-pass not required for construction). Structure C-8 is a gated box culvert which allows for water in the Collection Canal within Cell 2 to flow to the Discharge Canal of the A-2 STA.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-8



Feature of Work:	STRUCTURE C-8: 208 LF DOUBLE GATED 7'Wx7'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	197.7	FT	Assume 20' from top of excavation
Length	=	248.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	891.3	LF	Sheetpile perimeter
Area	=	49,021.3	SF	

Culvert excavation

Length	=	208.0	FT						
Total Depth	=	14.5	FT	Invert Elev. Minus Foundation Depth					
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick					
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick					
Thickness of Fort Thompson	=	4.5	FT	Top @-1.5 - 24ft thick					
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	99.7	FT	Assumes 40' endwalls both ways					
Top Width	=	157.7	FT						
Cross Section	=	1,865.7	SF						
Cross Section Organic	=	307.3	SF						
Cross Section of Cap Rock	=	1,069.3	SF						
Cross Section of Fort Thompson	=	489.0	SF						
Organic Cut Volume	=	63,925.3	CF	=	2,367.6	BCY	=		LCY
Cap Rock Cut Volume	=	222,421.3	CF	=	8,237.8	BCY	=		LCY
Fort Thompson Cut Volume	=	101,712.0	CF	=	3,767.1	BCY	=		LCY
EXCAVATION	TOTAL			=	14,372.5	BCY	=	17,965.7	LCY

Concrete Culvert Concrete

Culvert Pipes	2	Width	7		Height	7	
Length	=	208.0	FT				
Foundation Concrete Bottom Width	=	19.7	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	12,272.0	CF	=	454.5	CY	
Vertical Concrete Height	=	7.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	7,765.3	CF	=	287.6	CY	
Elevated Concrete							
Top Width	=	19.7	FT				
Thickness	=	2.0	FT				
Volume	=	8,181.3	CF	=	303.0	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same			
Foundation							
Length	=	20.0	FT				
Depth	=	2.0	FT				
Width	=	19.7	FT				
Volume	=	1,573.3	CF	=	58.3	CY	

Culvert Endwall						
Height	=	16.0 FT				Assume x2 (Culvert Height + 1')
Thickness	=	1.5 FT				
Width	=	19.7 FT				
Openings	=	98.0 SF				
Volume	=	650.0 CF	=	24.1	CY	
Needle Beam						
Height	=	2.5 FT				
Width	=	7.0 FT				
Depth	=	3.0 FT				
Volume		210.0 CF	=	7.8	CY	
Exterior Walls						
Edge Wall Height	=	16.0 FT				
Edge Wall Length	=	20.0 FT				total each side
Edge Wall Thickness	=	2.0 FT				
Interior Wall Height		16.0 FT				
Interior Wall Length		14.0 FT				
Inteiror Wall Thickness		1.7 FT				
Volume	=	3,306.7 CF	=	122.5	CY	
CONCRETE		TOTAL	=	1,257.7	CY	
Steel Rebar						Assumed 1.2% volume of concrete
STEEL REBAR		TOTAL	=	15.1	CY	Rebar
				99.8	TONS	

Culvert referenced as an example used approx. 0.8% steel per volume

Sheetpile Endwalls

Number	=	2.0 EA				x2 Endwalls per opening (HW/TW)
Width	=	80.0 FT				40 ft off each side of culvert
Length	=	30.0 FT				Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0 SF		30' Long Sheets, 160' Span		PZ-27
Concrete Cap	=	4.0 SF				Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0 CF	=	23.7	CY	Concrete

MISC METALS

Structure Railing	=	74.8 LF				Per each end
Endwall Railing	=	82.0 LF				Per each end
TOTAL RAILING	=	313.7 LF				3'6" Tall Steel Railing
Ladders	=	2.0 EACH				
height	=	25.5 FT EA	=	51.0	FT TOTAL	
Grating	=	42.0 SF per Gate				Approx. 6' long, width of each bay
TOTAL Grating	=	168.0 SF				Steel Grating

NEW GATES

Number of gates	=	2.0 EA				x1 per Culvert Pipe
Height	=	8.0 FT				Assumed 1' greater than Culvert Height
Width	=	6.0 FT				Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	4,267.2 LB EA				Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		8,534.4 LB	=	4.3	TONS	
Mechanical Components	=	2.0 EA				All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	56.0 LF				

Gate Seal Length	=	56.0	LF		Gate perimeter x # of gates		

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides							
number of placements	=	2.0	EA		1 each side		
Length	=	127.5	FT		Assume width of new canal		
Width	=	99.7	FT		Assume same as bottom width of excavation		
thickness	=	4.0	FT		Assumed		
Volume	=	50,830.0	CF/EA	=	1,882.6	CY/EA	
RIPRAP		TOTAL		=	3,765.2	CY	Riprap
Geotextile Filter Fabric	=	13,982.5	SF		Fabric		

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	156.0	FT/EA	
Total Length	=	312.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF		12x24	
Electrical	=	NEEDED				
Communications	=	NEEDED				
Modular Precast Concrete Structure						
Exterior Walls						
Height	=	12.0	FT			
Perimeter Length	=	72.0	FT			
Thickness	=	4.0	IN			
Volume	=	288.0		=	10.7	CY
Interior Wall						
Height	=	12.0	FT			
Length	=	12.0	FT			
Thickness	=	4.0	IN			
Volume	=	48.0		=	1.8	CY
Floor Slab						
Thickness	=	6.0	IN			
Area	=	288.0	SF			
Volume	=	144.0	CF	=	5.3	CY
Roof						
Thickness	=	5.0	IN			
Area	=	288.0	SF			
Volume	=	120.0	CF	=	4.4	CY
Fuel Pad	=	96.0	CF		Assume 8'x12'x12" thick reinforced concrete slab on grade pad	
	=	3.6	CY			

CONCRETE	TOTAL	=	25.8	CY

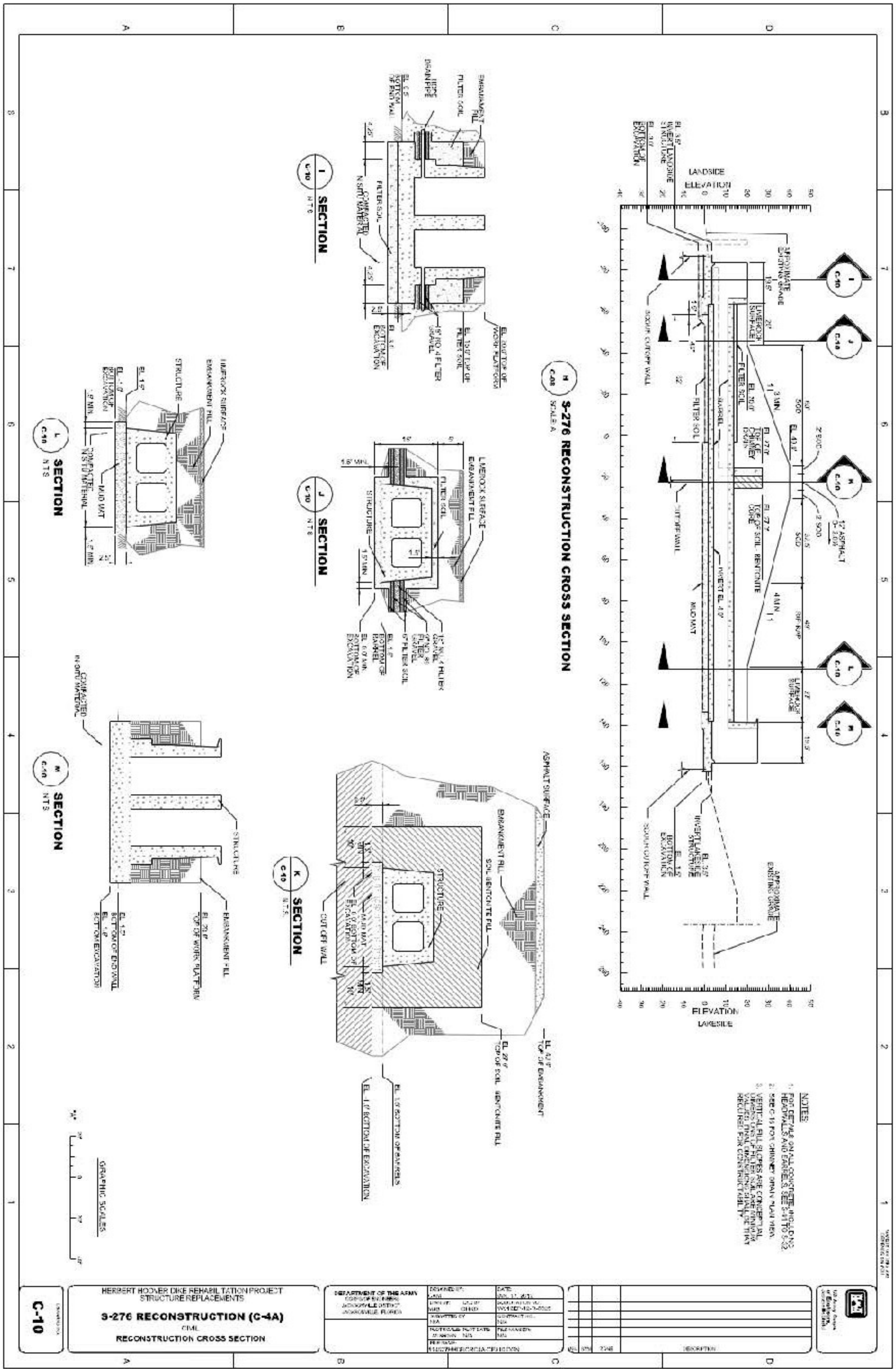
Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	891.3	LF	
Coffer dam:	49,021.3	SF	
Excavation:	14,372.5	CY	
Concrete:	1,257.7	CY	
Steel Rebar:	15.1	CY (?)	
Steel Rebar:	99.8	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	313.7	LF	
Grate:	168.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	2.0	EA	6' x 8' w/ mechanical components
Seals:	56.0	LF	
Backfill:	17,965.7	LCY	
Rip-rap:	3,765.2	CY	
Geofabric:	13,982.5	SF	
Boat Barrier:	312.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-9: 374 LF QUADRUPLE GATED 16’Wx12’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING
Scope Given:	374 LF quadruple gated 16’x12’ box culvert w/ endwalls (Inv. Elev. -6.00) w/ 12’x24’ control building and HW/TW monitoring stations w/ walkways (by-pass required for construction). Structure C-9 is a gated box culvert which allows for inflow to the A-2 Reservoir from the STA 3/4 Inflow Canal or for outflow to the STA 3/4 Inflow Canal from the A-2 Reservoir, depending on the stages in the A-2 Reservoir and the STA 3/4 Inflow Canal.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power. – Assume sheet pile will need to be driven around inlet structure on the canal side. Sheet pile depth 50 ft, set back from excavation of 25 ft, with pumping ongoing during construction in conjunction with a rim ditch excavation around the remainder of the culvert excavation.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Construction will be performed after the canal plugs are installed up and downstream of the proposed culvert location. Dewatering will be needed. Dewatering pumps used as needed throughout construction. Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-9



Feature of Work:	STRUCTURE C-9: 374 LF QUADRUPLE GATED 16'Wx12'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA		Size to be determined			
Width	=	255.0	FT		Assume 20' from top of excavation			
Length	=	414.0	FT		Assume 20' from length of excavation			
Depth	=	40.0	FT		Assumed			
Total Perimeter	=	1,338.0	LF		Sheetpile perimeter			
Area	=	105,570.0	SF					

Culvert excavation

Length	=	374.0	FT						
Total Depth	=	15.5	FT		Invert Elev. Minus Foundation Depth				
Thickness of Organic	=	2.0	FT		Top @8.5 - 2ft thick				
Thickness of Cap Rock	=	8.0	FT		Top @6.5 - 8ft thick				
Thickness of Fort Thompson	=	5.5	FT		Top @-1.5 - 24ft thick				
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	153.0	FT		Assumes 40' endwalls both ways				
Top Width	=	215.0	FT						
Cross Section	=	2,852.0	SF						
Cross Section Organic	=	422.0	SF						
Cross Section of Cap Rock	=	1,528.0	SF						
Cross Section of Fort Thompson	=	902.0	SF						
Organic Cut Volume	=	157,828.0	CF	=	5,845.5	BCY	=		LCY
Cap Rock Cut Volume	=	571,472.0	CF	=	21,165.6	BCY	=		LCY
Fort Thompson Cut Volume	=	337,348.0	CF	=	12,494.4	BCY	=		LCY
EXCAVATION		TOTAL		=	39,505.5	BCY	=	49,381.9	LCY

Concrete Culvert Concrete

Culvert Pipes	4	Width	16		Height	12	
Length	=	374.0	FT				
Foundation Concrete Bottom Width	=	73.0	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	81,906.0	CF	=	3,033.6	CY	
Vertical Concrete Height	=	12.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	41,888.0	CF	=	1,551.4	CY	
Elevated Concrete							
Top Width	=	73.0	FT				
Thickness	=	2.0	FT				
Volume	=	54,604.0	CF	=	2,022.4	CY	

Inlet and Outlet Works

Number	=	2.0	EA		Assumed intake and outlet are the same		
Foundation							
Length	=	20.0	FT				
Depth	=	2.0	FT				
Width	=	73.0	FT				
Volume	=	5,840.0	CF	=	216.3	CY	

Culvert Endwall							
Height	=	26.0	FT				Assume x2 (Culvert Height + 1')
Thickness	=	1.5	FT				
Width	=	73.0	FT				
Openings	=	768.0	SF				
Volume	=	3,390.0	CF	=	125.6	CY	
Needle Beam							
Height	=	2.5	FT				
Width	=	16.0	FT				
Depth	=	3.0	FT				
Volume		960.0	CF	=	35.6	CY	
Exterior Walls							
Edge Wall Height	=	26.0	FT				
Edge Wall Length	=	20.0	FT				total each side
Edge Wall Thickness	=	2.0	FT				
Interior Wall Height		26.0	FT				
Interior Wall Length		14.0	FT				
Inteiror Wall Thickness		1.7	FT				
Volume	=	7,800.0	CF	=	288.9	CY	
CONCRETE	TOTAL			=	7,273.6	CY	
Steel Rebar							Assumed 1.2% volume of concrete; Culvert referenced as an example used approx. 0.8% steel per volume
STEEL REBAR	TOTAL			=	87.3	CY	Rebar
					576.9	TONS	
Sheetpile Endwalls							
Number	=	2.0	EA				x2 Endwalls per opening (HW/TW)
Width	=	80.0	FT				40 ft off each side of culvert
Length	=	30.0	FT				Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0	SF				30' Long Sheets, 160' Span; PZ-27
Concrete Cap	=	4.0	SF				Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0	CF	=	23.7	CY	Concrete
MISC METALS							
Structure Railing	=	181.5	LF				Per each end
Endwall Railing	=	82.0	LF				Per each end
TOTAL RAILING	=	527.0	LF				3'6" Tall Steel Railing
Ladders	=	2.0	EACH				
height	=	25.5	FT EA	=	51.0	FT TOTAL	
		384.0					
Grating	=	96.0	SF per Gate				Approx. 6' long, width of each bay
TOTAL Grating	=	768.0	SF				Steel Grating
NEW GATES							
Number of gates	=	4.0	EA				x1 per Culvert Pipe
Height	=	13.0	FT				Assumed 1' greater than Culvert Height
Width	=	15.0	FT				Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	17,335.5	LB EA				Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		69,341.8	LB	=	34.7	TONS	
Mechanical Components	=	4.0	EA				All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	224.0	LF				

Gate Seal Length	=	224.0	LF		Gate perimeter x # of gates		

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides							
number of placements	=	2.0	EA		1 each side		
Length	=	127.5	FT		Assume width of new canal		
Width	=	153.0	FT		Assume same as bottom width of excavation		
thickness	=	4.0	FT		Assumed		
Volume	=	78,030.0	CF/EA	=	2,890.0	CY/EA	
RIPRAP		TOTAL		=	5,780.0	CY	Riprap
Geotextile Filter Fabric	=	20,782.5	SF		Fabric		

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	195.0	FT/EA	
Total Length	=	390.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF		12x24	
Electrical	=	NEEDED				
Communications	=	NEEDED				
Modular Precast Concrete Structure						
Exterior Walls						
Height	=	12.0	FT			
Perimeter Length	=	72.0	FT			
Thickness	=	4.0	IN			
Volume	=	288.0		=	10.7	CY
Interior Wall						
Height	=	12.0	FT			
Length	=	12.0	FT			
Thickness	=	4.0	IN			
Volume	=	48.0		=	1.8	CY
Floor Slab						
Thickness	=	6.0	IN			
Area	=	288.0	SF			
Volume	=	144.0	CF	=	5.3	CY
Roof						
Thickness	=	5.0	IN			
Area	=	288.0	SF			
Volume	=	120.0	CF	=	4.4	CY
Fuel Pad	=	96.0	CF		Assume 8'x12'x12" thick reinforced concrete slab on grade pad	
	=	3.6	CY			

CONCRETE	TOTAL	=	25.8	CY

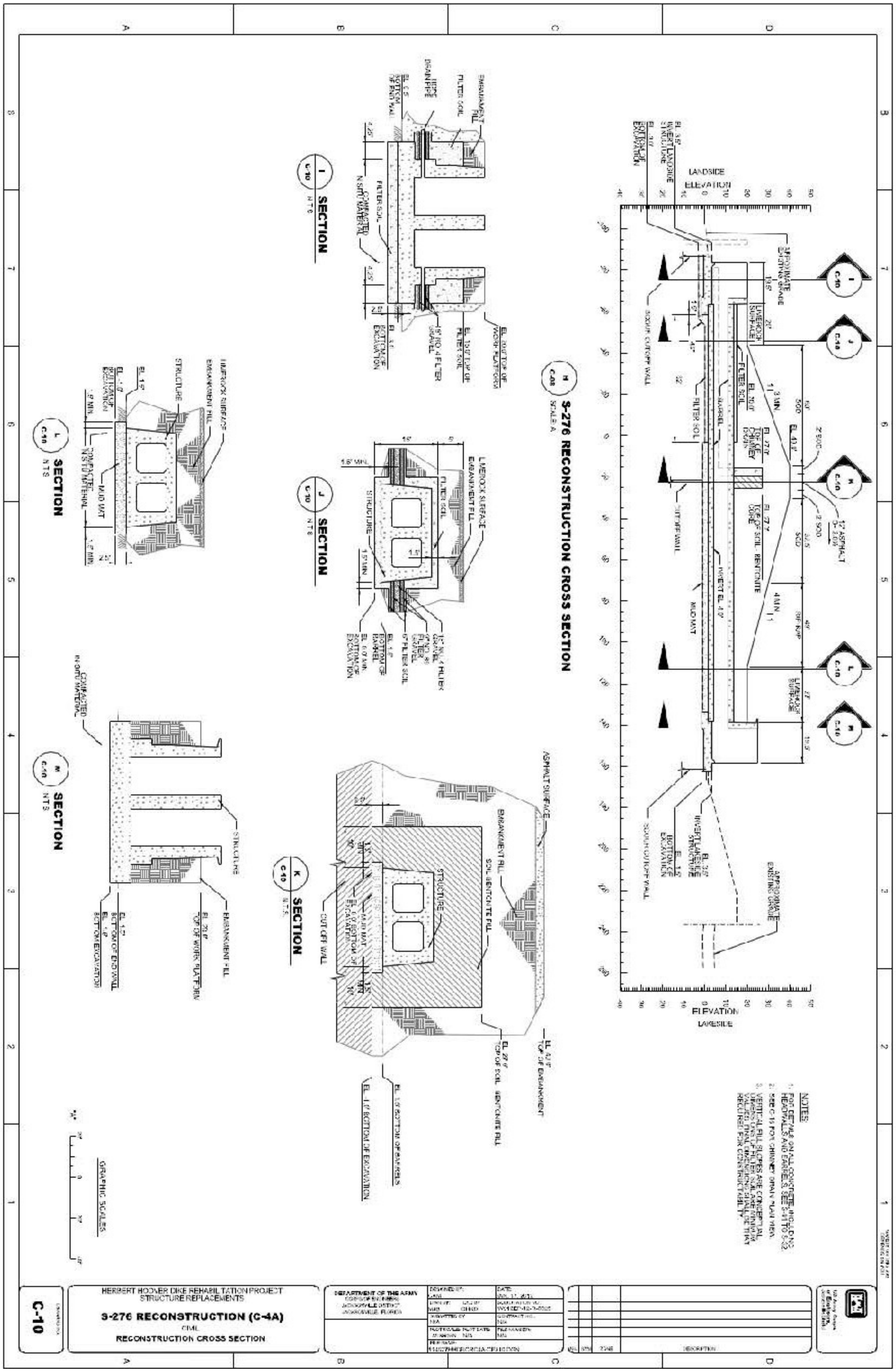
Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	1,338.0	LF	
Coffer dam:	105,570.0	SF	
Excavation:	39,505.5	CY	
Concrete:	7,273.6	CY	
Steel Rebar:	87.3	CY (?)	
Steel Rebar:	576.9	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	527.0	LF	
Grate:	768.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	4.0	EA	13' x 15' w/ mechanical components
Seals:	224.0	LF	
Backfill:	49,381.9	LCY	
Rip-rap:	5,780.0	CY	
Geofabric:	20,782.5	SF	
Boat Barrier:	390.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-10: 320 LF TRIPLE GATED 14'Wx12'H BOX CULVERT WITH ENDWALLS, 12'x24' CONTROL BUILDING
Scope Given:	320 LF quadruple gated 14'x12' box culvert w/ endwalls (Inv. Elev. -6.00) w/ 12'x24' control building and HW/TW monitoring stations w/ walkways (by-pass required for construction). The eastern dam embankment of the A-2 Reservoir (Typ. Section L) will have a gated box culvert, Structure C-10, which will allow for water to flow from the A-2 Reservoir to the A-1 FEB and vice versa, depending on the stages in the A-2 Reservoir and the A-1 FEB.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structures S-276 and S-277. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation. – Assume power will be provided from power lines in the area. – Assume that a diesel generator is needed for backup power. – Assume sheet pile will need to be driven around inlet structure on the canal side. Sheet pile depth 50 ft, set back from excavation of 25 ft, with pumping ongoing during construction in conjunction with a rim ditch excavation around the remainder of the culvert excavation.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation/blasting of limestone rock will be required to allow space for the foundation for the gated culvert structure. Culverts, foundations and structures will then be placed. Control structures for the culverts will be installed and a standalone Control station will be built in the area. An additional backup generator will be required along with local utility power. Apron, wing wall, and riprap placement will occur after Culverts have been placed. Backfill and compaction around the structure will occur, the plugs will be removed.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: C-10



Feature of Work:	STRUCTURE C-10: 320 LF TRIPLE GATED 14’Wx12’H BOX CULVERT WITH ENDWALLS, 12’x24’ CONTROL BUILDING

Quantity Take Off:

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	231.3	FT	Assume 20' from top of excavation
Length	=	360.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	1,182.7	LF	Sheetpile perimeter
Area	=	83,280.0	SF	

Culvert excavation

Length	=	320.0	FT							
Total Depth	=	15.5	FT	Invert Elev. Minus Foundation Depth						
Thickness of Organic	=	2.0	FT	Top @8.5 - 2ft thick						
Thickness of Cap Rock	=	8.0	FT	Top @6.5 - 8ft thick						
Thickness of Fort Thompson	=	5.5	FT	Top @-1.5 - 24ft thick						
Slope1	=	2.0	:1							
Slope2	=	2.0	:1							
Bottom Width	=	129.3	FT	Assumes 40' endwalls both ways						
Top Width	=	191.3	FT							
Cross Section	=	2,485.2	SF							
Cross Section Organic	=	374.7	SF							
Cross Section of Cap Rock	=	1,338.7	SF							
Cross Section of Fort Thompson	=	771.8	SF							
Organic Cut Volume	=	119,893.3	CF	=	4,440.5	BCY	=		LCY	
Cap Rock Cut Volume	=	428,373.3	CF	=	15,865.7	BCY	=		LCY	
Fort Thompson Cut Volume	=	246,986.7	CF	=	9,147.7	BCY	=		LCY	
EXCAVATION		TOTAL		=	29,453.8	BCY		36,817.3	LCY	

Concrete Culvert Concrete

Culvert Pipes	3	Width	14	Height	12		
Length	=	320.0	FT				
Foundation Concrete Bottom Width	=	49.3	FT				
Bottom Thickness	=	3.0	FT				
Volume	=	47,360.0	CF	=	1,754.1	CY	
Vertical Concrete Height	=	12.0	FT				
Thickness of Edge Walls	=	2.0	FT				
Thickness of Interior Walls	=	1.7	FT				
Volume	=	28,160.0	CF	=	1,043.0	CY	
Elevated Concrete							
Top Width	=	49.3	FT				
Thickness	=	2.0	FT				
Volume	=	31,573.3	CF	=	1,169.4	CY	

Inlet and Outlet Works

Number	=	2.0	EA	Assumed intake and outlet are the same			
Foundation							
Length	=	20.0	FT				
Depth	=	2.0	FT				
Width	=	49.3	FT				
Volume	=	3,946.7	CF	=	146.2	CY	

Culvert Endwall						
Height	=	26.0 FT			Assume x2 (Culvert Height + 1')	
Thickness	=	1.5 FT				
Width	=	49.3 FT				
Openings	=	504.0 SF				
Volume	=	2,336.0 CF	=	86.5 CY		
Needle Beam						
Height	=	2.5 FT				
Width	=	14.0 FT				
Depth	=	3.0 FT				
Volume		630.0 CF	=	23.3 CY		
Exterior Walls						
Edge Wall Height	=	26.0 FT				
Edge Wall Length	=	20.0 FT			total each side	
Edge Wall Thickness	=	2.0 FT				
Interior Wall Height		26.0 FT				
Interior Wall Length		14.0 FT				
Inteiror Wall Thickness		1.7 FT				
Volume	=	6,586.7 CF	=	244.0 CY		
CONCRETE	TOTAL		=	4,466.4 CY		
Steel Rebar					Assumed 1.2% volume of concrete	Culvert referenced as an example used approx. 0.8% steel per volume
STEEL REBAR	TOTAL		=	53.6 CY	Rebar	
				354.3 TONS		

Sheetpile Endwalls

Number	=	2.0 EA			x2 Endwalls per opening (HW/TW)
Width	=	80.0 FT			40 ft off each side of culvert
Length	=	30.0 FT			Assume PZ27 sheetpile, 30' long sheets
Sheetpile Area	=	4,800.0 SF		30' Long Sheets, 160' Span	PZ-27
Concrete Cap	=	4.0 SF			Assume 2'x2' cap with PZ27 sheets
Concrete Volume	=	640.0 CF	=	23.7 CY	Concrete

MISC METALS

Structure Railing	=	134.2 LF			Per each end
Endwall Railing	=	82.0 LF			Per each end
TOTAL RAILING	=	432.3 LF			3'6" Tall Steel Railing
Ladders	=	2.0 EACH			
height	=	25.5 FT EA	=	51.0 FT TOTAL	
Grating	=	84.0 SF per Gate			Approx. 6' long, width of each bay
TOTAL Grating	=	504.0 SF			Steel Grating

NEW GATES

Number of gates	=	3.0 EA			x1 per Culvert Pipe
Height	=	13.0 FT			Assumed 1' greater than Culvert Height
Width	=	13.0 FT			Assumed 1' smaller than Culvert Width (frame)
Total Weight of Gates	=	15,024.1 LB EA			Follows similar weight calculations as S-2, but reduces number of steel channels
TOTAL STEEL GATE WEIGHT		45,072.2 LB	=	22.5 TONS	
Mechanical Components	=	3.0 EA			All gate component information including frame, stem, motor, yoke, etc. to be provided by manufacturer
Imbeds for Gate	=	156.0 LF			

Gate Seal Length	=	156.0	LF			Gate perimeter x # of gates

Backfill

Assume Culvert is backfilled as part of levee construction

RIP RAP

common both sides							
number of placements	=	2.0	EA				1 each side
Length	=	127.5	FT				Assume width of new canal
Width	=	129.3	FT				Assume same as bottom width of excavation
thickness	=	4.0	FT				Assumed
Volume	=	65,960.0	CF/EA	=	2,443.0	CY/EA	
RIPRAP		TOTAL		=	4,885.9	CY	Riprap
Geotextile Filter Fabric	=	17,765.0	SF				Fabric

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	172.0	FT/EA	
Total Length	=	344.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

SWPPP

Floating Silt Boom	=	980.0	FT	Assumed
Silt Fence	=	6,492.0	FT	Assumed

Control Building

Size	=	288.0	SF				12x24
Electrical	=	NEEDED					
Communications	=	NEEDED					
Modular Precast Concrete Structure							
Exterior Walls							
Height	=	12.0	FT				
Perimeter Length	=	72.0	FT				
Thickness	=	4.0	IN				
Volume	=	288.0		=	10.7	CY	
Interior Wall							
Height	=	12.0	FT				
Length	=	12.0	FT				
Thickness	=	4.0	IN				
Volume	=	48.0		=	1.8	CY	
Floor Slab							
Thickness	=	6.0	IN				
Area	=	288.0	SF				
Volume	=	144.0	CF	=	5.3	CY	
Roof							
Thickness	=	5.0	IN				
Area	=	288.0	SF				
Volume	=	120.0	CF	=	4.4	CY	
Fuel Pad	=	96.0	CF				Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6	CY				

CONCRETE	TOTAL	=	25.8	CY

Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	1,182.7	LF	
Coffer dam:	83,280.0	SF	
Excavation:	29,453.8	CY	
Concrete:	4,466.4	CY	
Steel Rebar:	53.6	CY (?)	
Steel Rebar:	354.3	TONS	
Sheetpile:	4,800.0	SF	PZ27x160LFx30FT
Cap:	23.7	CY	
Railing:	432.3	LF	
Grate:	504.0	SF	
Ladders:	2.0	EA	25' EA
Gates:	3	EA	13' x 13' w/ mechanical components
Seals:	156.0	LF	
Backfill:	36,817.3	LCY	
Rip-rap:	4,885.9	CY	
Geofabric:	17,765.0	SF	
Boat Barrier:	344.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	980.0	LF	
Silt Fence:	6,492.0	LF	
Control bld.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
Generator Fuel Tank:	1,000.0	GALLONS	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE C-11: 225 LF 72" CORRUGATED ALUMINUM PIPE CULVERT WITH ENDDWALLS
Scope Given:	Structure C-11 will allow for the hydraulic connection between the remnant of the northern A-1 Seepage Canal and the eastern A-1 Seepage Canal.
Reference for Scope Basis:	
Scope Assumptions:	– Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume Excavation will be to the same depth below finished grade as shown in contract drawings for similar projects with a slope of 1:2 for construction. – Assume material as 2 ft of organic, 8 ft of blastable cap rock, and 24 ft of Fort Thompson layer for the remainder of the excavation.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	
Key Outstanding Questions/Issues:	

Feature of Work:	STRUCTURE C-11: 225 LF 72" CORRUGATED ALUMINUM PIPE CULVERT WITH ENDWALLS
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined					
Width	=	120.0	FT	Assume 20' from top of excavation					
Length	=	265.0	FT	Assume 20' from length of excavation					
Depth	=	40.0	FT	Assumed					
Total Perimeter	=	770.0	LF	Sheetpile perimeter					
Area	=	31,800.0	SF						

Culvert excavation

Length	=	225.0	FT						
Total Depth	=	15.5	FT		Invert Elev. Minus Foundation Depth				
Thickness of Organic	=	2.0	FT		Top @8.5 - 2ft thick				
Thickness of Cap Rock	=	8.0	FT		Top @6.5 - 8ft thick				
Thickness of Fort Thompson	=	5.5	FT		Top @-1.5 - 24ft thick				
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	18.0	FT		Assumes 5' endwalls both ways				
Top Width	=	80.0	FT						
Cross Section	=	759.5	SF						
Cross Section Organic	=	152.0	SF						
Cross Section of Cap Rock	=	448.0	SF						
Cross Section of Fort Thompson	=	159.5	SF						
Organic Cut Volume	=	34,200.0	CF	=	1,266.7	BCY	=		LCY
Cap Rock Cut Volume	=	100,800.0	CF	=	3,733.3	BCY	=		LCY
Fort Thompson Cut Volume	=	35,887.5	CF	=	1,329.2	BCY	=		LCY
EXCAVATION	TOTAL			=	6,329.2	BCY	=	7,911.5	LCY

Culvert Components

Culvert Pipes	1		Width	6		Height	6
Length	=	225.0	FT				
Bedding Width	=	8.0	FT				
Bottom Thickness	=	1.0	FT				
Bedding Gravel Volume	=	1,800.0	CF	=	66.7	CY	Gravel
Vertical Height above Bedding	=	14.5	FT		Assumed from natural ground to invert		
Thickness of Exterior Fill	=	1.0	FT				
Pipe Area	=	28.3	SF		Area of pipe		
Select Fill Volume	=	19,738.3	CF	=	731.0	CY	Select Fill

Inlet and Outlet Works

Number	=	2.0	EA		Assumed intake and outlet are the same	
Foundation						
Area	=	157.4	SF		Assume 60 degree opening wingwalls, 15' wingwalls	
Depth	=	2.0	FT			
Volume	=	629.7	CF	=	23.3	CY
Culvert Endwall						
Height	=	15.0	FT		Assume 1/2' below opening	
Thickness	=	1.5	FT			
Width	=	8.0	FT			
Openings	=	36.0	SF			

Volume	=	252.0	CF	=	9.3	CY	
Culvert Wingwalls							
Height	=	15.0	FT				
Thickness	=	1.5	FT				
Width	=	15.0	FT				
Volume	=	675.0	CF	=	25.0		
CONCRETE	TOTAL			=	57.7	CY	
Steel Rebar					Assumed 1.2% volume of concrete		Culvert referenced as an example used approx. 0.8% steel per volume
STEEL REBAR	TOTAL			=	0.7	CY	Rebar
					4.6	TONS	

RIP RAP

common both sides							
number of placements	=	2.0	EA		1 each side		
Length	=	127.5	FT		Assume width of new canal		
Width	=	48.0	FT		Assume 20' each way past endwall		
thickness	=	4.0	FT		Assumed		
Volume	=	24,480.0	CF/EA	=	906.7	CY/EA	
RIPRAP	TOTAL			=	1,813.3	CY	Riprap
Geotextile Filter Fabric	=	7,395.0	SF		Fabric		

SWPPP

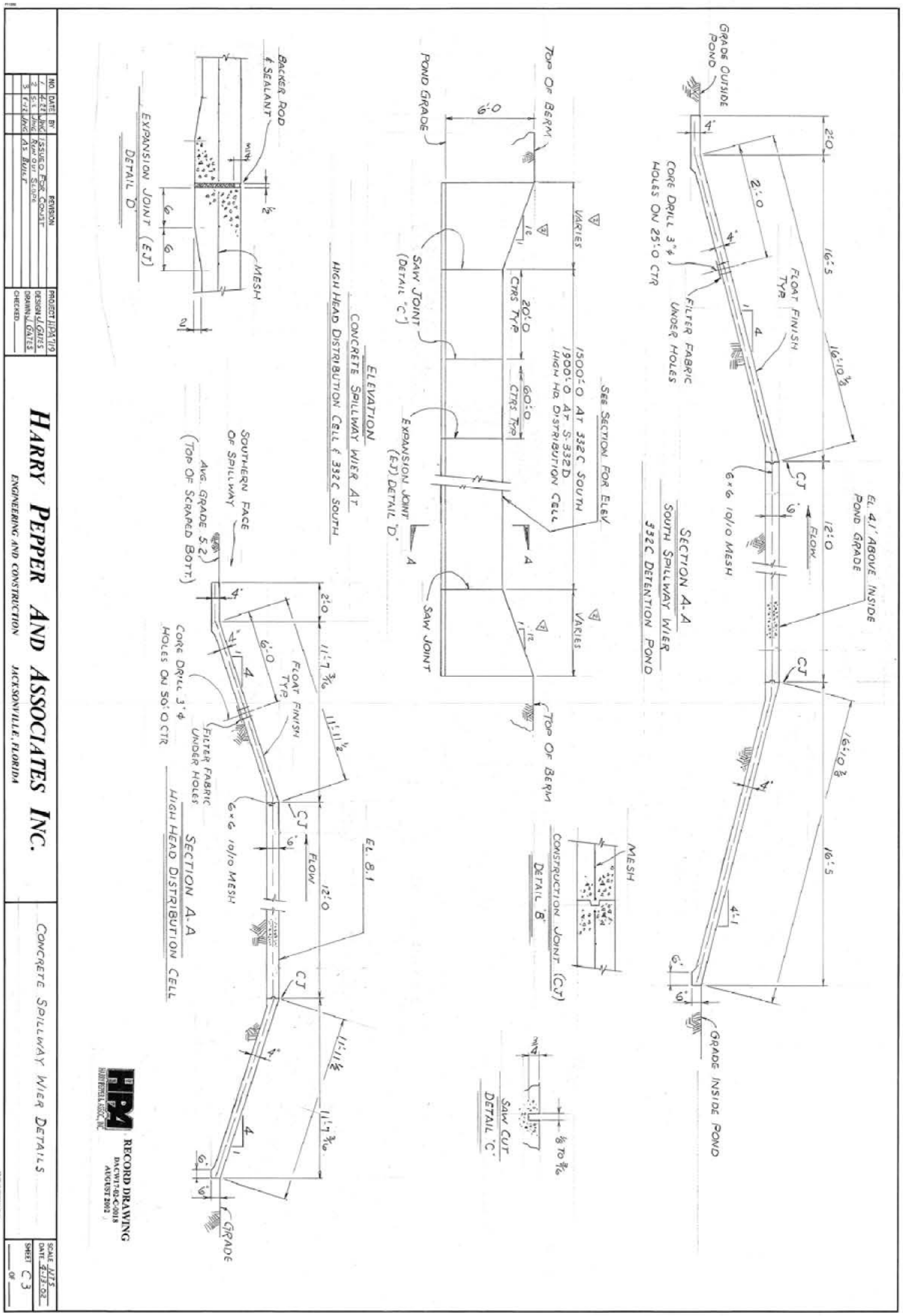
Floating Silt Boom	=	980.0	FT		Assumed
Silt Fence	=	6,492.0	FT		Assumed

Quantities Summary

Coffer dam:	770.0	LF
Coffer dam:	31,800.0	SF
Excavation:	6,329.2	CY
Concrete:	57.7	CY
Steel Rebar:	0.7	CY (?)
Steel Rebar:	4.6	TONS
Backfill:	7,911.5	LCY
Rip-rap:	1,813.3	CY
Geofabric:	7,395.0	SF
Floating Curtain:	980.0	LF
Silt Fence:	6,492.0	LF

Feature of Work:	STRUCTURE S-1: 13.5FT WIDE EMERGENCY OVERFLOW UN-GATED WEIR/SPILLWAY
Scope Given:	Emergency overflow weir/spillway (by-pass not required for construction). Structure SW-1 is the overflow spillway for the A-2 Reservoir per DCM-3. Its crest elevation is 31.1 Feet NAVD 88 which is the NFSL of the A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structure S-327. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – A-2 Reservoir is not operational prior to overflow weir being constructed. – Assumed that levee is constructed to design grade of overflow weir. Minimal excavation is needed prior to placement of concrete. – Assumed that the weir will start at the toe of the levee then rise at a constant slope up to top of canal, be 14 ft wide, then back down to the opposite toe of the levee.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	– Site survey and stake entire area of Emergency Overflow Weir. – Silt Fence the entire site. Silt fence maintenance will be ongoing during construction of the overflow weir. – Excavate site for keyed ends near the toe of the levee and the intersection of the levee crown and the weir. – Place filter fabric below future holes, set and tie reinforcing. Form, place, finish, and cure concrete. Saw cut joints. Strip forms backfill and compact at edges of concrete.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: S-1



Feature of Work:	STRUCTURE SW-1: 13.5FT WIDE EMERGENCY OVERFLOW UN-GATED WEIR/SPILLWAY
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Concrete

Spillway Length	=	500.0	FT				Assumed along direction of levee
Spillway Crest Width	=	13.5	FT				Given
Spillway Crest Length	=	159.2	FT				
Levee Crest Elevation	=	45.3	FT				Top of bank elevation
Spillway Crest Elevation	=	31.1	FT				Given
Grade Elevation	=	6.5	FT				Top of caprock
Spillway Sloped Length to Levee Top	=	342.0	FT				x2 for each side of crest
Slope towards levee from Spillway Crest	=	12.0	:1				
Distance from Interior Levee to Spillway Crest	=	110.7	FT				
Distance from Spillway Crest to Canal	=	203.9	FT				
North length of levee slope	=	113.4	FT				5:1 slope
South length of levee slope	=	203.3	FT				9:1 slope
Distance from South slope to edge of levee	=	65.5	FT				
Apron length	=	2.0	FT				
Top of Spillway depth	=	0.5	FT				6" top
Slopes of Spillway depth	=	0.3	FT				4" sides
Apron Depth	=	1.0	FT				assumed depth
6" Thick Concrete Volume	=	3,383.0	CF	=	125.3	CY	
4" Thick Concrete Volume	=	57,838.0	CF	=	2,142.1	CY	
Apron Volume	=	1,000.0	CF	=	37.0	CY	
TOTAL CONCRETE	=	62,221.0	CF	=	2,304.5	CY	
Steel Rebar							Assumed 1.2% volume of concrete
STEEL REBAR		TOTAL		=	27.7	CY	Rebar
					182.8	TONS	

Total Length over Spillway	=	330.2	FT	
Saw Cut Spacing	=	20.0	FT	
Number of Saw Cuts	=	25.0	EA	Round down (length/spacing)
Length of Saw Cuts	=	8,254.9	LF	
Spacing of Expansion Joints	=	60.0	FT	
Number of Expansion Joints	=	8.0	EA	Round down (length/spacing)
Length of Expansion Joints	=	2,641.6	FT	

Backfill

Between Levee and Adjacent Berm

Cross-Section Area	=	194.7	SF				
Volume	=	97,335.5	CF	=	3,605.0	CY	Backfill

Site Prep

Perimeter	=	1,660.4	SF			
Area of work	=	165,097.5	SF	=	3.8	Acres

Silt Fence

Silt Fence	=	2,075.5	LF	Assumed 125% longer than the perimeter of the work area

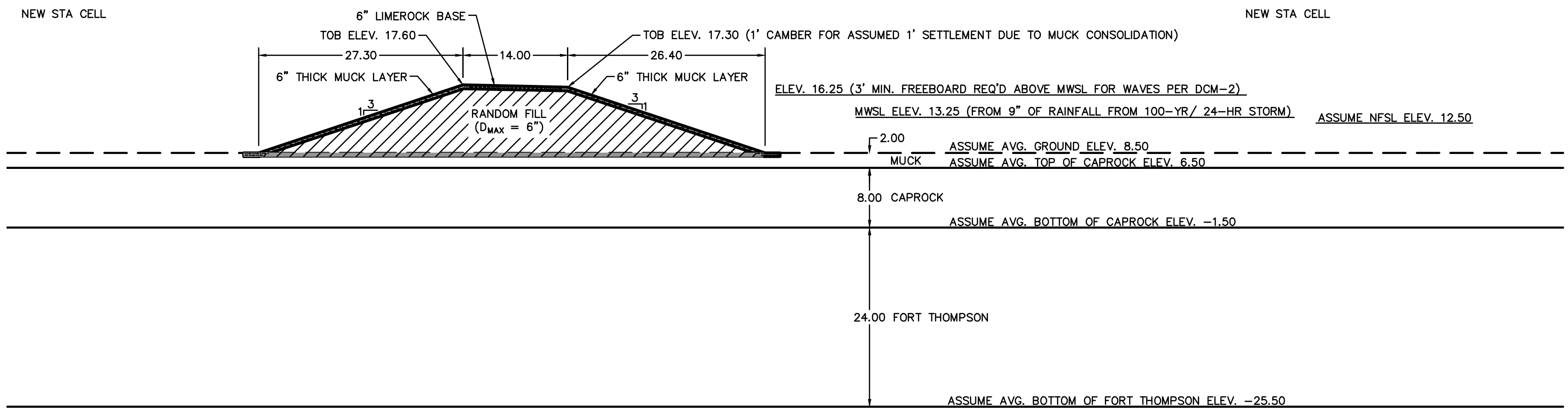
Quantities Summary

Concrete:	2,304.5	CY
Steel Rebar:	27.7	CY (?)
Steel Rebar:	182.8	TONS
Saw Cuts:	8,254.9	LF
Expansion Joints:	2,641.6	LF
Backfill:	3,605.0	CY
Silt Fence:	2,075.5	LF

Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Contract 5: A-2 Reservoir and A-2 STA Embankments and Canals

Feature of Work:	TYPICAL LEVEE SECTION A
Scope Given:	Levee Section A is utilized as a typical section: 16,003 LF (3.03 MI) running West to East between CELL 1 SAV/CELL 2 SAV AND CELL 3 EAV/CELL 4 EAV.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 12.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	

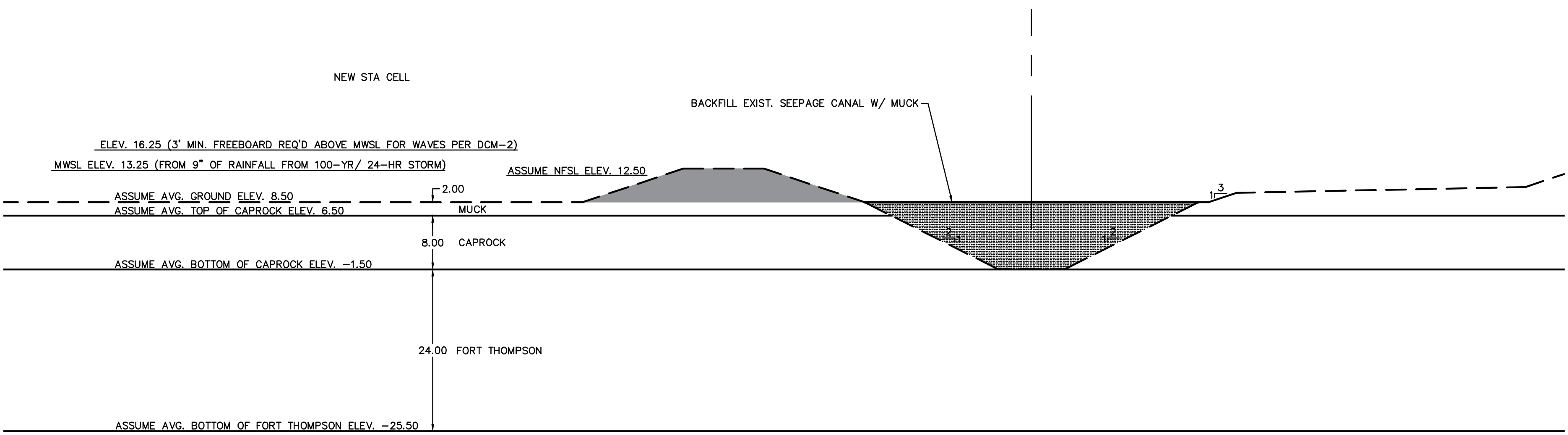


LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

TYPICAL SECTION A

NOT TO SCALE



TYPICAL SECTION B-1

NOT TO SCALE

LEVEE SECTION A

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		63	16,003			23		
Clearing & Grubbing		90	16,003			33		
Muck Cut for Embankment C&G	35.85		16,003	21,248				
Muck Fill (along side slopes)	31.30		16,003	18,553			22,264	
6" Limrock Base	6.00		16,003	3,557			4,446	274,288
Random Fill (Dmax = 6")	364.22		16,003	215,873			269,841	

Muck Stockpile							25,498	

Section A Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	21,248	CY	Muck Cut
Excavate, Muck Stockpile	25,498	CY	Muck Stockpile
Drill and Blast Caprock	219,430	CY	Sum of Neat Fill, Limerock
Excavate Caprock to Stockpile	274,288	CY	x1.25
Process Limerock	4,446	CY	Sum of listed items
Place Random Fill, Lime Rock	274,288	CY	Sum of listed items
Bank Topsoil Placement	22,264	CY	Muck Fill
Fine Grading	23	Acre	Hydroseeding
Seeding	23	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION B-1
Scope Given:	Levee Section B-1 is utilized as a typical section: 12,330 LF (2.34 MI) running West to East, South of CELL 2 SAV and CELL 4 EAV.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 12.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	

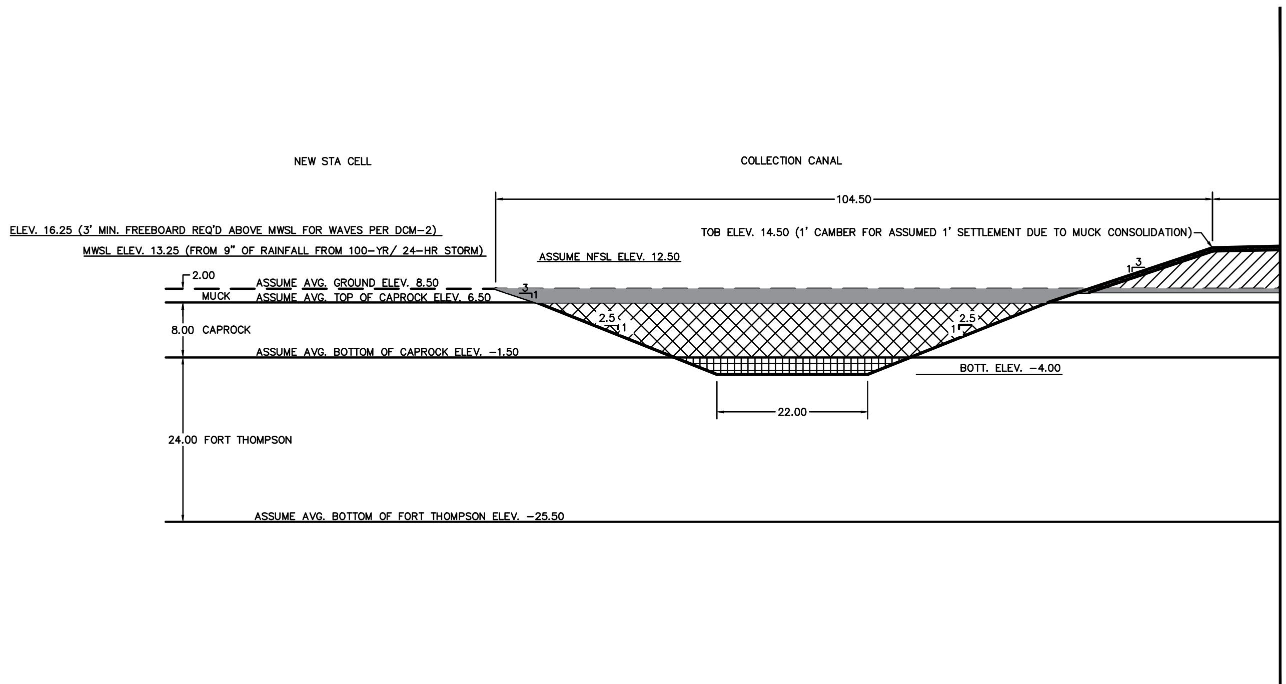
LEVEE SECTION B-1 - ALONG EXIST. STA 3/4 SEEPAGE CANAL

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		92	12,330			26		
Clearing & Grubbing		110	12,330			31		
Muck Cut of existing berm/ farm road	135.00		12,330	61,649			73,978	
Muck Fill (backfill exist. STA-3/4 seepage canal)	296.51		12,330	135,403			162,484	88,505

Section B-1
Summaries for MCACES

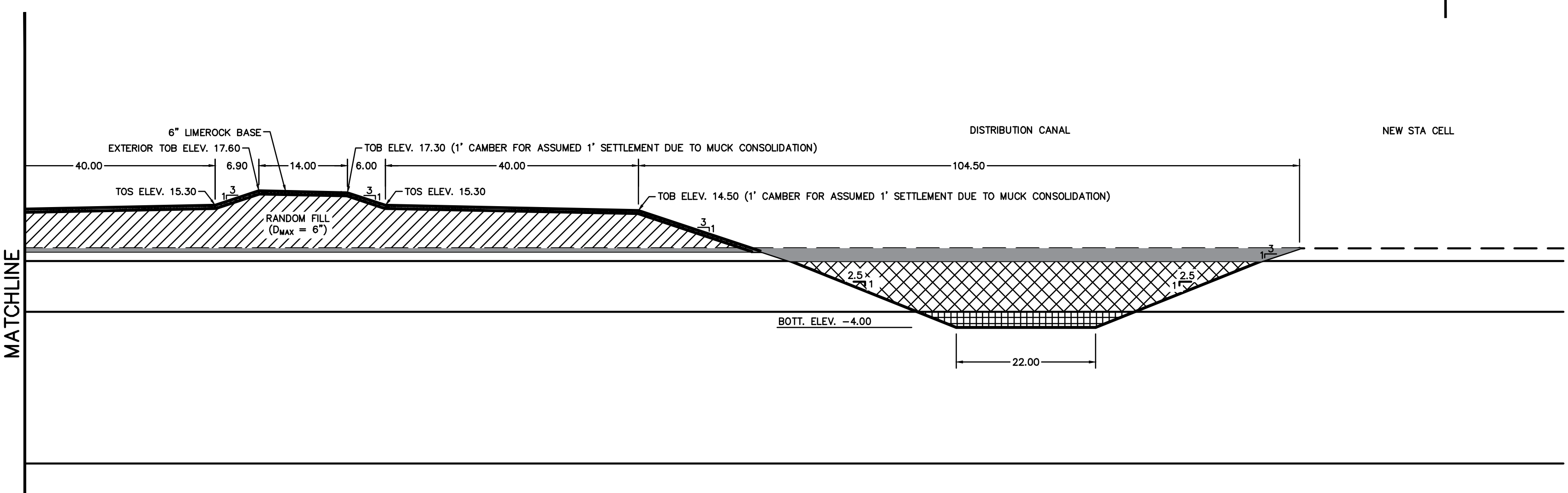
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	61,649	CY	Muck Cut
Excavate, Muck Stockpile	162,484	CY	Muck Stockpile
Fine Grading	26	Acre	Hydroseeding
Seeding	26	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION C
Scope Given:	Levee Section C is utilized as a typical section: 20,508 LF (3.88 MI) running North to South, between CELL 1 SAV/CELL 3 EAV and CELL 2 SAV/CELL 4 EAV.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 12.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION



TYPICAL SECTION C

NOT TO SCALE

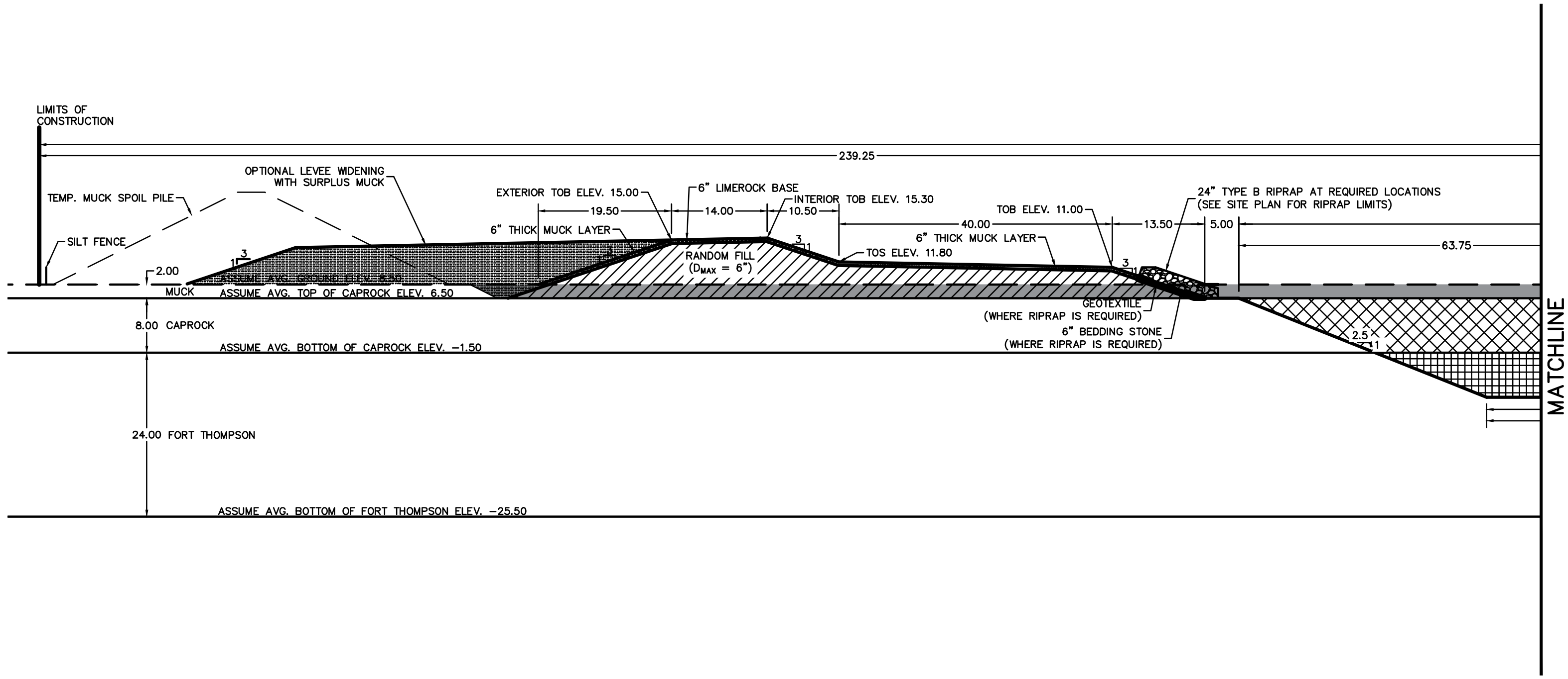
LEVEE SECTION C

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		159	20,508			75		
Clearing & Grubbing		330	20,508			155		
Muck Cut for Embankment C&G	72.95		20,508	55,410			299,417	All Muck
Muck Cut (Collection Canal)	160.63		20,508	122,004				
Caprock Cut (Collection Canal)	436.00		20,508	331,166			413,958	
Ft. Thompson Cut (Collection Canal)	70.63		20,508	53,644				384,810
Muck Cut (Distribution Canal)	160.63		20,508	122,004				
Caprock Cut (Distribution Canal)	436.00		20,508	331,166			413,958	
Ft. Thompson Cut (Distribution Canal)	70.63		20,508	53,644				384,810
Muck Fill (along side slopes)	67.53		20,508	51,293			61,552	
6" Limerock Base	6.00		20,508	4,558			5,698	
Random Fill (Dmax = 6")	845.62		20,508	642,297			802,872	808,570

Section C
Summaries for MCACES

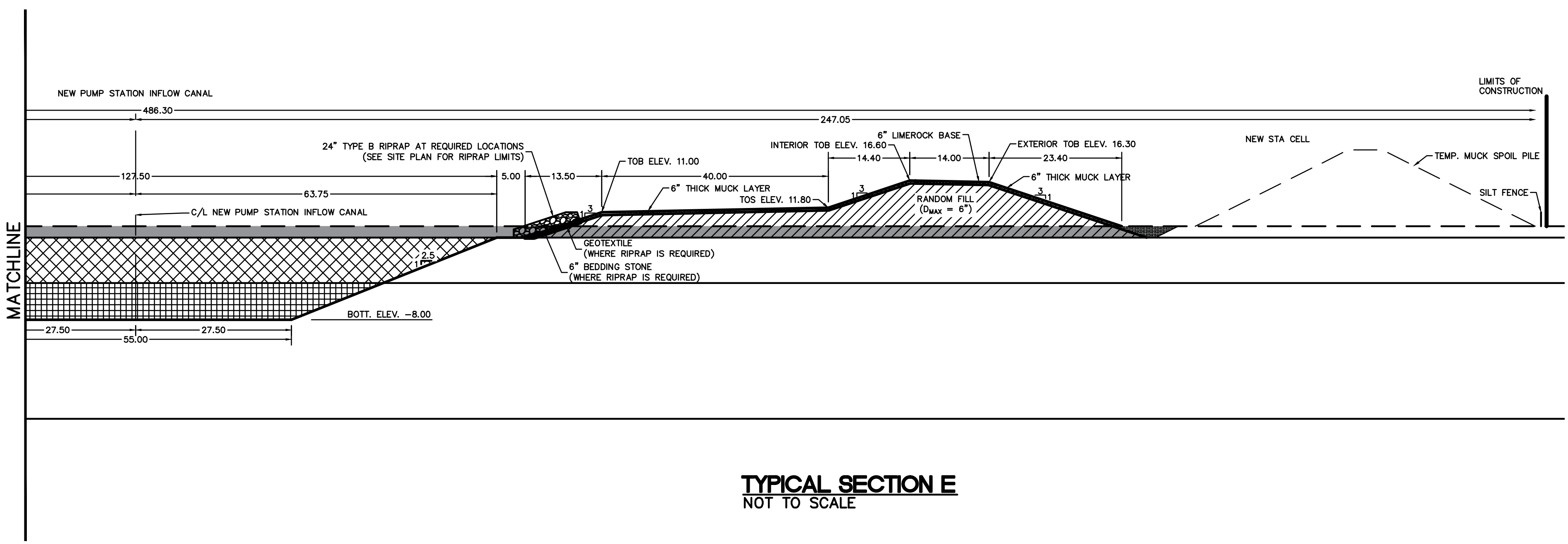
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	299,417	CY	Muck Cut
Excavate, Muck Stockpile	359,300	CY	Muck Cut x 1.2
Drill and Blast Caprock	662,332	CY	Sum of Neat Fill, Limerock
Excavate Caprock to Stockpile	827,916	CY	x1.25
Drill and Blast Ft. Thompson	107,287	CY	Sum of Neat Fill, Limerock
Excavate Rock to Stockpile	134,109	CY	x1.25
Process Limerock	5,698	CY	Sum of listed items
Place Random Fill, Lime Rock	808,570	CY	Sum of listed items
Bank Topsoil Placement	61,552	CY	Muck Fill
Fine Grading	75	Acre	Hydroseeding
Seeding	75	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION E: NEW PUMP STATION INFLOW CANAL (ADJACENT TO A-2 STA)
Scope Given:	Levee Section E is utilized as a typical section: 22,312 LF (4.23 MI) running West to East, along the North of CELL 1 SAV and CELL 3 EAV.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION



TYPICAL SECTION E

NOT TO SCALE

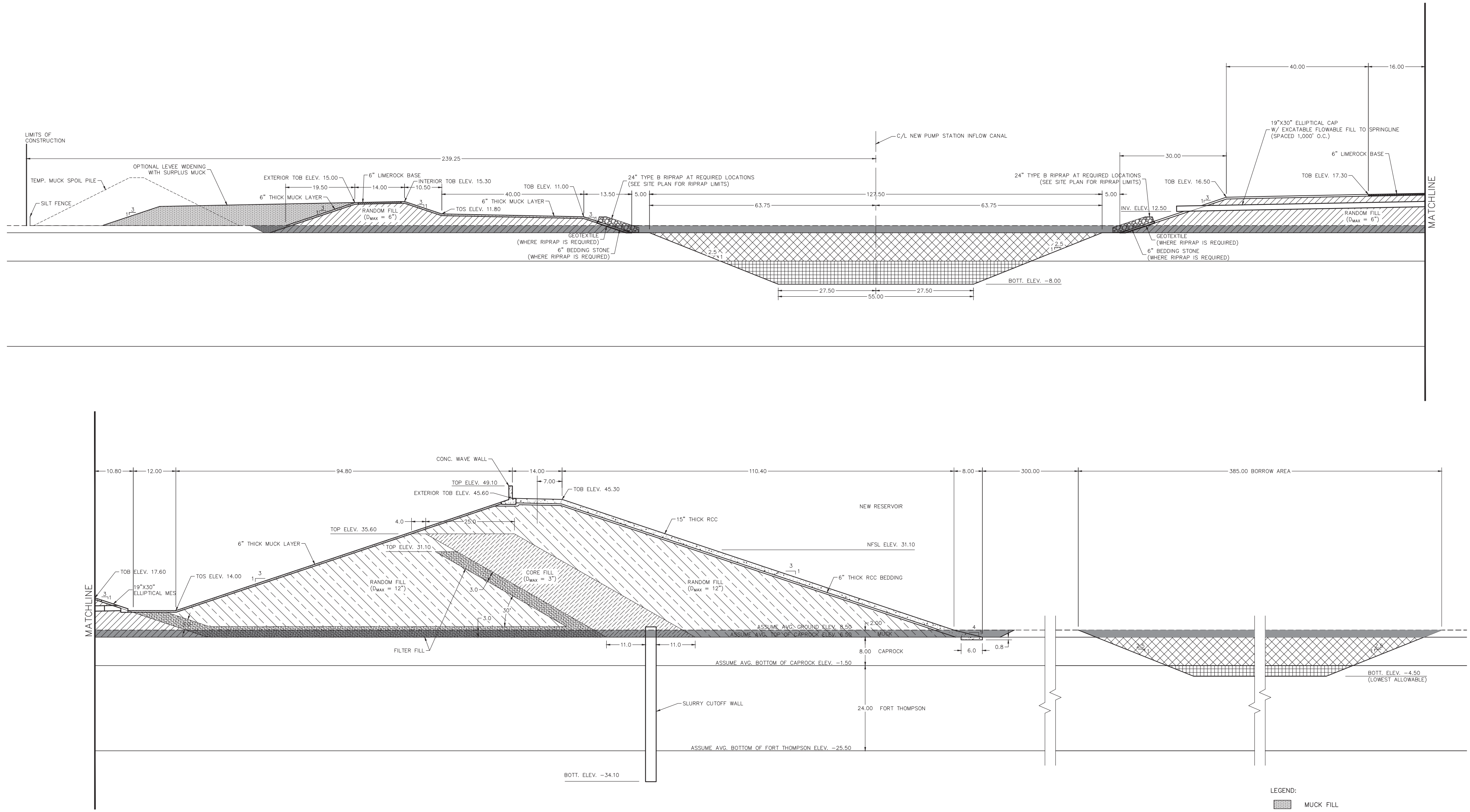
SECTION E

NEW PUMP STATION INFLOW CANAL (ADJACENT TO A-2 STA)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		204	22,312			104		
Clearing & Grubbing		500	22,312			256		
Muck Cut - north side	348.50		22,312	287,996				
Muck Cut - south side	364.10		22,312	300,888				588,883
Caprock Cut (PS inflow canal)	860.00		22,312	710,693			888,366	
Ft. Thompson Cut (PS inflow canal)	463.13		22,312	382,721				1,093,414
Muck Temp. Stockpile - north side	418.20		22,312	345,595			414,714	
Muck Temp. Stockpile - south side	436.92		22,312	361,065			433,278	847,992
Muck Fill (along side slopes w/ no riprap)	116.63		21,119	91,232			109,478	
Muck Fill (along side slopes w/ riprap)	107.26		1,193	4,739			5,687	115,165
6" Limerock Base	12.00		22,312	9,919			12,399	
Random Fill (Dmax = 6")	1041.85		22,312	860,974			1,076,217	1,091,623
24" Type B Riprap (at bends)	45.08		1,193	1,992			2,490	
6" Bedding Stone (at bends)	9.38		1,193	414			518	
Geotextile for Riprap (at bends)		28	1,193		3,767			

Section E Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	#VALUE!	CY	Muck Cut
Excavate, Muck Stockpile	#VALUE!	CY	Muck Cut x 1.2
Drill and Blast Caprock	710,693	CY	Sum of Neat Fill, Limerock
Excavate Caprock to Stockpile	888,366	CY	x1.25
Drill and Blast Ft. Thompson	382,721	CY	Sum of Neat Fill, Limerock
Excavate Rock to Stockpile	478,401	CY	x1.25
Process Limerock, Riprap, Bedding Stone	15,406	CY	Sum of listed items
Place Random Fill, Lime Rock, Riprap, Bedding Stone	1,091,623	CY	Sum of listed items
Bank Topsoil Placement	115,165	CY	Muck Fill
Fine Grading	104	Acre	Hydroseeding
Drainage Geotextiles	3,767	SY	Geotextile
Riprap	2,490	CY	Riprap
Seeding	104	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION F(L): NEW PUMP STATION INFLOW CANAL (ADJACENT TO A-2 RESERVOIR)
Scope Given:	Levee Section F(L) is utilized as a typical section: 31,140 LF (5.90 MI) running West to East, along the North of A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

TYPICAL SECTION F(L)
NOT TO SCALE

SECTION F(L)

NEW PUMP STATION INFLOW CANAL (ADJACENT TO A-2 RESERVOIR)

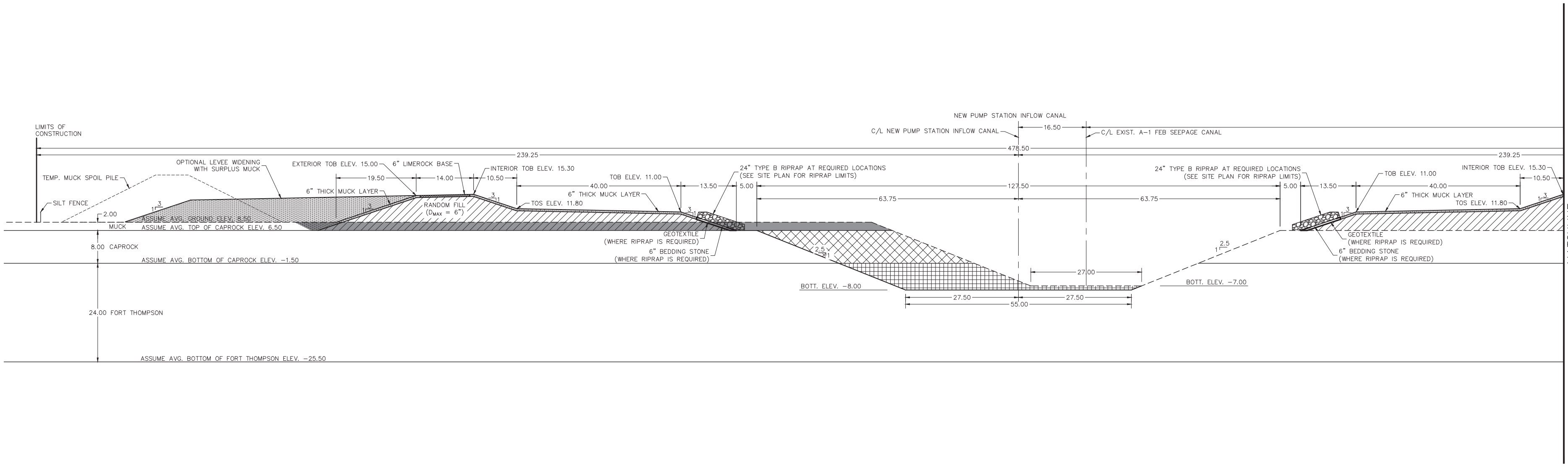
Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		289	31,126			207		
Clearing & Grubbing		1070	31,140			765		
Muck Cut - north side	348.50		31,126	401,753				2,226,121
Muck Cut - south side	823.50		31,126	949,335				
Caprock Cut (PS inflow canal)	860.00		31,126	991,412				
Ft. Thompson Cut (PS inflow canal)	463.13		31,126	533,893				1,525,305
Muck Cut (reservoir/borrow area)	759.05		31,126	875,034				
Caprock Cut (reservoir/borrow area)	2836.19		31,126	3,269,573				
Ft. Thompson Cut (reservoir/borrow area)	981.07		31,126	1,130,984				4,400,557
Muck Temp. Stockpile - north side	418.20		31,126	482,103			578,524	
Muck Temp. Stockpile - south side	1899.06		31,126	2,189,242			2,627,091	3,205,614
Muck Fill (along side slopes w/ no riprap)	151.63		29,041	163,086			195,703	
Muck Fill (along side slopes w/ riprap)	142.25		2,085	10,985			13,182	208,885
6" Limerock Base	14.00		31,126	16,144			20,180	
Random Fill (Dmax = 6")	1342.69		31,126	1,547,864			1,934,830	
Random Fill (Dmax = 12")	3498.52		31,126	4,033,109			5,041,386	
Random Fill (Dmax = 24")	0.00		31,126	-			-	
Core Fill, Bentonite Enriched (Dmax = 3")	718.78		31,126	828,617			1,035,771	
Slurry Cutoff Wall	130.80		31,126	150,787	1,357,082 SF			
Filter Fill (ASTM C33 Course Sand)	508.32		31,126	585,993			732,491	########
6" Thick RCC Bedding	68.33		31,126	78,769			98,461	
15" Thick RCC	173.53		31,126	200,044	480,105			
Conc. Wave Wall	9.03		31,126	10,409				
24" Type B Riprap (at bends)	45.08		2,085	3,481			4,351	
6" Bedding Stone (at bends)	9.38		2,085	724			905	5,256
Geotextile for Riprap (at bends)		28	2,085		6,583			

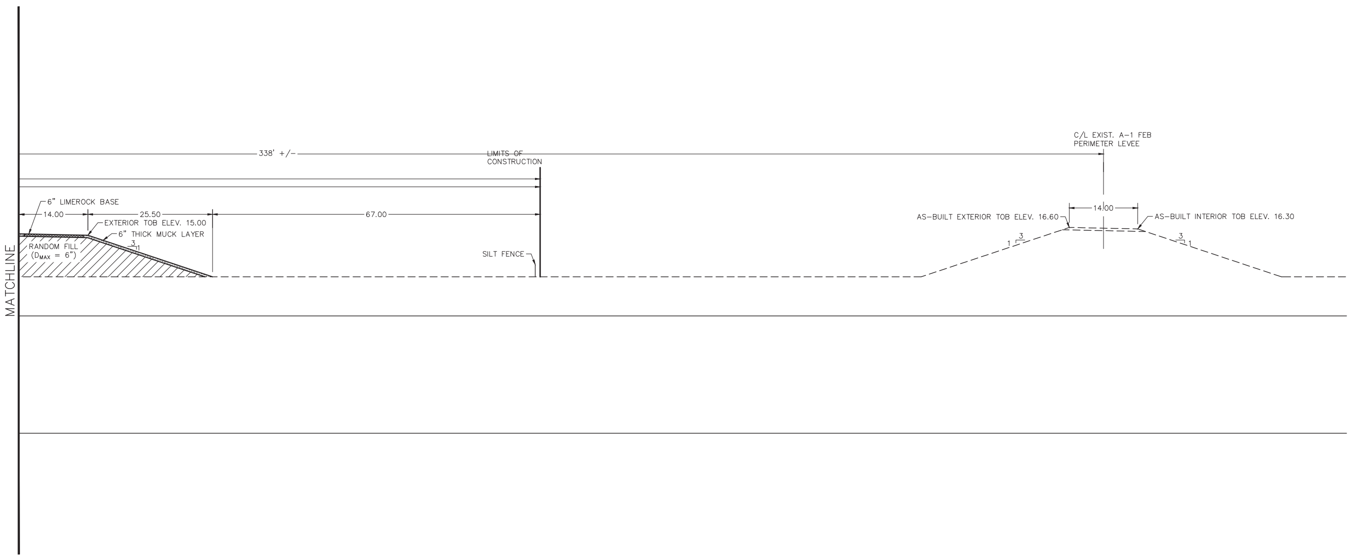
Component	Pipe Quantities (LF)	Structure Quantities (No.)		
19X30" Elliptical CAP w/ flowable fill to springline	2,336			
19X30" Elliptical Mitered End Section (MES)		32	1,920	SF

Section F(L)
Summaries for MCACES

MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	2,226,121	CY	Muck Cut
19x30 CAP	2,336	LF	19x30 CAP
MES	1,920	SF	19x30 MES
TRENCHING	31,126	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	1,357,082 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	3,205,614	CY	Muck Stockpile
Drill and Blast Caprock	4,260,986	CY	Sum of Caprocks
Excavate Caprock to Stockpile	5,326,232	CY	x1.25
Handling	5,326,232	CY	x1.25
Drill and Blast Ft. Thompson	1,664,876	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	2,081,096	CY	x1.25
Handling	2,081,096	CY	x1.25
Process Limerock, Sand, Riprap, Bedding Stone	856,388	CY	Sum of listed items
Place Random Fill, Lime Rock, Bedding	8,864,024	CY	Sum of listed items
Fill/Compact Random Fill	8,864,024	CY	
Borrow, clay, till	828,617	CY	Core Fill, Bentonite
Load/Haul Riprap+Bedding	5,256	CY	Riprap + Bedding
Fill and Compact Base	905	CY	Bedding Stone
Place Riprap	4,351	CY	Type B Riprap
Geotextile Fabric	6,583	SY	Geotextile
RCC Material	480,105	SY	15" Thick RCC
Concrete Barrier	31,126	LF	Conc. Wave Wall
Bank Topsoil Placement	208,885	CY	Muck Fill
Fine Grading	207	Acre	Hydroseeding
Drainage Geotextiles	6,583	SY	Geotextile
Riprap	4,351	CY	Riprap
Seeding	207	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION G: NEW PUMP STATION INFLOW CANAL (USING EXISTING A-1 FEB SEEPAGE CANAL)
Scope Given:	Levee Section G is utilized as a typical section: 8,241 LF (1.56 MI) running West to East, along the North of A-1 FEB.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	





LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

TYPICAL SECTION G

NOT TO SCALE

SECTION G

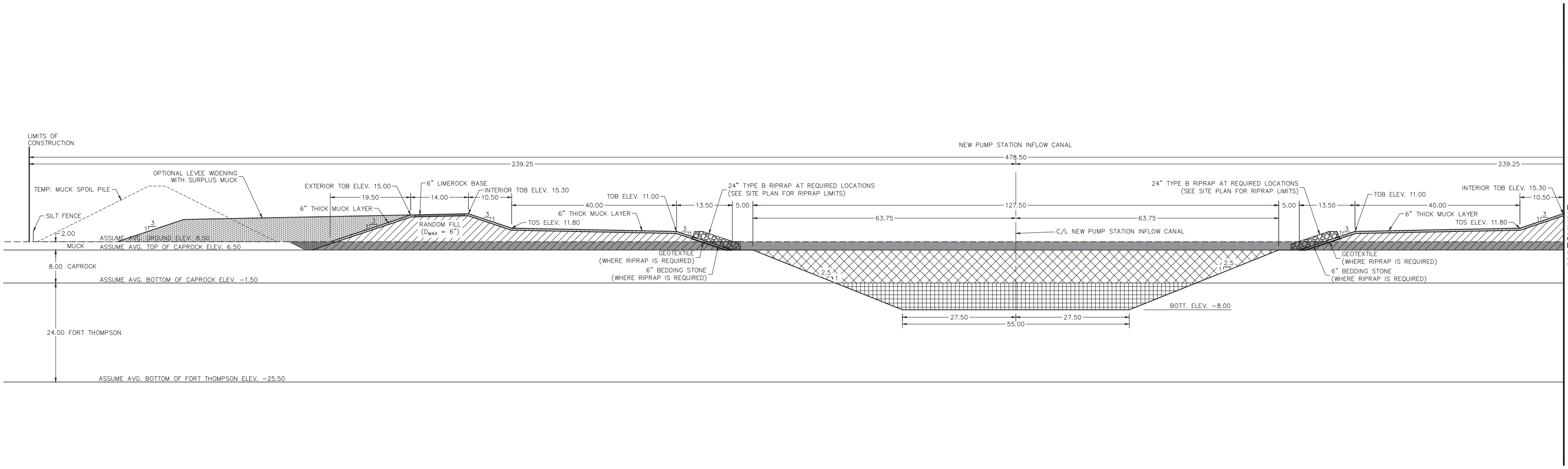
NEW PUMP STATION INFLOW CANAL (USING EXIST A-1 FEB SEEPAGE CANAL)

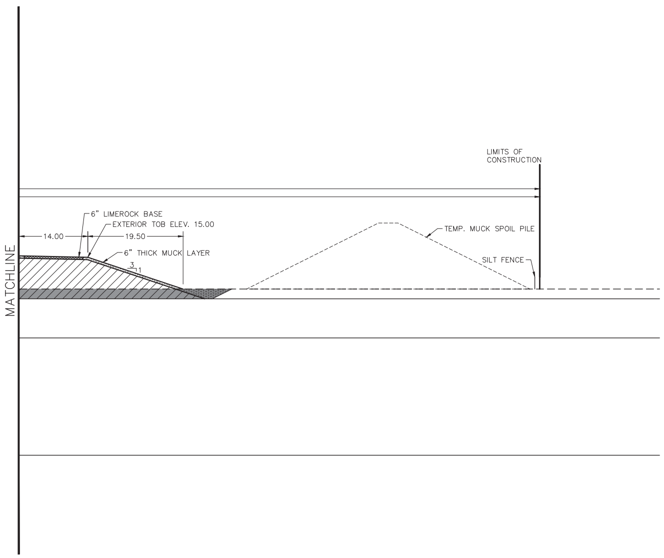
Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		192	8,241			36		
Clearing & Grubbing		220	8,241			42		
Muck Cut - north side	282.00		8,241	86,070				
Caprock Cut (PS inflow canal)	264.00		8,241	80,577			100,721	
Ft. Thompson Cut (PS inflow canal)	239.00		8,241	72,946			91,183	153,523
Muck Temp. Stockpile - north side	338.40		8,241	103,285			123,941	
Muck Fill (along side slopes w/ no riprap)	102.52		6,197	23,530			28,236	
Muck Fill (along side slopes w/ riprap)	93.15		2,044	7,052			8,462	36,698
6" Limerock Base	12.00		8,241	3,663			4,579	
Random Fill (Dmax = 6")	955.22		8,241	291,548			364,435	369,014
24" Type B Riprap (at bends)	45.08		2,044	3,412			4,266	
6" Bedding Stone (at bends)	9.38		2,044	710			887	5,153
Geotextile for Riprap (at bends)		28	2,044		6,454			

Section G
Summaries for MCACES

MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	86,070	CY	Muck Cut
Excavate, Muck Stockpile	123,941	CY	Muck Stockpile
Drill and Blast Caprock	80,577	CY	Sum of Caprocks
Excavate Caprock to Stockpile	100,721	CY	x1.25
Handling	100,721	CY	x1.25
Drill and Blast Ft. Thompson	72,946	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	91,183	CY	x1.25
Handling	91,183	CY	x1.25
Process Limerock, Riprap, Bedding Stone	9,732	CY	Sum of listed items
Place Random Fill, Lime Rock	369,014	CY	Sum of listed items
Load/Haul Riprap+Bedding	5,153	CY	Riprap + Bedding
Fill and Compact Base	887	CY	Bedding Stone
Place Riprap	4,266	CY	Type B Riprap
Geotextile Fabric	6,454	SY	Geotextile
Bank Topsoil Placement	36,698	CY	Muck Fill
Fine Grading	36	Acre	Hydroseeding
Drainage Geotextiles	6,454	SY	Geotextile
Riprap	4,266	CY	Riprap
Seeding	36	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION H: NEW PUMP STATION INFLOW CANAL
Scope Given:	Levee Section H is utilized as a typical section: 8,241 LF (1.56 MI) running West to Northeast, toward L-18 Canal.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	





LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

TYPICAL SECTION H

NOT TO SCALE

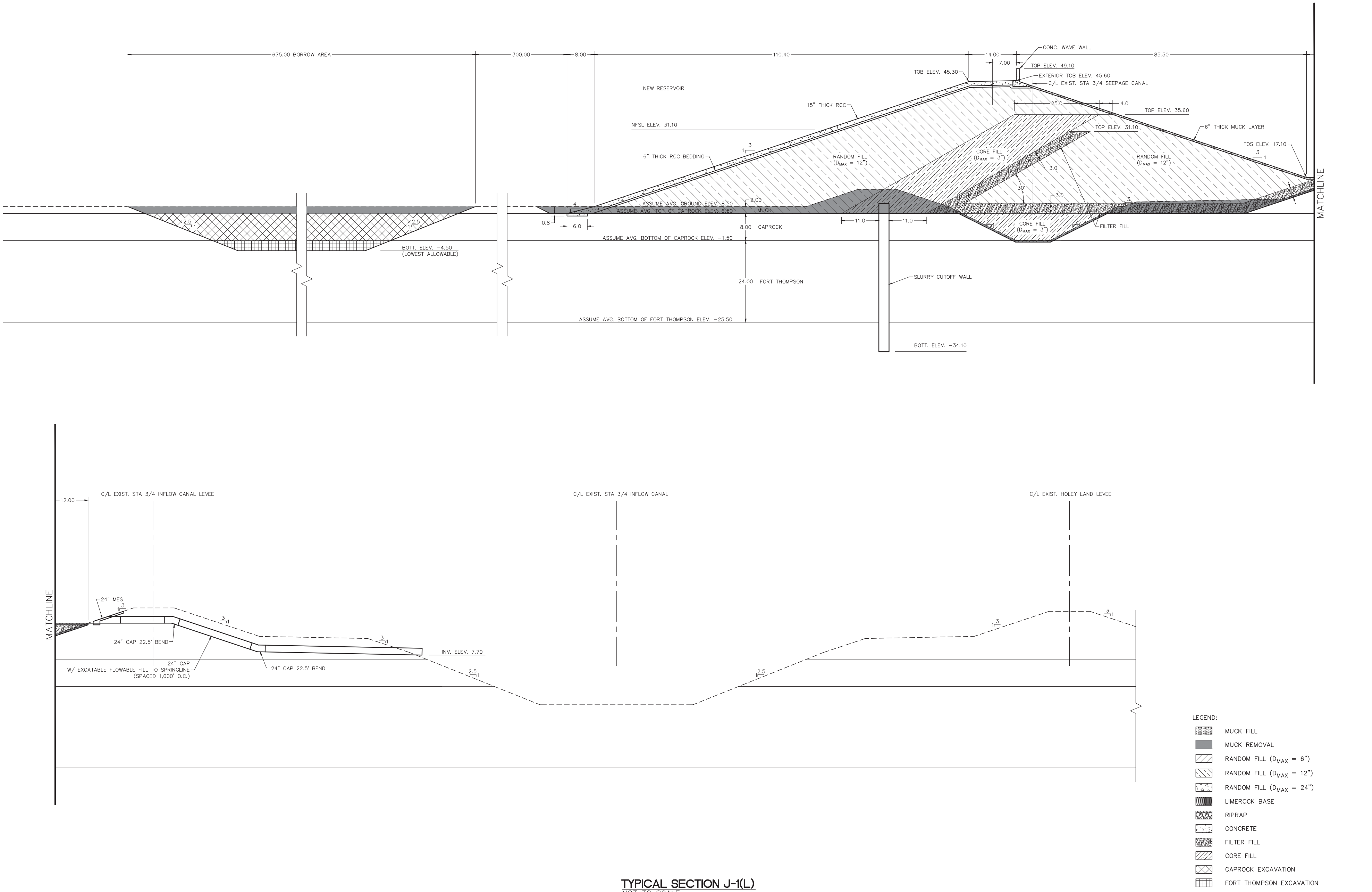
SECTION H

NEW PUMP STATION INFLOW CANAL

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		196	3,817			17		
Clearing & Grubbing		490	3,817			43		
Muck Cut - north side	348.50		3,817	49,273				
Muck Cut - south side	348.50		3,817	49,273				98,546
Caprock Cut (PS inflow canal)	860.00		3,817	121,592				
Ft. Thompson Cut (PS inflow canal)	463.13		3,817	65,479				187,072
Muck Temp. Stockpile - north side	418.20		3,817	59,128			70,953	
Muck Temp. Stockpile - south side	418.20		3,817	59,128			70,953	141,906
Muck Fill (along side slopes w/ no riprap)	112.52		3,817	15,909			19,091	
Muck Fill (along side slopes w/ riprap)	103.15		-	-			-	19,091
6" Limerock Base	12.00		3,817	1,697			2,121	
Random Fill (Dmax = 6")	955.22		3,817	135,055			168,819	170,941
24" Type B Riprap (at bends)	45.08		-	-				
6" Bedding Stone (at bends)	9.38		-	-				-
Geotextile for Riprap (at bends)		28	-		-			

Section H Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	98,546	CY	Muck Cut
Excavate, Muck Stockpile	141,906	CY	Muck Stockpile
Drill and Blast Caprock	121,592	CY	Sum of Caprocks
Excavate Caprock to Stockpile	151,990	CY	x1.25
Handling	151,990	CY	x1.25
Drill and Blast Ft. Thompson	65,479	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	81,849	CY	x1.25
Handling	81,849	CY	x1.25
Process Limerock	2,121	CY	Sum of listed items
Place Random Fill, Lime Rock	170,941	CY	Sum of listed items
Bank Topsoil Placement	19,091	CY	Muck Fill
Fine Grading	17	Acre	Hydroseeding
Seeding	17	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION J-1(L): A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST. A-1 FEB SEEPAGE CANAL)
Scope Given:	Levee Section J-1(L) is utilized as a typical section: 26,342 LF (4.99 MI) running West to East, along the South of A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION J-1(L)
NOT TO SCALE

SECTION J-1(L)

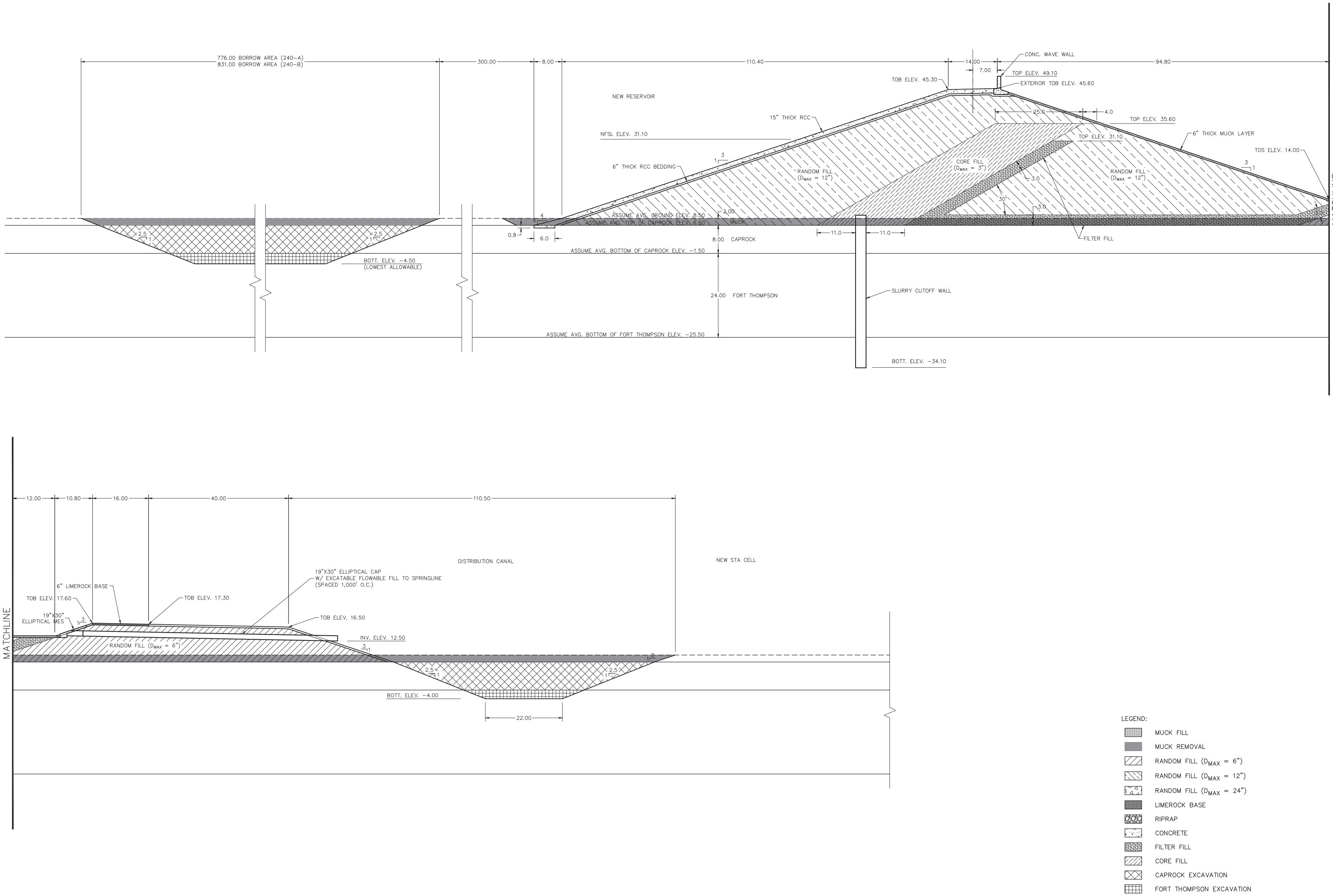
A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST A-1 FEB SEEPAGE CANAL)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		99	25,937			59		
Clearing & Grubbing		950	25,937			566		
Muck Cut - dam	573.42		25,937	550,856				
Muck Cut (reservoir/borrow area)	1338.54		25,937	1,285,865				1,836,721
Caprock Cut (reservoir/borrow area)	5154.17		25,937	4,951,333				
Ft. Thompson Cut (reservoir/borrow area)	1850.31		25,937	1,777,496				6,728,829
Muck Temp. Stockpile	2294.36		25,937	2,204,065			2,644,878	
Muck Fill (no reduction for MESs & culverts)	49.41		25,937	47,467			56,960	
Random Fill for Dam (Dmax = 24")	0.00		25,937	-			-	
Core Fill, Bentonite Enriched (Dmax = 3")	947.20		25,937	909,927			1,137,409	
Slurry Cutoff Wall	130.80		25,937	125,653	1,130,873 SF			
Random Fill for Dam (Dmax = 12")	3403.58		25,937	3,269,637			4,087,047	
Filter Fill (ASTM C33 Course Sand)	481.93		25,937	462,963			578,704	
Drain Fill	0.00		25,937	-			-	
Random Fill (Dmax = 6") (no reduction for culverts)	0.00		25,937	-			-	5,803,159
15" RCC	173.53		25,937	166,699	400,077			
6" RCC Bedding	68.33		25,937	65,639			82,049	
Conc. Wave Wall	9.03		25,937	8,674				

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
24" CAP	2,158			
24" Mitered End Sect. w/ flowable fill to springline		26	1,560	SF
24" CAP 22.5 Deg. Bends		52		

Section J-1(L) Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	1,836,721	CY	Muck Cut
24 CAP	2,158	LF	24" CAP
24 CAP bends	52	EA	24" CAP 22.5 Deg Bends
MES	1,560	SF	24 MES
TRENCHING	25,937	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	1,130,873 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	2,644,878	CY	Muck Stockpile
Drill and Blast Caprock	4,951,333	CY	Sum of Caprocks
Excavate Caprock to Stockpile	6,189,166	CY	x1.25
Handling	6,189,166	CY	x1.25
Drill and Blast Ft. Thompson	1,777,496	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	2,221,871	CY	x1.25
Handling	2,221,871	CY	x1.25
Process Sand, Bedding Stone	660,752	CY	Sum of listed items
Place Random Fill, Core, Filter	5,803,159	CY	Sum of listed items
Fill/Compact Random Fill	5,803,159	CY	
Borrow, clay, till	909,927	CY	Core Fill, Bentonite
RCC Material	480,105	SY	15" Thick RCC
Concrete Barrier	31,126	LF	Conc. Wave Wall
Bank Topsoil Placement	208,885	CY	Muck Fill
Fine Grading	207	Acre	Hydroseeding
Drainage Geotextiles	6,583	SY	Geotextile
Riprap	4,351	CY	Riprap
Seeding	207	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION K(L): A-2 EAST RESERVOIR DAM EMBANKMENT (NEXT TO NEW STA CELLS)
Scope Given:	Levee Section K(L) is utilized as a typical section: 20,508 LF (3.88 MI) running North to South, between CELL 3 EAV/CELL 4 EAV and A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION K(L)

NOT TO SCALE

SECTION K(L)

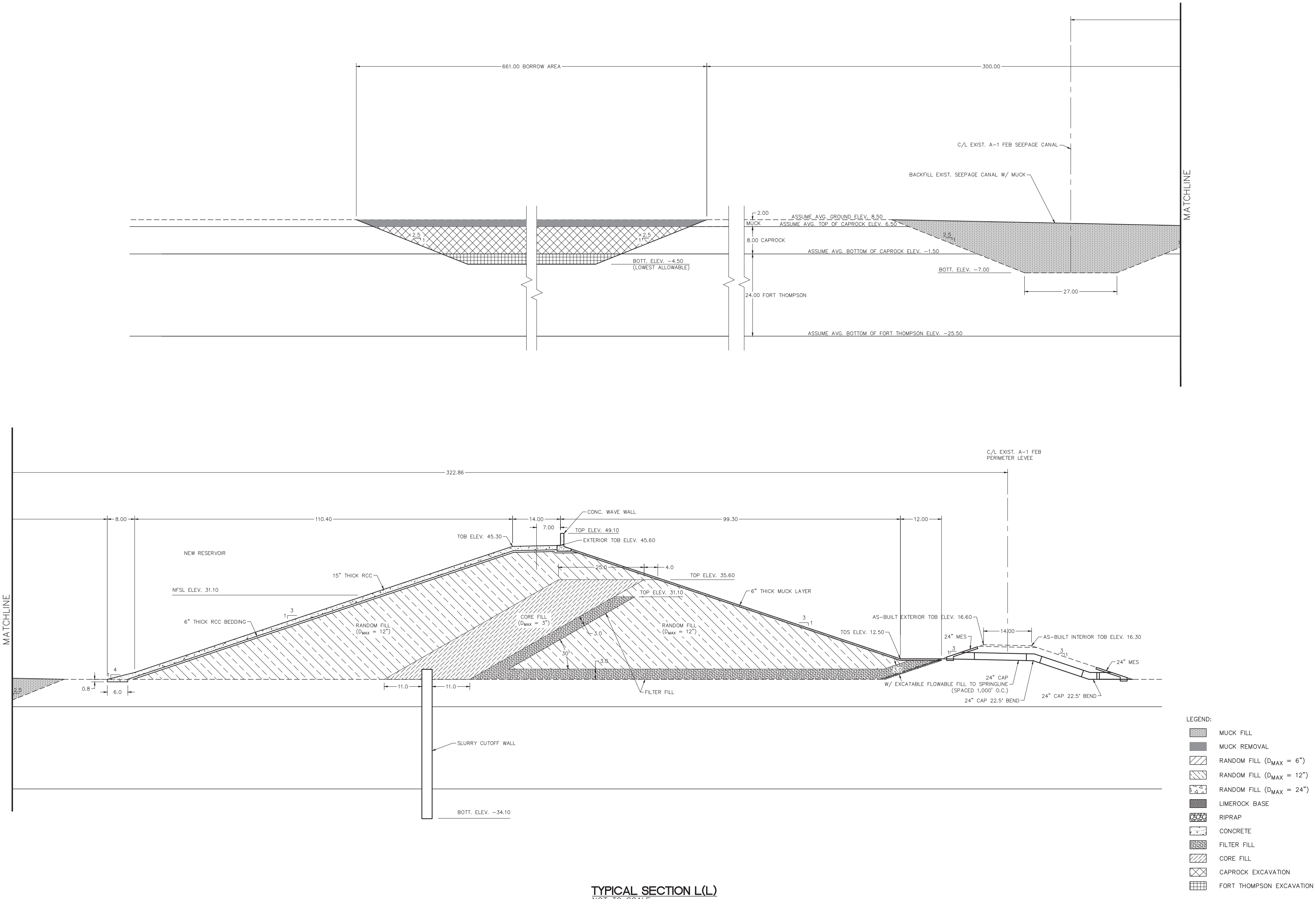
A-2 EAST RESERVOIR DAM EMBANKMENT (NEXT TO NEW STA CELLS)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		192	20,508			90		
Clearing & Grubbing		1230	20,508			579		
Muck Cut - dam & canal	841.00		20,508	638,786				1,809,142
Caprock Cut (canal)	436.00		20,508	331,166				
Ft. Thompson Cut (canal)	70.63		20,508	53,644				384,810
Muck Cut (reservoir/borrow area)	1540.84		20,508	1,170,356				
Caprock Cut (reservoir/borrow area)	5963.37		20,508	4,529,514				
Ft. Thompson Cut (reservoir/borrow area)	2153.77		20,508	1,635,904				6,165,418
Muck Temp. Stockpile	2858.21		20,508	2,170,971			2,605,165	
Muck Fill (no reduction for MESs & culverts)	95.36		20,508	72,434			86,921	
6" Limrock Base	8.00		20,508	6,078			7,597	
Random Fill (Dmax = 6") (no reduction for culverts)	865.08		20,508	657,078			821,347	
Random Fill (Dma x= 12") (no reduction for culverts)	3498.52		20,508	2,657,318			3,321,648	
Random Fill (Dmax = 24")	0.00		20,508	-			-	########
Core Fill, Bentonite Enriched (Dmax = 3")	718.78		20,508	545,956			682,445	
Slurry Cutoff Wall	130.80		20,508	99,350	894,149 SF			
Filter Fill (ASTM C33 Course Sand)	508.32		20,508	386,097			482,621	
15" RCC	173.53		20,508	131,804	395,412			
6" RCC Bedding	68.33		20,508	51,899			64,873	
Conc. Wave Wall	9.03		20,508	6,858				

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
19X30" Elliptical CAP w/ flowable fill to springline	1,533			
19X30" Elliptical Mitered End Section (MES)		21	1,260	SF

Section K(L) Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	1,809,142	CY	Muck Cut
19x30 CAP	1,533	LF	19x30 CAP
MES	1,260	SF	19x30 MES
TRENCHING	20,508	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	894,149 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	2,605,165	CY	Muck Stockpile
Drill and Blast Caprock	4,860,680	CY	Sum of Caprocks
Excavate Caprock to Stockpile	6,075,850	CY	x1.25
Handling	6,075,850	CY	x1.25
Drill and Blast Ft. Thompson	1,689,548	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	2,111,935	CY	x1.25
Handling	2,111,935	CY	x1.25
Process Limerock, Filter Fill, Bedding Stone	555,092	CY	Sum of listed items
Place Random Fill, Core, Filter, Limerock	5,380,532	CY	Sum of listed items
Fill/Compact Random Fill	5,380,532	CY	
Borrow, clay, till	545,956	CY	Core Fill, Bentonite
RCC Material	395,412	SY	15" Thick RCC
Concrete Barrier	20,508	LF	Conc. Wave Wall
Bank Topsoil Placement	86,921	CY	Muck Fill
Fine Grading	90	Acre	Hydroseeding
Seeding	90	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION L(L): A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST. A-1 FEB PERIMETER LEVEE)
Scope Given:	Levee Section L(L) is utilized as a typical section: 15,376 LF (2.91 MI) running South to North, between A-2 Reservoir and A-1 FEB.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50 • NSFL EL 31.10
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION L(L)
NOT TO SCALE

SECTION L(L)

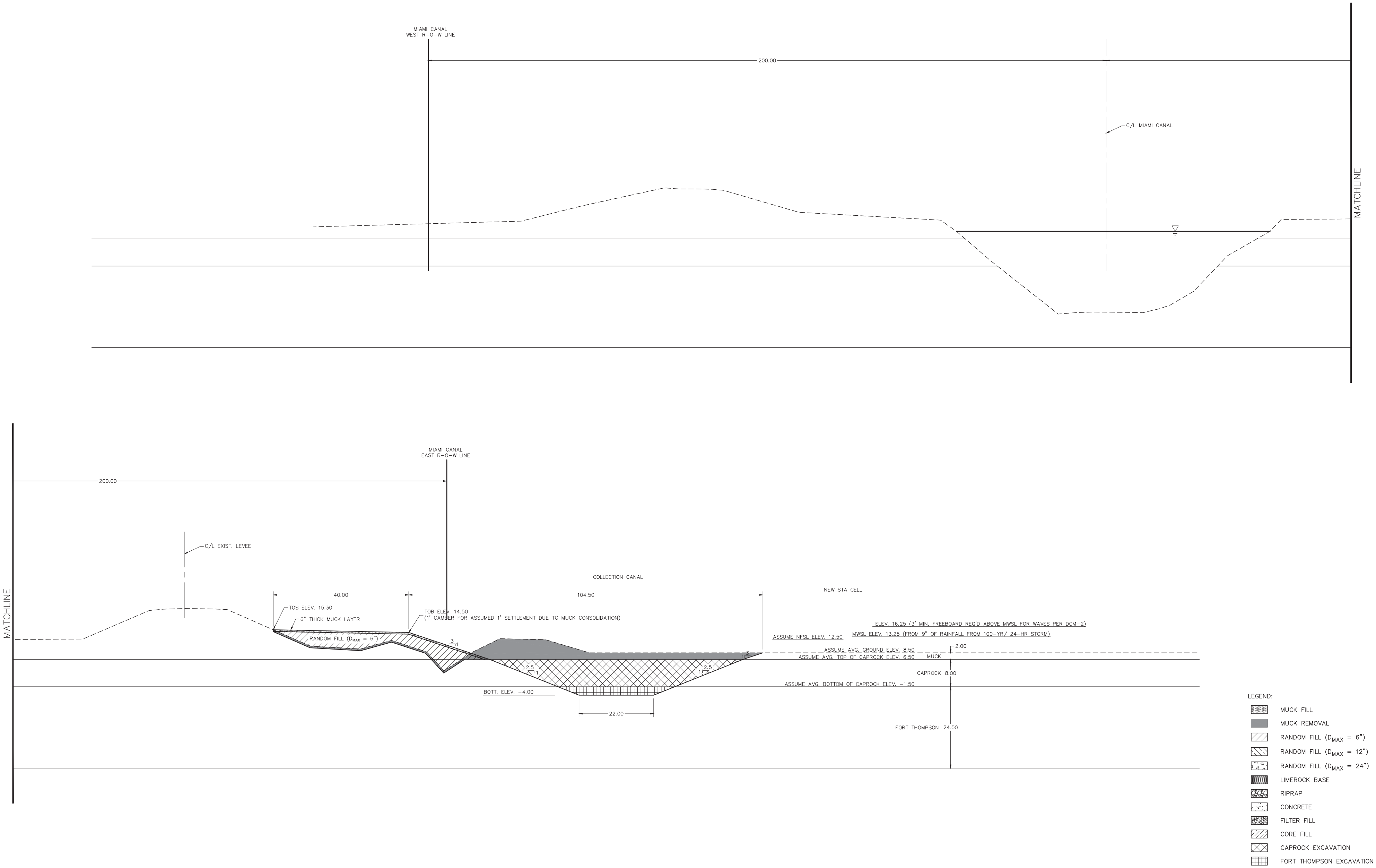
A-2 RESERVOIR DAM EMBANKMENT (NEXT TO EXIST. A-1 FEB PERIMETER LEVEE)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		113	15,376			40		
Clearing & Grubbing		830	15,376			293		
Muck Cut - dam	9.07		15,376	5,165				
Muck Cut (reservoir/borrow area)	1311.81		15,376	747,052				752,217
Caprock Cut (reservoir/borrow area)	5047.24		15,376	2,874,312				
Ft. Thompson Cut (reservoir/borrow area)	1810.22		15,376	1,030,885				3,905,197
Muck Temp. Stockpile	1585.06		15,376	902,661			1,083,193	
Muck Fill (dam)	56.68		15,376	32,281			38,737	
Muck Fill (A-1 FEB seepage canal)	914.63		15,376	520,862			625,034	663,771
Random Fill for Dam (Dmax = 24")	0.00		15,376	-			-	
Core Fill, Bentonite Enriched (Dmax = 3")	718.78		15,376	409,334			511,667	
Slurry Cutoff Wall	130.80		15,376	74,488	670,394 SF			
Random Fill for Dam (Dmax=12")	3523.75		15,376	2,006,713			2,508,391	
Filter Fill (ASTM C33 Course Sand)	521.09		15,376	296,751			370,938	########
15" RCC	173.53		15,376	98,821	296,462			
6" RCC Bedding	68.33		15,376	38,911			48,639	
Conc. Wave Wall	9.03		15,376	5,142				

Component	Pipe Quantities (LF)	Structure Quantities (No.)		
24" CAP	480			
24" Mitered End Sect. w/ flowable fill to springline		32	1,920	SF
24" CAP 22.5 Deg. Bends		32		

Section L(L) Summaries for MCACES			
MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	752,217	CY	Muck Cut
24 CAP	480	LF	24" CAP
24 CAP bends	32	EA	24" CAP 22.5 Deg Bends
MES	1,920	SF	24 MES
TRENCHING	15,376	LF	Slurry Cutoff Wall (3' wide)
SLURRY WALL	670,394 SF	SF	Slurry Cutoff Wall
Excavate, Muck Stockpile	1,083,193	CY	Muck Stockpile
Drill and Blast Caprock	2,874,312	CY	Sum of Caprocks
Excavate Caprock to Stockpile	3,592,890	CY	x1.25
Handling	3,592,890	CY	x1.25
Drill and Blast Ft. Thompson	1,030,885	CY	Sum of Ft. Thompsons
Excavate Rock to Stockpile	1,288,606	CY	x1.25
Handling	1,288,606	CY	x1.25
Process Filter Fill	370,938	CY	Sum of listed items
Place Random Fill, Core, Filter	3,439,636	CY	Sum of listed items
Fill/Compact Random Fill	3,439,636	CY	
Borrow, clay, till	409,334	CY	Core Fill, Bentonite
RCC Material	296,462	SY	15" Thick RCC
Concrete Barrier	15,376	LF	Conc. Wave Wall
Bank Topsoil Placement	663,771	CY	Muck Fill
Fine Grading	40	Acre	Hydroseeding
Seeding	40	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION N: STA CELL 1 NEXT TO MIAMI CANAL (NORTH)
Scope Given:	Levee Section N is utilized as a typical section: 5,309 LF (0.95 MI) running South to North, along East of CELL 1 SAV/Miami (L-23) Canal.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION N

NOT TO SCALE

SECTION N

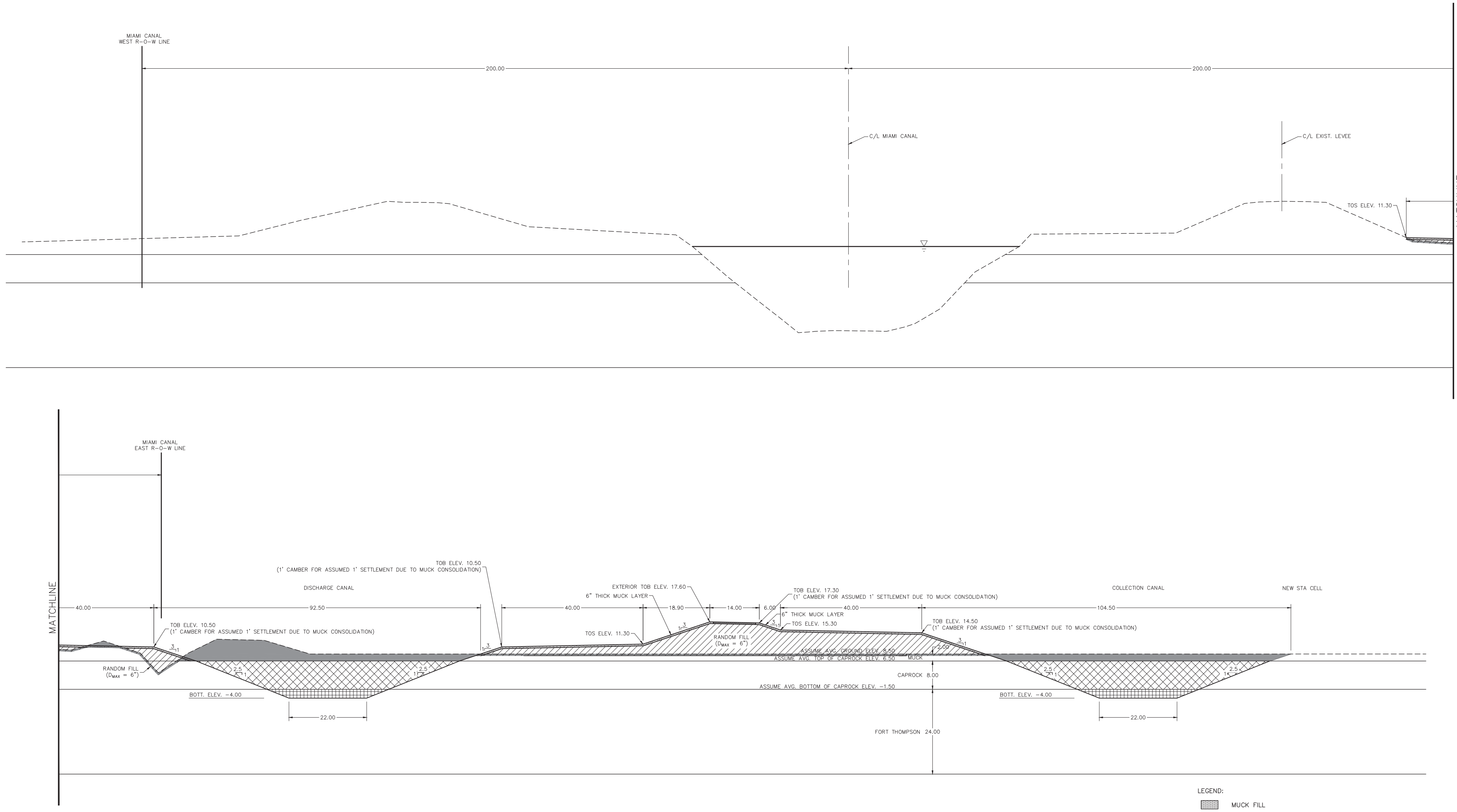
STA CELL 1 NEXT TO MIAMI CANAL (north)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		72	5,039			8		
Clearing & Grubbing		170	5,039			20		
Muck Cut (collection canal & levee)	296.56		5,039	55,347				
Caprock Cut (canal)	436.00		5,039	81,370				
Ft. Thompson Cut (canal)	70.63		5,039	13,181				94,551
Muck Temp. Stockpile	355.87		5,039	66,416			79,700	
Muck Fill (levee)	32.24		5,039	6,016			7,220	
Random Fill (Dmax = 6")	237.66		5,039	44,354			55,442	

Section N
Summaries for MCACES

MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	55,347	CY	Muck Cut
Excavate, Muck Stockpile	79,700	CY	Muck Cut x 1.2
Drill and Blast Caprock	81,370	CY	Sum of Neat Fill, Limerock
Excavate Caprock to Stockpile	101,713	CY	x1.25
Drill and Blast Ft. Thompson	13,181	CY	Sum of Neat Fill, Limerock
Excavate Rock to Stockpile	16,476	CY	x1.25
Place Random Fill	55,442	CY	Sum of listed items
Bank Topsoil Placement	7,220	CY	Muck Fill
Fine Grading	8	Acre	Hydroseeding
Seeding	8	Acre	Hydroseeding

Feature of Work:	TYPICAL LEVEE SECTION N-1: STA CELL 2 NEXT TO MIAMI CANAL (SOUTH)
Scope Given:	Levee Section N-1 is utilized as a typical section: 10,232 LF (1.94 MI) running South to North, along East of CELL 2 SAV/Miami (L-23) Canal.
Reference for Scope Basis:	
Scope Assumptions:	• Avg. Ground EL 8.50 • 2 ft Muck Layer: Avg. Bottom EL 6.50 • 8 ft Caprock Layer: Avg. Bottom EL -1.50 • 24 ft Fort Thompson Layer: Avg. Bottom EL -25.50
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	- Site survey and stake entire length and width of Levee. - Install silt fence and maintain as needed. - Excavate Organic Material. Stockpile any materials shown. - Construct a haul road parallel to the levee/excavation shown. This will be ongoing as needed during construction. Haul road maintenance will be ongoing during construction. Assumed same length as the canal will be removed after construction. Assumed width of 14 ft 1 ft thick. - Excavate material into haul truck. - Construct levee sections and/or canals as shown.
Key Outstanding Questions/Issues:	



TYPICAL SECTION N-1

NOT TO SCALE

LEGEND:

- MUCK FILL
- MUCK REMOVAL
- RANDOM FILL (D_{MAX} = 6")
- RANDOM FILL (D_{MAX} = 12")
- RANDOM FILL (D_{MAX} = 24")
- LIMEROCK BASE
- RIPRAP
- CONCRETE
- FILTER FILL
- CORE FILL
- CAPROCK EXCAVATION
- FORT THOMPSON EXCAVATION

SECTION N-1

STA CELL 2 NEXT TO MIAMI CANAL (south)

Component	Cross Sect. Area (sqft)	Cross Sect. Length (ft)	Section Length on Site Plan (ft)	Neat Vol. (cuyd)	Neat Area (sqyd)	Neat Area (acres)	Factored Volume (CY)	
Hydroseeding		205	10,232			48		
Clearing & Grubbing		380	10,232			89		
Muck Cut (discharge & collection canals & levees)	525.15		10,232	199,008				
Caprock Cut (canals)	872.00		10,232	330,445				
Ft. Thompson Cut (canals)	141.25		10,232	53,527				383,972
Muck Temp. Stockpile	630.18		10,232	238,809			286,571	
Muck Fill (levees)	93.44		10,232	35,410			42,492	
6" Limrock Base	6.00		10,232	2,274			2,843	
Random Fill (Dmax = 6")	770.35		10,232	291,925			364,906	367,749

Section N-1
Summaries for MCACES

MCACES Categories	Value	Units	Notes (QTO)
PUSH - Muck	199,008	CY	Muck Cut
Excavate, Muck Stockpile	286,571	CY	Muck Cut x 1.2
Drill and Blast Caprock	330,445	CY	Sum of Neat Fill, Limerock
Excavate Caprock to Stockpile	413,057	CY	x1.25
Drill and Blast Ft. Thompson	53,527	CY	Sum of Neat Fill, Limerock
Excavate Rock to Stockpile	66,909	CY	x1.25
Process Limerock	2,843	CY	Sum of listed items
Place Random Fill, Lime Rock	367,749	CY	Sum of listed items
Bank Topsoil Placement	42,492	CY	Muck Fill
Fine Grading	48	Acre	Hydroseeding
Seeding	48	Acre	Hydroseeding

Feature of Work:	CANAL PLUG CP-1: 500 LF EARTHEN PLUG
Scope Given:	500 LF earthen plug (by-pass not required for construction)
Reference for Scope Basis:	
Scope Assumptions:	– Assume G-372S Pump Station will remain. – Assume plug will be installed prior to reconstruction of G-200 Pump Station.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	– Survey site and stake entire length of canal. – Install floating turbidity boom and silt fence along the entire length of the canal. Floating turbidity boom and silt fence maintenance will be ongoing during construction of the canal. Maintenance of existing levee access road will be on going throughout construction.
Key Outstanding Questions/Issues:	

Feature of Work:	CANAL PLUG CP-1: 500 LF EARTHEN PLUG

Quantity Take Off:

User Input	Row Calculation	Sum of Values above

Plug Installation

Assume Material will be taken from a nearby borrow area along with levee construction

Assume Similar to existing STA 3/4 Seepage Canal

Length	=	500.0	FT			Given
Canal Top Width	=	50.0	FT			Rounded Up from 49.7'
Canal Bottom Width	=	12.0	FT			Increased by 2' from 10'
Depth	=	10.0	FT			Seepage Canal Depth 10'
Volume of Fill	=	155,000.0	CF			
Volume of Fill (with 25% added)	=	193,750.0	CF	=	7,175.9	CY

Feature of Work:	FARM PUMP REMOVAL AND EAST-WEST DITCH FILLING
Scope Given:	Remove existing farm pump and fill all ditches running along the East-West direction in the
Reference for Scope Basis:	
Scope Assumptions:	– Assume work will involve excavation and hauling of farm pump equipment. – Assume ditches will be filled by pushing material from existing adjacent land.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	
Key Outstanding Questions/Issues:	

Feature of Work:	Farm Pump Removal and East-West Ditch Fill

Quantity Take Off:

User Input | Row Calculation | Sum of Values above

Pump Removal

Structure 1							
Length	=	62.0	FT				Google Earth estimate
Width	=	42.0	FT				Google Earth estimate
Depth	=	10.0	FT				Assumed from similar seepage canal depths
Volume of Fill	=	13,020.0	CF				Assume volume of excavation to remove structure is 50% of total area
Structure 2							
Length	=	36.0	FT				Google Earth estimate
Width	=	42.0	FT				Google Earth estimate
Depth	=	10.0	FT				Assumed from similar seepage canal depths
Volume of Fill	=	7,560.0	CF				Assume volume of excavation to remove structure is 50% of total area
Volume of material removal	=	20,580.0	CF	=	762.2	CY	

E-W Ditch Fill

Assume all material will come from adjacent existing farm land, and will only require displacement into ditches

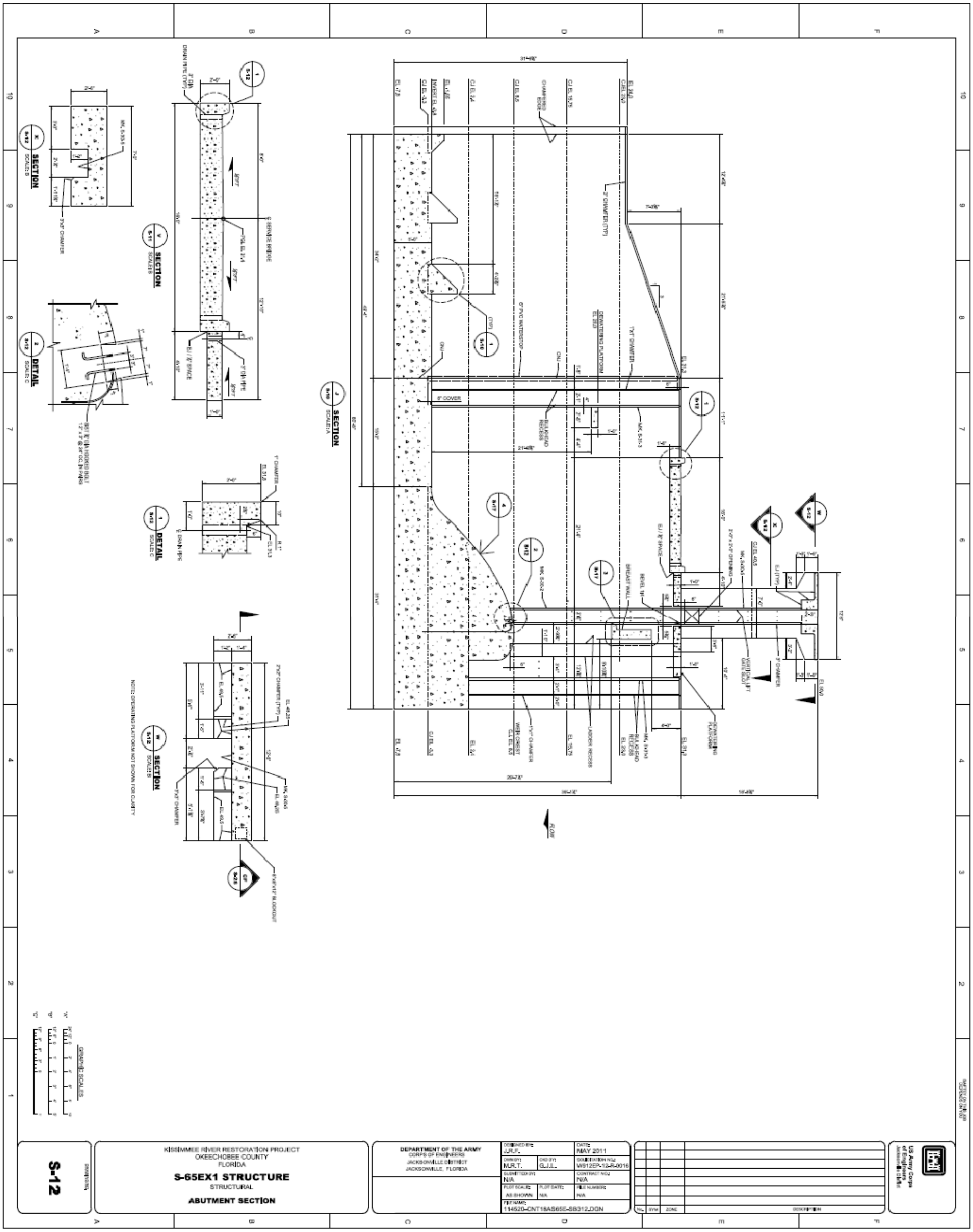
Narrow Ditches							
Total length of ditches	=	293,770.0	FT				Google Earth estimate
Width of ditches	=	20.0	FT				Google Earth estimated average
Depth	=	5.0	FT				Assumed
Volume of earthwork	=	29,377,000.0	CF	=	1,088,037.0	CY	
Wide Ditches							
Total length of ditches	=	23,510.0	FT				Google Earth estimate
Width of ditches	=	30.0	FT				Google Earth estimated average
Depth	=	8.0	FT				Assumed
Volume of earthwork	=	5,642,400.0	CF	=	208,977.8	CY	
Canals							
Total length of canals	=	45,101.0	FT				Google Earth estimate
Width of canals	=	75.0	FT				Google Earth estimated average
Depth	=	10.0	FT				Assumed from similar seepage canal depths
Volume of earthwork	=	33,825,750.0	CF	=	1,252,805.6	CY	
EARTHWORK		TOTAL		=	2,549,820.4	CY	

Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Contract 6: Gated Spillways Construction

Feature of Work:	STRUCTURE S-2: TWO-WAY FLOW GATED SPILLWAY
Scope Given:	Gated spillway w/ (3) 25'Wx14'H Gates (Gate Opening Bottom Elev. -2.00) w/ 12'x24' Control Bldg. & HW/TW Monitoring Stations w/ Walkways (by-pass not required for construction). Allows for flow from the Miami Canal to the A-2 Reservoir to be controlled when Pump Station P-1 is pumping. Allows for outflow to Miami Canal from A-2 Reservoir Culvert C-1 to be controlled.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structure S-65EX. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume aprons are in addition to the concrete structure shown in the provided drawings. – Assume power for the structure will be provided from local power lines. – Assume that a diesel generator is needed for backup power. – Assume 50 KW Diesel Generator with 1000 gallon above ground tank.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation of materials to allow for construction of the foundation of the cross canal gate structure and the canal apron/wingwall. Concrete work for structure followed by apron and wingwalls. Backfill suitable material around the structure and import riprap. Construct control station, diesel generator, and fuel storage. Place gates and other associated closure devices for the gate structure.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: S-2



Feature of Work:	STRUCTURE SW-2: TWO-WAY FLOW GATED SPILLWAY
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	152.5	FT	Assume 20' from top of excavation
Length	=	180.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	665.0	LF	Sheetpile perimeter
Area	=	27,450.0	SF	

Spillway Excavation

Assume Spillway Excavation will be partially performed during canal excavation, if no canal exists

Length	=	140.0	FT	Add'l 40' assumed for wingwall installation each way					
Total Depth	=	25.5	FT	15' below crest elevation for crest, footer, and tremie					
Thickness of Organic	=	2.0	FT						
Thickness of Cap Rock	=	8.0	FT						
Thickness of Fort Thompson	=	15.5	FT						
Canal Slope		2.5	:1	From Typical Sections					
				Canal bottom: 55' wide, Canal top: 127.5' wide					
Bottom Width	=	112.5	FT	Assumes 20' past canal excavation (minus canal width)					
Top Width	=	112.5	FT	Assumes slope same as canal					
Cross Section	=	2,868.8	SF						
Cross Section Organic	=	225.0	SF						
Cross Section of Cap Rock	=	900.0	SF						
Cross Section of Fort Thompson	=	1,743.8	SF						
Organic Cut Volume	=	31,500.0	CF	=	1,166.7	BCY	=		LCY
Cap Rock Cut Volume	=	126,000.0	CF	=	4,666.7	BCY	=		LCY
Fort Thompson Cut Volume	=	244,125.0	CF	=	9,041.7	BCY	=		LCY
EXCAVATION		TOTAL		=	14,875.0	BCY	=	18,593.8	LCY

Structure Dimensions and Volumes

Units	=	-	EA	For use only if existing canal is located where structure is to be placed, tremie pour below area of structure, approx. 20 ft past structure dimensions, 5 ft thick			
Underwater Concrete Seal Volume	=	-	CF				
(Unreinforced concrete)							
Tremie Volume	=	-	CF	=	-	CY	Tremie Concrete

Structure	1	Length	60	ft	Width	86	ft
Gate Openings	3	Height	14	ft	Width	25	ft

Number of Gates	=	3.0	EA				
Superstructure/Gate Structure							
Number of Towers	=	4.0	EA				
Tower Cross-Section	=	145.0	SF	Taken From Side View (17.5' tall)			
Tower Width	=	3.0	FT				
Volume	=	1,740.0	CF	=	64.4	CY	
Number of Piers	=	2.0	EA				
Pier Cross-Section	=	126.0	SF	Taken from Plan View			
Pier Height	=	24.0	FT	Nearby Bank El = 15.0', Canal Depth = -8.0', +1'			
Volume	=	6,048.0	CF	=	224.0	CY	
Abutment Walls	=	2.0	EA				
Cross-Section of Abutment Wall	=	150.0	SF	Taken from Plan View			

Wall Height	=	24.0	FT				Nearby Bank El = 15.0', Canal Depth = -8.0', +1'
Volume	=	7,200.0	CF	=	266.7	CY	
Beam Cross-Section	=	15.0	SF				
Beam Length	=	81.0	FT				Width minus abutment walls
volume of elevated beam	=	1,215.0	CF	=	45.0	CY	
Cross-Section of Platform, Bridge, Brestwall	=	46.5	SF				
Width	=	81.0	FT				
Volume	=	3,766.5	CF	=	139.5	CY	
OGEE volume							
Cross section	=	143.9	SF				Borrowed from similar structure
Width	=	81.0	FT				
OGEE Spillway volume	=	11,655.9	CF	=	431.7	CY	
Approach apron							Assume 12' long, 86' wide. 5' thick per S-65EX design
Length	=	12.0	FT				
Thickness	=	5.0	FT				
Volume	=	5,160.0	CF	=	191.1	CY	
Stilling Basin							Assume 22' long, 86' wide. 5' thick per S-65EX design
Length	=	22.0	FT				
Thickness	=	5.0	FT				
Volume	=	9,460.0	CF	=	350.4	CY	
CONCRETE	TOTAL			=	1,712.8	CY	Concrete
Steel Rebar							Assumed 1.2% volume of concrete
STEEL REBAR	TOTAL			=	20.6	CY	Rebar
					135.9	TONS	

Wing Walls and Cutoff

Assume same for US and DS sides

Wingwalls							
Number	=	4.0	EA				
Length	=	50.0	FT				Length to reach past riprap banks
Depth	=	35.0	FT				Past bottom of structure of slab
Area of Sheet Pile	=	7,000.0	SF				
Pile Cap						x4	
Height	=	2.0	FT				
Width	=	2.0	FT				
Volume	=	800.0	CF	=	29.6	CY	Concrete
Cutoff Walls							
Number	=	2.0	EA				US & DS
Depth	=	15.0	FT				Min. 10' required
Width	=	86.0	FT				
Area of Sheet Pile	=	2,580.0	SF				
TOTAL SHEETPILE		9,580.0	SF				Steel Sheetpile Wall
Anchor Rod Length	=	60.0	FT				
spacing	=	4.0	FT				
number of rods	=	96.0	EA				

RIP RAP

Lengths and depths assumed, and similar on US and DS

Number	=	2.0	EA

Length	=	30.0	FT		Assume riprap will extend 30' from structure		
Width	=	167.5	FT		Assume canal width plus excavation width		
Depth	=	3.0	FT		Average depth		
Volume	=	30,150.0	CF	=	1,116.7	CY	Riprap
Geotextile Filter Fabric	=	5,625.0	SF		Fabric		

NEW GATES

Assumptions borrowed from a similar design

Gate weight calculations

Height	=	16.0			Assume 2' taller than opening	
Width	=	25.0				
3/8" Plate steel	=	15.3	lb/sq ft		Given	
1/2" Plate steel	=	20.4	lb/sq ft		Given	
1" Plate Steel	=	40.8	lb/sq ft		Given	
Gate Skin 3/8" Plate Steel	=	400.0	sq ft		Same size as gate dimensions above	
3/8" Plate stiffeners and seal angles	=	87.0	sq ft		Assume 5 sq ft for seal angles and 82 for stiffeners	
Horizontal C-Channels (1/2")	=	541.7	sq ft		Assume ea. channel is equivalent to 26"x25' (10 Channels).	
Vertical C-Channels (1/2")	=	346.7	sq ft		Assume each vertical channel is 26"x16' (10 Channels).	
Pull Pad eyes (1")	=	4.0	sq ft		Assume 4 pad eyes per gate @ 1 sq ft each	
Total 3/8" Plus 10% for misc. items	=	535.7	sq ft	=	8,196.2	lbs
Total 1/2" plus 15% for misc items	=	1,021.6	sq ft	=	20,840.3	lbs
Total 1" steel	=	4.0	sq ft	=	163.2	lbs
lbs/sq ft for 28'x14' gate	=	73.0	lb/sq ft			
Area of single gate	=	400.0	sq ft		assumed 3 ft bigger then opening in each direction	
Approximate weight of gate	=	29,199.7	lb			
Overweight factor for larger gates (10%)	=	32,119.7	LB EA	=	96,359.0	LB Total
Total Steel Gate Weight				=	48.2	Tons

Gate embeds/seal lengths

Gate Dimensions						
Width	=	25.0	FT			
Height	=	16.0	FT			
Gate Well Height	=	42.0	FT			
Gate Well Embed	=	119.0	FT			
Total Embed Length	=	357.0	FT		3 gates	
Seal Length	=	57.0	FT		seal length is the perimeter of bottom and both sides	
Total Seal Length	=	171.0	FT		total of 3 gates	
US and DS Bulkhead Slot	=	438.0	FT		6 times vertical plus width of new gate per slot	
Bulkheads	=	32,119.7	LB EA		Assume same size as gates	
Number	=	6.0	EA		x2 per gate needed	
Total Length of imbeds	=	795.0	FT			
Total Weight of Stoplogs	=	192,718.1	LB	=	96.4	Tons
TOTAL J BULB for GATES AND STOP LOGS	=	567.0	FT			

Backfill

Assume structure/wingwalls are backfilled as part of levee constructi

Railings and Ladders

Railing				
Length	=	836.0	FT	Assumed 4 time the length of a wing wall and 6 times the width of the structure and twice the length
Height	=	3.5	FT	
Ladders				
Count	=	6.0	EA	Assumed ladders on each side of the structure
Height	=	17.5	FT	average of all three types
Total Height	=	105.0	FT	

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	170.0	FT/EA	Assumed
Total Length	=	340.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

Site Fencing

Length	=	1,000.0	FT	Approx. chainlink fence required ~600', assume 1,000'
Gates	=	4.0	EA	Assumed

SWPPP

Length	=	1,000.0	LF	Assumed
Floating Silt Boom	=	250.0	LF	Assumed

Control Building

Size	=	288.0	SF				12x24
Electrical	=	NEEDED					
Communications	=	NEEDED					
Modular Precast Concrete Structure							
Exterior Walls							
Height	=	12.0	FT				
Perimeter Length	=	72.0	FT				
Thickness	=	4.0	IN				
Volume	=	288.0		=	10.7	CY	
Interior Wall							
Height	=	12.0	FT				
Length	=	12.0	FT				
Thickness	=	4.0	IN				
Volume	=	48.0		=	1.8	CY	
Floor Slab							
Thickness	=	6.0	IN				
Area	=	288.0	SF				
Volume	=	144.0	CF	=	5.3	CY	
Roof							
Thickness	=	5.0	IN				
Area	=	288.0	SF				
Volume	=	120.0	CF	=	4.4	CY	
Fuel Pad	=	96.0	CF				Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6	CY				
CONCRETE		TOTAL		=	25.8	CY	

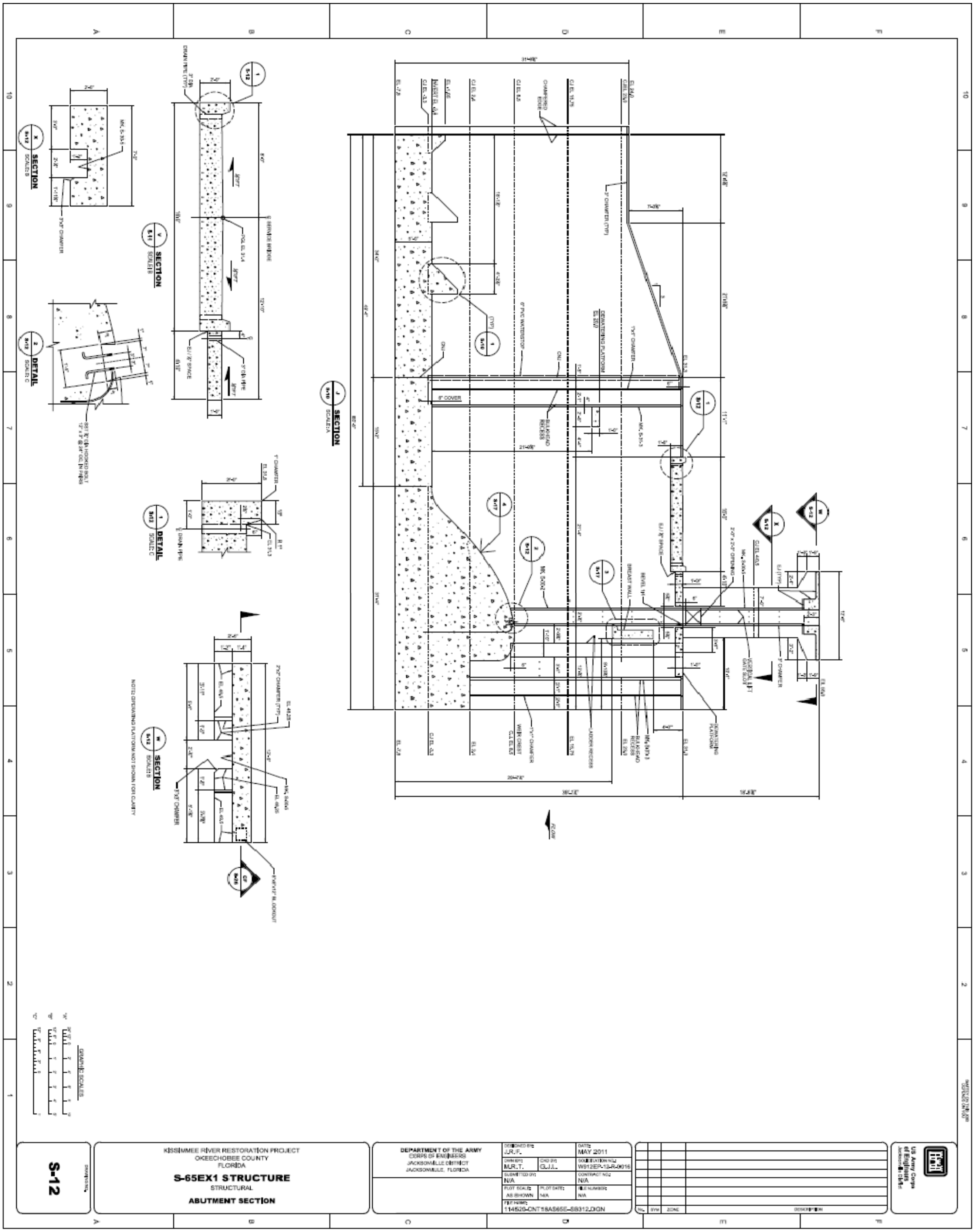
Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	665.0	LF	
Coffer dam:	27,450.0	SF	
Tremie Concrete:	0.0	CY	
Excavation:	14,875.0	CY	
Concrete:	1,712.8	CY	
Steel Rebar:	20.6	CY (?)	
Steel Rebar:	135.9	TONS	
Sheetpile:	9,580.0	SF	160' Wall length x 30' Long sheets
Cap:	29.6	CY	
Railing:	836.0	LF	
Ladders:	6.0	EA	
Gates:	3.0	EA	16'x25'
Total steel gate wt	48.2	Tons	
Stoplogs	6.0	EA	
Total stoplog wt	96.36	Tons	
Seals:	171.0	LF	
Backfill:	-	LCY	
Rip-rap:	1,116.7	CY	
Geofabric:	5,625.0	SF	
Boat Barrier:	340.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	250.0	LF	
Silt Fence:	1,000.0	LF	
Control bldg.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE S-3: TWO-WAY FLOW GATED SPILLWAY
Scope Given:	Gated spillway w/ (3) 25'Wx14'H Gates (Gate Opening Bottom Elev. -2.00) w/ 12'x24' Control Bldg. & HW/TW Monitoring Stations w/ Walkways (by-pass not required for construction). Allows for flow from the NNR Canal to the A-2 Reservoir to be controlled when Pump Station P-1 is pumping. Allows for outflow to NNR Canal from A-2 Reservoir Culvert C-1 to be controlled.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structure S-65EX. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume aprons are in addition to the concrete structure shown in the provided drawings. – Assume power for the structure will be provided from local power lines. – Assume that a diesel generator is needed for backup power. – Assume 35 KW Diesel Generator with 1000 gallon above ground tank.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation of materials to allow for construction of the foundation of the cross canal gate structure and the canal apron/wingwall. Concrete work for structure followed by apron and wingwalls. Backfill suitable material around the structure and import riprap. Construct control station, diesel generator, and fuel storage. Place gates and other associated closure devices for the gate structure.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: S-3



Feature of Work:	STRUCTURE SW-3: TWO-WAY FLOW GATED SPILLWAY

Quantity Take Off:

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	152.5	FT	Assume 20' from top of excavation
Length	=	180.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	665.0	LF	Sheetpile perimeter
Area	=	27,450.0	SF	

Spillway Excavation

Assume Spillway Excavation will be partially performed during canal excavation, if no canal exists

Length	=	140.0	FT	Add'l 40' assumed for wingwall installation each way						
Total Depth	=	25.5	FT	15' below crest elevation for crest, footer, and tremie						
Thickness of Organic	=	2.0	FT							
Thickness of Cap Rock	=	8.0	FT							
Thickness of Fort Thompson	=	15.5	FT							
Canal Slope		2.5	:1	From Typical Sections						
				Canal bottom: 55' wide, Canal top: 127.5' wide						
Bottom Width	=	112.5	FT	Assumes 20' past canal excavation (minus canal width)						
Top Width	=	112.5	FT	Assumes slope same as canal						
Cross Section	=	2,868.8	SF							
Cross Section Organic	=	225.0	SF							
Cross Section of Cap Rock	=	900.0	SF							
Cross Section of Fort Thompson	=	1,743.8	SF							
Organic Cut Volume	=	31,500.0	CF		=	1,166.7	BCY	=		LCY
Cap Rock Cut Volume	=	126,000.0	CF		=	4,666.7	BCY	=		LCY
Fort Thompson Cut Volume	=	244,125.0	CF		=	9,041.7	BCY	=		LCY
EXCAVATION		TOTAL			=	14,875.0	BCY	=	18,593.8	LCY

Structure Dimensions and Volumes

Units	=	-	EA	For use only if existing canal is located where structure is to be placed, tremie pour below area of structure, approx. 20 ft past structure dimensions, 5 ft thick			
Underwater Concrete Seal Volume	=	-	CF				
(Unreinforced concrete)							
Tremie Volume	=	-	CF	=	-	CY	Tremie Concrete

Structure	1	Length	60	ft	Width	86	ft
Gate Openings	3	Height	14	ft	Width	25	ft

Number of Gates	=	3.0	EA				
Superstructure/Gate Structure							
Number of Towers	=	4.0	EA				
Tower Cross-Section	=	145.0	SF	Taken From Side View (17.5' tall)			
Tower Width	=	3.0	FT				
Volume	=	1,740.0	CF	=	64.4	CY	
Number of Piers	=	2.0	EA				
Pier Cross-Section	=	126.0	SF	Taken from Plan View			
Pier Height	=	24.0	FT	Nearby Bank El = 15.0', Canal Depth = -8.0', +1'			
Volume	=	6,048.0	CF	=	224.0	CY	
Abutment Walls	=	2.0	EA				
Cross-Section of Abutment Wall	=	150.0	SF	Taken from Plan View			

Wall Height	=	24.0	FT			Nearby Bank El = 15.0', Canal Depth = -8.0', +1'	
Volume	=	7,200.0	CF	=	266.7	CY	
Beam Cross-Section	=	15.0	SF				
Beam Length	=	81.0	FT			Width minus abutment walls	
volume of elevated beam	=	1,215.0	CF	=	45.0	CY	
Cross-Section of Platform, Bridge, Brestwall	=	46.5	SF				
Width	=	81.0	FT				
Volume	=	3,766.5	CF	=	139.5	CY	
OGEE volume							
Cross section	=	143.9	SF			Borrowed from similar structure	
Width	=	81.0	FT				
OGEE Spillway volume	=	11,655.9	CF	=	431.7	CY	
Approach apron						Assume 12' long, 86' wide. 5' thick per S-65EX design	
Length	=	12.0	FT				
Thickness	=	5.0	FT				
Volume	=	5,160.0	CF	=	191.1	CY	
Stilling Basin						Assume 22' long, 86' wide. 5' thick per S-65EX design	
Length	=	22.0	FT				
Thickness	=	5.0	FT				
Volume	=	9,460.0	CF	=	350.4	CY	
CONCRETE	TOTAL			=	1,712.8	CY	Concrete
Steel Rebar						Assumed 1.2% volume of concrete	
STEEL REBAR	TOTAL			=	20.6	CY	Rebar
					135.9	TONS	

Wing Walls and Cutoff

Assume same for US and DS sides

Wingwalls							
Number	=	4.0	EA				
Length	=	50.0	FT			Length to reach past riprap banks	
Depth	=	35.0	FT			Past bottom of structure of slab	
Area of Sheet Pile	=	7,000.0	SF				
Pile Cap						x4	
Height	=	2.0	FT				
Width	=	2.0	FT				
Volume	=	800.0	CF	=	29.6	CY	Concrete
Cutoff Walls							
Number	=	2.0	EA			US & DS	
Depth	=	15.0	FT			Min. 10' required	
Width	=	86.0	FT				
Area of Sheet Pile	=	2,580.0	SF				
TOTAL SHEETPILE		9,580.0	SF			Steel Sheetpile Wall	
Anchor Rod Length	=	60.0	FT				
spacing	=	4.0	FT				
number of rods	=	96.0	EA				

RIP RAP

Lengths and depths assumed, and similar on US and DS

Number	=	2.0	EA

Length	=	30.0	FT		Assume riprap will extend 30' from structure		
Width	=	167.5	FT		Assume canal width plus excavation width		
Depth	=	3.0	FT		Average depth		
Volume	=	30,150.0	CF	=	1,116.7	CY	Riprap
Geotextile Filter Fabric	=	5,625.0	SF		Fabric		

NEW GATES

Assumptions borrowed from a similar design

Gate weight calculations

Height	=	16.0			Assume 2' taller than opening	
Width	=	25.0				
3/8" Plate steel	=	15.3	lb/sq ft		Given	
1/2" Plate steel	=	20.4	lb/sq ft		Given	
1" Plate Steel	=	40.8	lb/sq ft		Given	
Gate Skin 3/8" Plate Steel	=	400.0	sq ft		Same size as gate dimensions above	
3/8" Plate stiffeners and seal angles	=	87.0	sq ft		Assume 5 sq ft for seal angles and 82 for stiffeners	
Horizontal C-Channels (1/2")	=	541.7	sq ft		Assume ea. channel is equivalent to 26"x25' (10 Channels).	
Vertical C-Channels (1/2")	=	346.7	sq ft		Assume each vertical channel is 26"x16' (10 Channels).	
Pull Pad eyes (1")	=	4.0	sq ft		Assume 4 pad eyes per gate @ 1 sq ft each	
Total 3/8" Plus 10% for misc. items	=	535.7	sq ft	=	8,196.2	lbs
Total 1/2" plus 15% for misc items	=	1,021.6	sq ft	=	20,840.3	lbs
Total 1" steel	=	4.0	sq ft	=	163.2	lbs
lbs/sq ft for 28'x14' gate	=	73.0	lb/sq ft			
Area of single gate	=	400.0	sq ft		assumed 3 ft bigger then opening in each direction	
Approximate weight of gate	=	29,199.7	lb			
Overweight factor for larger gates (10%)	=	32,119.7	LB EA	=	96,359.0	LB Total
Total Steel Gate Weight				=	48.2	Tons

Gate embeds/seal lengths

Gate Dimensions				
Width	=	25.0	FT	
Height	=	16.0	FT	
Gate Well Height	=	42.0	FT	
Gate Well Embed	=	119.0	FT	
Total Embed Length	=	357.0	FT	3 gates
Seal Length	=	57.0	FT	seal length is the perimeter of bottom and both sides
Total Seal Length	=	171.0	FT	total of 3 gates
US and DS Bulkhead Slot	=	438.0	FT	6 times vertical plus width of new gate per slot
Bulkheads	=	32,119.7	LB EA	Assume same size as gates
Number	=	6.0	EA	x2 per gate needed
Total Length of imbeds	=	795.0	FT	
Total Weight of Stoplogs	=	192,718.1	LB	= 96.4 Tons
TOTAL J BULB for GATES AND STOP LOGS	=	567.0	FT	

Backfill

Assume structure/wingwalls are backfilled as part of levee constructi

Railings and Ladders

Railing						
Length	=	836.0	FT			Assumed 4 time the length of a wing wall and 6 times the width of the structure and twice the length
Height	=	3.5	FT			
Ladders						
Count	=	6.0	EA			Assumed ladders on each side of the structure
Height	=	17.5	FT			average of all three types
Total Height	=	105.0	FT			

Boat Barrier

Number	=	2.0	EA			
Piles for Buoys	=	3.0	EA			Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	170.0	FT/EA			Assumed
Total Length	=	340.0	FT			Buoy style barrier
Total Piles	=	6.0	EA			

Site Fencing

Length	=	1,000.0	FT			Approx. chainlink fence required ~600', assume 1,000'
Gates	=	4.0	EA			Assumed

SWPPP

Length	=	1,000.0	LF			Assumed
Floating Silt Boom	=	250.0	LF			Assumed

Control Building

Size	=	288.0	SF			12x24
Electrical	=	NEEDED				
Communications	=	NEEDED				
Modular Precast Concrete Structure						
Exterior Walls						
Height	=	12.0	FT			
Perimeter Length	=	72.0	FT			
Thickness	=	4.0	IN			
Volume	=	288.0		=	10.7	CY
Interior Wall						
Height	=	12.0	FT			
Length	=	12.0	FT			
Thickness	=	4.0	IN			
Volume	=	48.0		=	1.8	CY
Floor Slab						
Thickness	=	6.0	IN			
Area	=	288.0	SF			
Volume	=	144.0	CF	=	5.3	CY
Roof						
Thickness	=	5.0	IN			
Area	=	288.0	SF			
Volume	=	120.0	CF	=	4.4	CY
Fuel Pad	=	96.0	CF			Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6	CY			
CONCRETE		TOTAL		=	25.8	CY

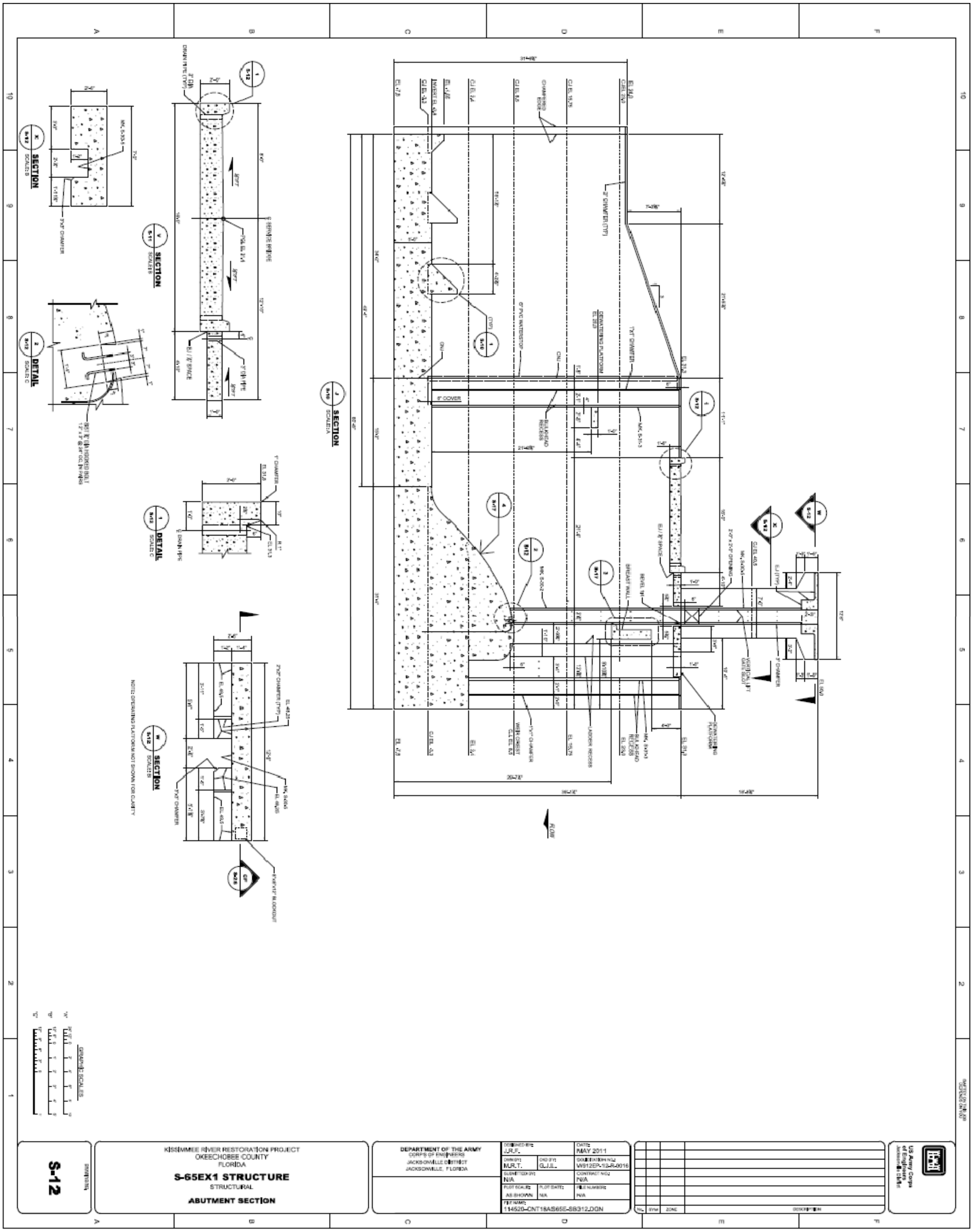
Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	665.0	LF	
Coffer dam:	27,450.0	SF	
Tremie Concrete:	0.0	CY	
Excavation:	14,875.0	CY	
Concrete:	1,712.8	CY	
Steel Rebar:	20.6	CY (?)	
Steel Rebar:	135.9	TONS	
Sheetpile:	9,580.0	SF	160' Wall length x 30' Long sheets
Cap:	29.6	CY	
Railing:	836.0	LF	
Ladders:	6.0	EA	
Gates:	3.0	EA	16'x25'
Total steel gate wt	48.2	Tons	
Stoplogs	6.0	EA	
Total stoplog wt	96.36	Tons	
Seals:	171.0	LF	
Backfill:	-	LCY	
Rip-rap:	1,116.7	CY	
Geofabric:	5,625.0	SF	
Boat Barrier:	340.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	250.0	LF	
Silt Fence:	1,000.0	LF	
Control bldg.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

Feature of Work:	STRUCTURE S-4: TWO-WAY FLOW GATED SPILLWAY
Scope Given:	Gated spillway w/ (3) 25'Wx16'H Gates (Gate Opening Bottom Elev. 0.50) w/ 12'x24' Control Bldg. & HW/TW Monitoring Stations w/ Walkways (by-pass not required for construction). Will function as a divide structure within the STA 3/4 Inflow Canal. Allows for the west reach of the STA 3/4 Inflow Canal to be hydraulically isolated from the east reach of the STA 3/4 Inflow Canal, which will allow for west reach of STA 3/4 Inflow Canal to be staged up when G-372 conveys water to the A-2 Reservoir via Culvert C-9 and/or to A-1 FEB via G-720, while simultaneously allowing for the east reach of STA 3/4 Inflow Canal to remain at a lower stage to facilitate outflow from the A-1 FEB to STA 3/4.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structure S-65EX. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume aprons are in addition to the concrete structure shown in the provided drawings. – Assume power for the structure will be provided from local power lines. – Assume that a diesel generator is needed for backup power. – Assume 35 KW Diesel Generator with 1000 gallon above ground tank.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Excavation of materials to allow for construction of the foundation of the cross canal gate structure and the canal apron/wingwall. Concrete work for structure followed by apron and wingwalls. Backfill suitable material around the structure and import riprap. Construct control station, diesel generator, and fuel storage. Place gates and other associated closure devices for the gate structure.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: S-4



Feature of Work:	STRUCTURE SW-4: TWO-WAY FLOW GATED SPILLWAY
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	152.5	FT	Assume 20' from top of excavation
Length	=	180.0	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	665.0	LF	Sheetpile perimeter
Area	=	27,450.0	SF	

Spillway Excavation

Assume Spillway Excavation will be partially performed during canal excavation, if no canal exists

Length	=	140.0	FT	Add'l 40' assumed for wingwall installation each way						
Total Depth	=	25.5	FT	15' below crest elevation for crest, footer, and tremie						
Thickness of Organic	=	2.0	FT							
Thickness of Cap Rock	=	8.0	FT							
Thickness of Fort Thompson	=	15.5	FT							
Canal Slope		2.5	:1	From Typical Sections						
				Canal bottom: 55' wide, Canal top: 127.5' wide						
Bottom Width	=	112.5	FT	Assumes 20' past canal excavation (minus canal width)						
Top Width	=	112.5	FT	Assumes slope same as canal						
Cross Section	=	2,868.8	SF							
Cross Section Organic	=	225.0	SF							
Cross Section of Cap Rock	=	900.0	SF							
Cross Section of Fort Thompson	=	1,743.8	SF							
Organic Cut Volume	=	31,500.0	CF		=	1,166.7	BCY	=		LCY
Cap Rock Cut Volume	=	126,000.0	CF		=	4,666.7	BCY	=		LCY
Fort Thompson Cut Volume	=	244,125.0	CF		=	9,041.7	BCY	=		LCY
EXCAVATION		TOTAL			=	14,875.0	BCY	=	18,593.8	LCY

Structure Dimensions and Volumes

Units	=	1.0	EA	For use only if existing canal is located where structure is to be placed, tremie pour below area of structure, approx. 20 ft past structure dimensions, 5 ft thick			
Underwater Concrete Seal Volume	=	63,000.0	CF				
(Unreinforced concrete)							
Tremie Volume	=	63,000.0	CF	=	2,333.3	CY	Tremie Concrete

Structure	1	Length	60	ft	Width	86	ft
Gate Openings	3	Height	16	ft	Width	25	ft

Number of Gates	=	3.0	EA				
Superstructure/Gate Structure							
Number of Towers	=	4.0	EA				
Tower Cross-Section	=	160.0	SF	Taken From Side View (19.5' tall)			
Tower Width	=	3.0	FT				
Volume	=	1,920.0	CF		=	71.1	CY
Number of Piers	=	2.0	EA				
Pier Cross-Section	=	126.0	SF	Taken from Plan View			
Pier Height	=	26.0	FT	Nearby Bank El = 15.0', Canal Depth = -8.0', +1'			
Volume	=	6,552.0	CF		=	242.7	CY
Abutment Walls	=	2.0	EA				
Cross-Section of Abutment Wall	=	150.0	SF	Taken from Plan View			

Wall Height	=	26.0	FT				Nearby Bank El = 15.0', Canal Depth = -8.0', +1'
Volume	=	7,800.0	CF	=	288.9	CY	
Beam Cross-Section	=	15.0	SF				
Beam Length	=	81.0	FT				Width minus abutment walls
volume of elevated beam	=	1,215.0	CF	=	45.0	CY	
Cross-Section of Platform, Bridge, Brestwall	=	46.5	SF				
Width	=	81.0	FT				
Volume	=	3,766.5	CF	=	139.5	CY	
OGEE volume							
Cross section	=	143.9	SF				Borrowed from similar structure
Width	=	81.0	FT				2.5 ft thick walls
OGEE Spillway volume	=	11,655.9	CF	=	431.7	CY	
Approach apron							Assume 12' long, 86' wide. 5' thick per S-65EX design
Length	=	12.0	FT				
Thickness	=	5.0	FT				
Volume	=	5,160.0	CF	=	191.1	CY	
Stilling Basin							Assume 22' long, 86' wide. 5' thick per S-65EX design
Length	=	22.0	FT				
Thickness	=	5.0	FT				
Volume	=	9,460.0	CF	=	350.4	CY	
CONCRETE	TOTAL			=	1,760.3	CY	Concrete
Steel Rebar							Assumed 1.2% volume of concrete
STEEL REBAR	TOTAL			=	21.1	CY	Rebar
					139.6	TONS	

Wing Walls and Cutoff

Assume same for US and DS sides

Wingwalls							
Number	=	4.0	EA				
Length	=	50.0	FT				Length to reach past riprap banks
Depth	=	37.0	FT				Past bottom of structure of slab
Area of Sheet Pile	=	7,400.0	SF				
Pile Cap					x4		
Height	=	2.0	FT				
Width	=	2.0	FT				
Volume	=	800.0	CF	=	29.6	CY	Concrete
Cutoff Walls							
Number	=	2.0	EA				US & DS
Depth	=	15.0	FT				Min. 10' required
Width	=	86.0	FT				
Area of Sheet Pile	=	2,580.0	SF				
TOTAL SHEETPILE		9,980.0	SF				Steel Sheetpile Wall
Anchor Rod Length	=	60.0	FT				
spacing	=	4.0	FT				
number of rods	=	96.0	EA				

RIP RAP

Lengths and depths assumed, and similar on US and DS

Number	=	2.0	EA

Length	=	30.0	FT		Assume riprap will extend 30' from structure	
Width	=	167.5	FT		Assume canal width plus excavation width	
Depth	=	3.0	FT		Average depth	
Volume	=	30,150.0	CF	=	1,116.7 CY	Riprap
Geotextile Filter Fabric	=	5,625.0	SF		Fabric	

NEW GATES

Assumptions borrowed from a similar design

Gate weight calculations

Height	=	18.0			Assume 2' taller than opening	
Width	=	25.0				
3/8" Plate steel	=	15.3	lb/sq ft		Given	
1/2" Plate steel	=	20.4	lb/sq ft		Given	
1" Plate Steel	=	40.8	lb/sq ft		Given	
Gate Skin 3/8" Plate Steel	=	450.0	sq ft		Same size as gate dimensions above	
3/8" Plate stiffeners and seal angles	=	87.0	sq ft		Assume 5 sq ft for seal angles and 82 for stiffeners	
Horizontal C-Channels (1/2")	=	541.7	sq ft		Assume ea. channel is equivalent to 26"x25' (10 Channels).	
Vertical C-Channels (1/2")	=	346.7	sq ft		Assume each vertical channel is 26"x16' (10 Channels).	
Pull Pad eyes (1")	=	4.0	sq ft		Assume 4 pad eyes per gate @ 1 sq ft each	
Total 3/8" Plus 10% for misc. items	=	590.7	sq ft	=	9,037.7	lbs
Total 1/2" plus 15% for misc items	=	1,021.6	sq ft	=	20,840.3	lbs
Total 1" steel	=	4.0	sq ft	=	163.2	lbs
lbs/sq ft for 28'x14' gate	=	66.8	lb/sq ft			
Area of single gate	=	450.0	sq ft		assumed 3 ft bigger then opening in each direction	
Approximate weight of gate	=	30,041.2	lb			
Overweight factor for larger gates (10%)	=	33,045.3	LB EA	=	99,136.0	LB Total
Total Steel Gate Weight				=	49.6	Tons

Gate embeds/seal lengths

Gate Dimensions				
Width	=	25.0	FT	
Height	=	18.0	FT	
Gate Well Height	=	42.0	FT	
Gate Well Embed	=	119.0	FT	
Total Embed Length	=	357.0	FT	3 gates
Seal Length	=	61.0	FT	seal length is the perimeter of bottom and both sides
Total Seal Length	=	183.0	FT	total of 3 gates
US and DS Bulkhead Slot	=	462.0	FT	6 times vertical plus width of new gate per slot
Bulkheads	=	33,045.3	LB EA	Assume same size as gates
Number	=	6.0	EA	x2 per gate needed
Total Length of imbeds	=	819.0	FT	
Total Weight of Stoplogs	=	198,272.0	LB	= 99.1 Tons
TOTAL J BULB for GATES AND STOP LOGS	=	567.0	FT	

Backfill

Assume structure/wingwalls are backfilled as part of levee constructi

Railings and Ladders

Railing						
Length	=	836.0	FT			Assumed 4 time the length of a wing wall and 6 times the width of the structure and twice the length
Height	=	3.5	FT			
Ladders						
Count	=	6.0	EA			Assumed ladders on each side of the structure
Height	=	17.5	FT			average of all three types
Total Height	=	105.0	FT			

Boat Barrier

Number	=	2.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	170.0	FT/EA	Assumed
Total Length	=	340.0	FT	Buoy style barrier
Total Piles	=	6.0	EA	

Site Fencing

Length	=	1,000.0	FT	Approx. chainlink fence required ~600', assume 1,000'
Gates	=	4.0	EA	Assumed

SWPPP

Length	=	1,000.0	LF	Assumed
Floating Silt Boom	=	250.0	LF	Assumed

Control Building

Size	=	288.0	SF				12x24
Electrical	=	NEEDED					
Communications	=	NEEDED					
Modular Precast Concrete Structure							
Exterior Walls							
Height	=	12.0	FT				
Perimeter Length	=	72.0	FT				
Thickness	=	4.0	IN				
Volume	=	288.0		=	10.7	CY	
Interior Wall							
Height	=	12.0	FT				
Length	=	12.0	FT				
Thickness	=	4.0	IN				
Volume	=	48.0		=	1.8	CY	
Floor Slab							
Thickness	=	6.0	IN				
Area	=	288.0	SF				
Volume	=	144.0	CF	=	5.3	CY	
Roof							
Thickness	=	5.0	IN				
Area	=	288.0	SF				
Volume	=	120.0	CF	=	4.4	CY	
Fuel Pad	=	96.0	CF				Assume 8'x12'x12" thick reinforced concrete slab on grade pad
	=	3.6	CY				
CONCRETE		TOTAL		=	25.8	CY	

Total Doors	=	2.0	EA	
Size	=	4'-0" x 7'-0"		
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
26" x 26" Exhaust Hoods	=	1.0	EA	
30" x 30" Exhaust Hoods	=	1.0	EA	
30" x 30"Intake Hoods	=	2.0	EA	
18" x 18" Intake Air Hood	=	1.0	EA	
18" x 18" Exhaust Hood	=	1.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP
Generator Fuel Tank	=	1,000.0	GALLON	
Gravel Pad	=	216.0	CF	Assume 50% greater area than building, 6" thick
	=	8.0	CY	
Filter Fabric		472.0	SF	

Quantities Summary

Coffer dam:	665.0	LF	
Coffer dam:	27,450.0	SF	
Tremie Concrete:	2,333.3	CY	
Excavation:	14,875.0	CY	
Concrete:	1,760.3	CY	
Steel Rebar:	21.1	CY (?)	
Steel Rebar:	139.6	TONS	
Sheetpile:	9,980.0	SF	160' Wall length x 30' Long sheets
Cap:	29.6	CY	
Railing:	836.0	LF	
Ladders:	6.0	EA	
Gates:	3.0	EA	18'x25'
Total steel gate wt	49.6	Tons	
Stoplogs	6.0	EA	
Total stoplog wt	99.14	Tons	
Seals:	183.0	LF	
Backfill:	-	LCY	
Rip-rap:	1,116.7	CY	
Geofabric:	5,625.0	SF	
Boat Barrier:	340.0	LF	
Barrier Piles:	6.0	EA	
Floating Curtain:	250.0	LF	
Silt Fence:	1,000.0	LF	
Control bldg.:	25.8	CY	Concrete
Total Doors	2.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Fire Extinguishers	2.0	EA	
26" x 26" Exhaust Hoods	1.0	EA	
30" x 30" Exhaust Hoods	1.0	EA	
30" x 30"Intake Hoods	2.0	EA	
18" x 18" Intake Air Hood	1.0	EA	
18" x 18" Exhaust Hood	1.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	
CTRL BLDG Gravel Pad	8.0	CY	
CTRL BLDG Pad Fabric	472.0	SF	

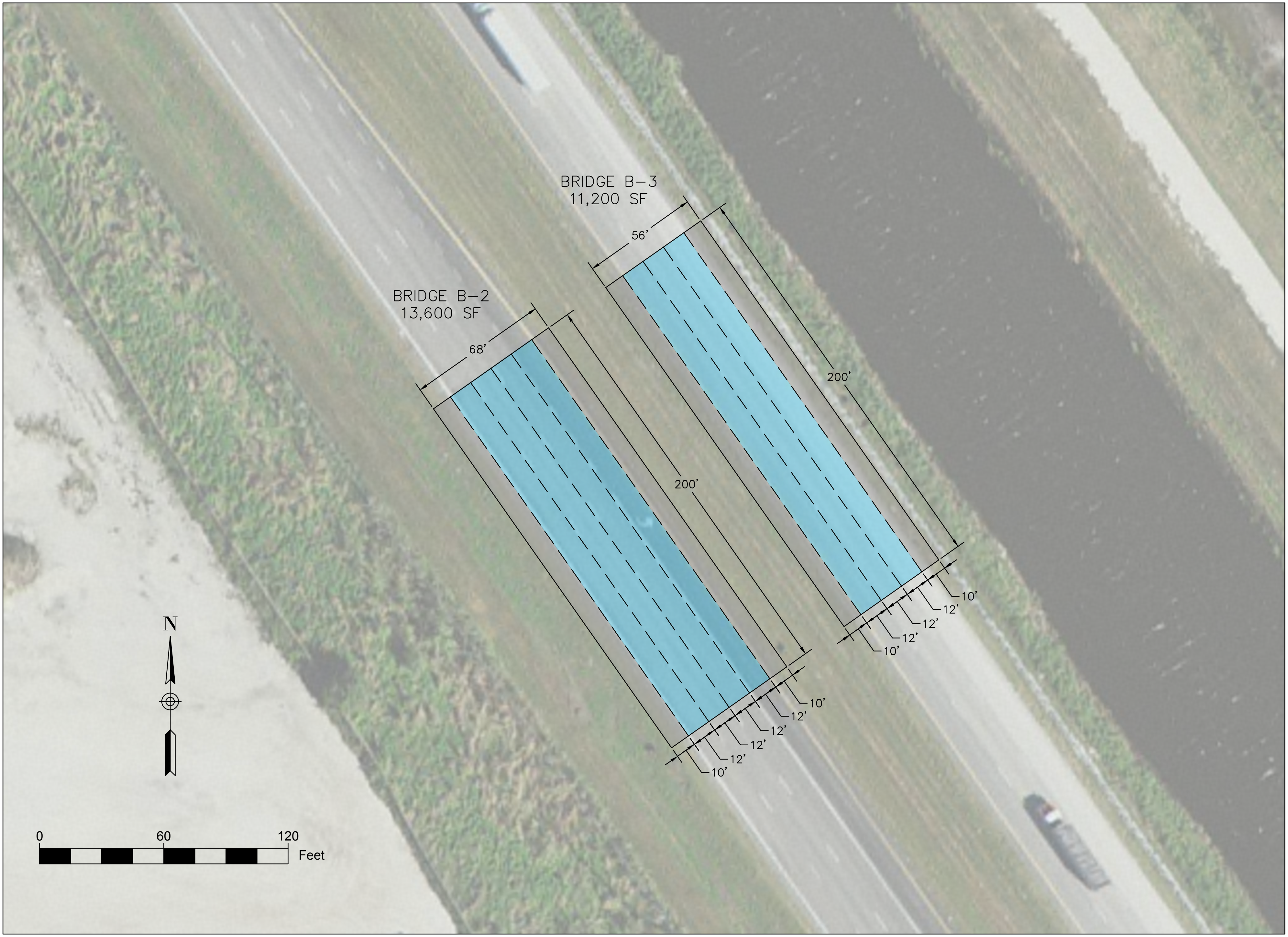
Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Contract 7: Bridges – U.S. 27 Bridges and L-23 Bridge (B-1, B-2, and B-3)

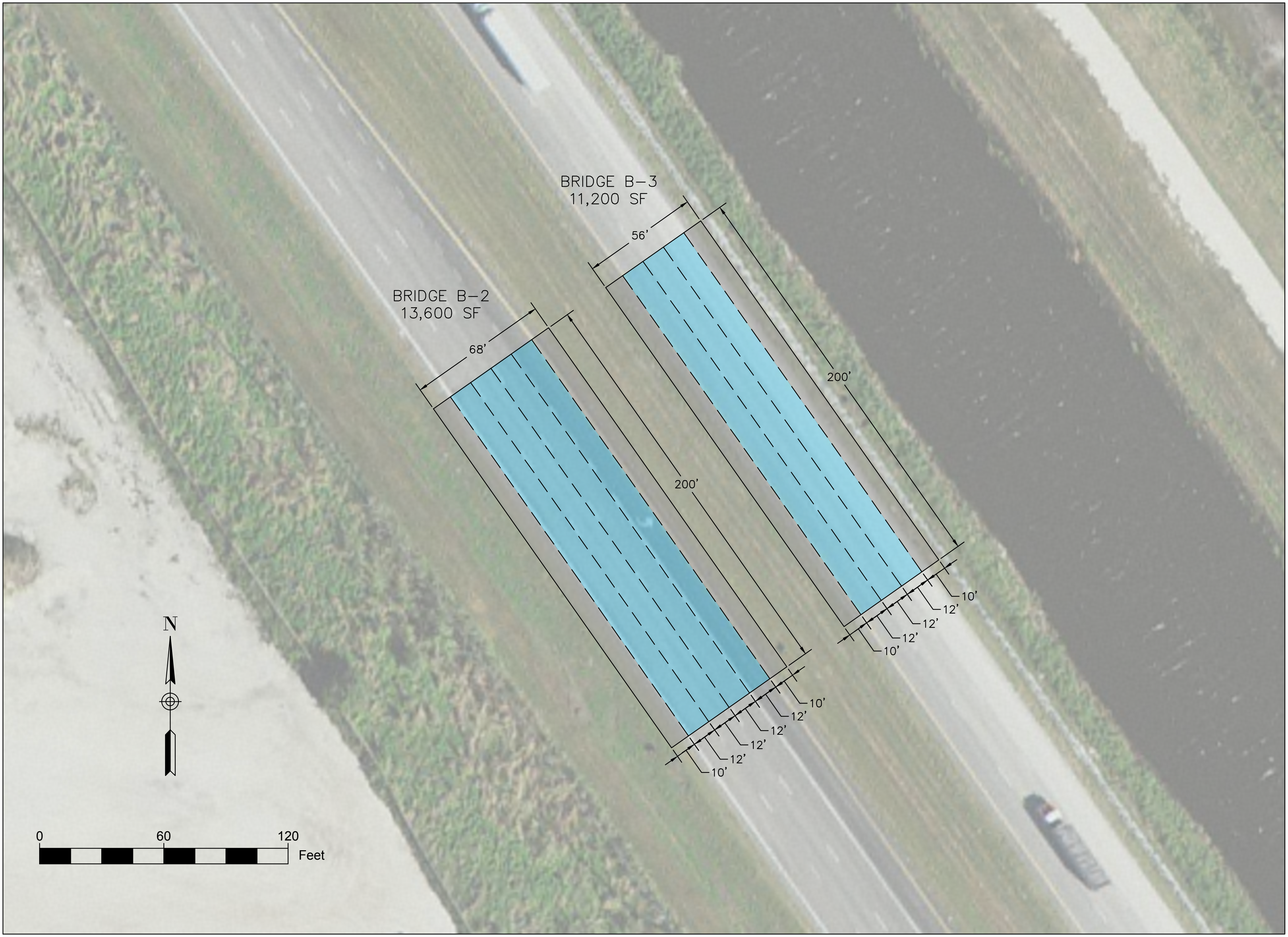
Feature of Work:	BRIDGE B-1 (2-LANE BRIDGE, APPROX. 200 FT SPAN)
Scope Given:	Bridge B-1 is a 2-lane bridge designed per AASHTO/FDOT Standards for HS25 loading for crossing over new pump station inflow canal. Located across Section E, East of Miami (L-23) Canal.
Reference for Scope Basis:	
Scope Assumptions:	Design assumptions follow a costing model provided by FDOT that estimates bridge pricing based on the square footage of the bridge. Travel lanes are 12' wide, shoulders at each side are 10' wide.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	
Key Outstanding Questions/Issues:	


44'
200'
BRIDGE B-1
8,800 SF
10'
12'
12'
10'
N
0
60
120
Feet

Feature of Work:	BRIDGE B-2 (2-LANE BRIDGE, APPROX. 200 FT SPAN)
Scope Given:	Bridge B-2 is a 2-Lane highway bridge designed per AASHTO/FDOT Standards for HS25 loading for crossing over new pump station inflow canal. Located across Section H, West of North New River (L-18) Canal.
Reference for Scope Basis:	
Scope Assumptions:	Design assumptions follow a costing model provided by FDOT that estimates bridge pricing based on the square footage of the bridge. Bridge B-2, based on its location and the existing configuration of the road, would require 4 lanes. Travel lanes are 12' wide, shoulders at each side are 10' wide.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	
Key Outstanding Questions/Issues:	


BRIDGE B-3
11,200 SF
56'
200'
10'
12'
12'
12'
10'
BRIDGE B-2
13,600 SF
68'
200'
10'
12'
12'
12'
12'
10'
N
0
60
120
Feet

Feature of Work:	BRIDGE B-3 (2-LANE BRIDGE, APPROX. 200 FT SPAN)
Scope Given:	Bridge B-2 is a 2-Lane highway bridge designed per AASHTO/FDOT Standards for HS25 loading for crossing over new pump station inflow canal. Located across Section H, West of North New River (L-18) Canal.
Reference for Scope Basis:	
Scope Assumptions:	Design assumptions follow a costing model provided by FDOT that estimates bridge pricing based on the square footage of the bridge. Bridge B-3, based on its location and the existing configuration of the road, would require 3 lanes. Travel lanes are 12’ wide, shoulders at each side are 10’ wide.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	
Key Outstanding Questions/Issues:	



BRIDGE B-3
11,200 SF
56'
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10'
BRIDGE B-2
13,600 SF
68'
200'
10'
12'
12'
12'
12'
10'
N
0
60
120
Feet

Bridge Quotes

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

U.S. Highway 27 Bridges

CONTRACTOR anzac

Bridge Costs

A highway bridge is defined as any span of 20 feet or more in length. Not all bridges go over bodies of water. Overpasses and ramps that are part of highway interchanges are bridges too. A large proportion of the statewide highway construction budget, usually in excess of 20%, is devoted to bridge construction. Typically, the FDOT completes between 100 and 200 bridges each year. As a rule of thumb, bridges from 20 to 45 feet in length are short span bridges. Bridges from 45 to 150 feet are medium span bridges, and those extending over 150 feet are long span bridges.

In recent years, the overall trend has been an increase in bridge construction costs. However, a few categories of costs have decreased. These estimates, based on FDOT experience, are only provided for use in preliminary planning, and should not be used as a substitute for detailed engineering estimates.

New Construction

(Cost per Square Foot)

Bridge Type	Low	High
Short Span Bridges:		
Reinforced Concrete Flat Slab Simple Span*	$115	$160
Pre-cast Concrete Slab Simple Span*	$110	$200
Reinforced Concrete Flat Slab Continuous Span*	NA	NA
Medium and Long Span Bridges:		
Concrete Deck/ Steel Girder - Simple Span*	$125	$142
Concrete Deck/ Steel Girder - Continuous Span*	$135	$170
Concrete Deck/ Pre-stressed Girder - Simple Span	$90	$145
Concrete Deck/ Pre-stressed Girder - Continuous Span	$95	$211
Concrete Deck/ Steel Box Girder – Span Range from 150' to 280' (for curvature, add a 15% premium)	$140	$180
Segmental Concrete Box Girders - Cantilever Construction, Span Range from 150' to 280'	$140	$160
Movable Bridge - Bascule Spans and Piers	$1,800	$2,000
* Increase the cost by twenty percent for phased construction.		

Bridge Demolition and Widening

(Cost per Square Foot)

Bridge Demolition:	**Low**	**High**
Typical Bridge Removal	$35	$60
Movable Span Bridge (Bascule)	$60	$70
Widening:		
Bridge Widening Construction	$85	$160

FOR FURTHER INFORMATION:

Structures Design Guidelines, FDOT Structures Manual, Volume 1, January 2014
http://www.dot.state.fl.us/structures/StructuresManual/CurrentRelease/Vol1SDG.pdf

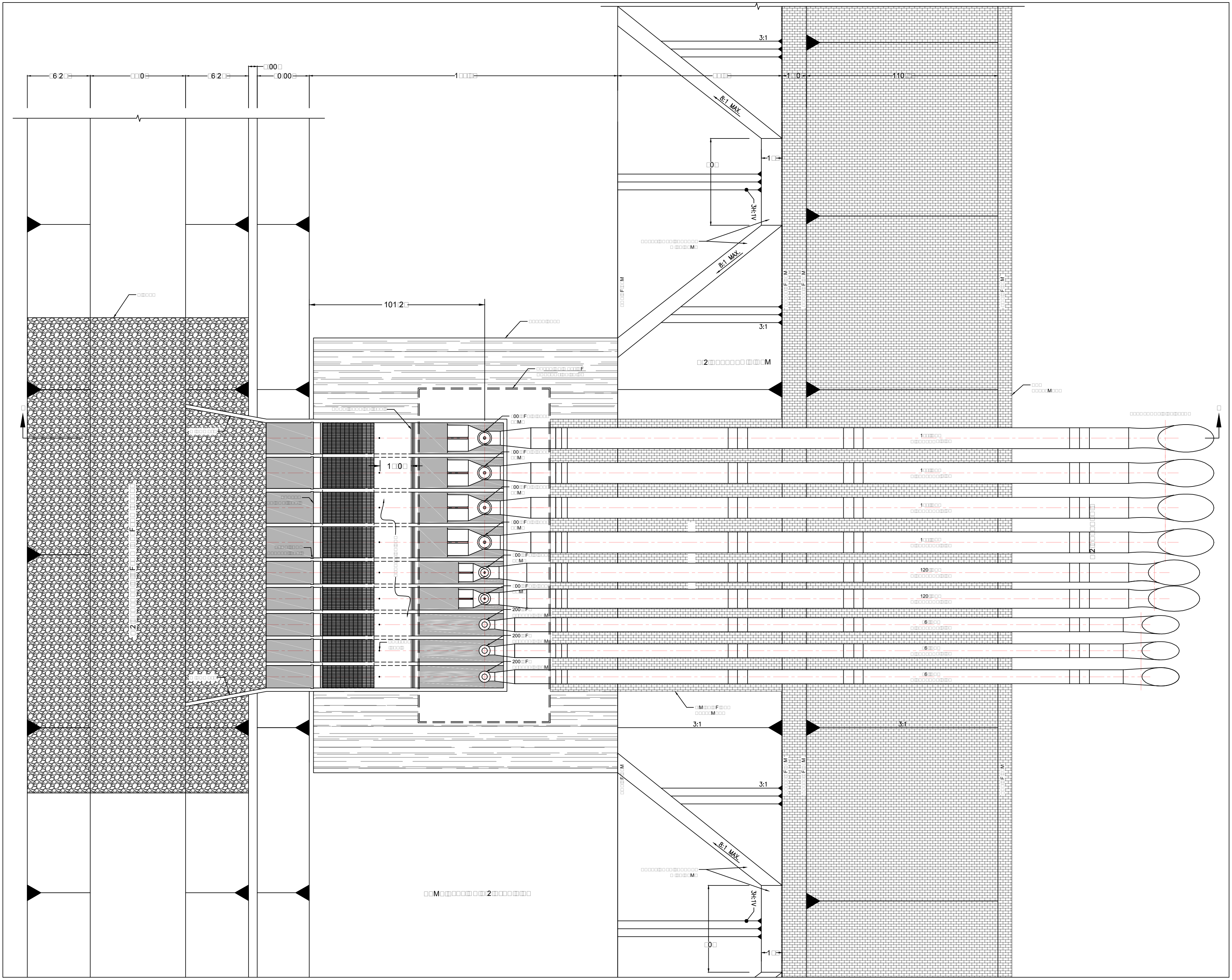
CONTACT:

Martin Markovich, Office of Policy Planning (850) 414-4918, martin.markovich@dot.state.fl.us

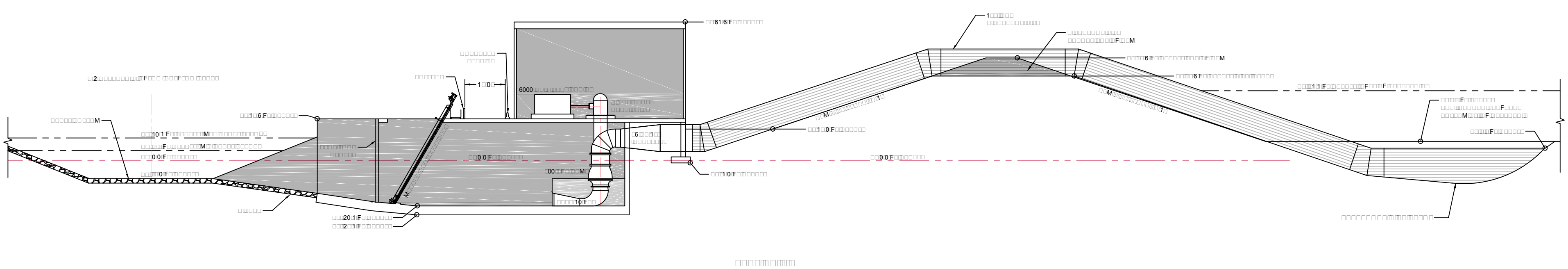
Cost Estimate Scope Assumptions, Representative Drawings, and Quantity Takeoffs

Contract 8: A-2 Reservoir Pump Stations

Feature of Work:	STRUCTURE P-1: 4,600 CFS DIESEL PUMP STATION
Scope Given:	4,500 CFS diesel pump station (by-pass not required for construction). Pump Station P-1 will pump water from the A-2 Reservoir Inflow-Outflow Canal to the A-2 Reservoir.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structure Pump Station 357. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume there will be a total of five 900 cfs pumps. – Assume discharge of pumps will be piped by 60'' diameter pipes into the A-2 Reservoir. – Assume the discharge structure will consist of a concrete headwall full height of the canal 30 ft wide 18 inch thick reinforced concrete, 20'x30' apron 18 inch thick reinforced concrete, wing walls extending 30ft up and downstream of the discharge point sloping from full height of the canal to bottom of canal 18 inch thick reinforced concrete and riprap lining 136 ft beyond the concrete apron. – Assume the excavation will extend 3 feet below the inflow canal bottom elevation. – Assume pump station will be constructed of reinforced concrete below grade and a combination of cast-in-place columns and reinforced CMU walls. – Assume a fuel pad will be required for storage tanks for the diesel pump and the diesel generator, assumed 2 feet thick reinforced concrete.
Supporting Documentation: (by Cost Team)	Quantity Takeoff, Material Quotes
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Cap slab will be placed in bottom of excavation. Structure will be built and excavation for the inlet basin will commence. Suction apron will be placed along with excavation for discharge piping and discharge headwall/discharge apron. Excavate out discharge piping and backfill levee.
Key Challenges, Risks, and Opportunities	



3:1
8:1 MAX.



Feature of Work:	STRUCTURE P-1: 4,600 CFS DIESEL PUMP STATION
Quantity Take Off:	

User Input | Row Calculation | Sum of Values above

Sheetpile Dewatering

Dewatering Pumps	=	TBD	EA	Size to be determined
Width	=	347.4	FT	Assume 20' from top of excavation
Length	=	225.2	FT	Assume 20' from length of excavation
Depth	=	40.0	FT	Assumed
Total Perimeter	=	1,145.2	LF	Sheetpile perimeter
Area	=	78,241.4	SF	

Pump Station Excavation

Length	=	185.2	FT	Measured from CAD					
Total Depth	=	32.6	FT						
Thickness of Organic	=	2.0	FT						
Thickness of Cap Rock	=	8.0	FT						
Thickness of Fort Thompson	=	22.6	FT						
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	177.0	FT	Assumes excavation extends 10ft out from structure					
Top Width	=	307.4	FT						
Cross Section	=	7,895.7	SF						
Cross Section Organic	=	606.8	SF						
Cross Section of Cap Rock	=	2,267.2	SF						
Cross Section of Fort Thompson	=	5,021.7	SF						
Organic Cut Volume	=	112,391.5	CF	=	4,162.6	BCY	=		LCY
Cap Rock Cut Volume	=	419,930.8	CF	=	15,553.0	BCY	=		LCY
Fort Thompson Cut Volume	=	930,123.0	CF	=	34,449.0	BCY	=		LCY
EXCAVATION		TOTAL		=	54,164.6	BCY		67,705.8	LCY

Structure Dimensions and Volumes

Structure	1	Length	60	ft	Width	157	ft
Intake Bays	9	Height	43	ft			

Foundation							
Depth	=	4.0	FT				Taken from Plans
Length	=	140.0	FT				Taken from Plans
Width	=	157.0	FT				
Volume	=	87,920.0	CF	=	3,256.3	CY	
Superstructure							
Number of Piers	=	8.0	EA				
Pier Width	=	2.0	FT				Taken from Plan View
Pier Length	=	136.8	FT				
Pier Height	=	39.0	FT				Structure Height below Control Building
Volume	=	85,363.2	CF	=	3,161.6	CY	
Abutment Walls	=	2.0	EA				
Abutment Width	=	2.0	FT				Taken from Plan View
Abutment Length	=	136.8	FT				
Abutment Height	=	39.0	FT				Structure Height below Control Building
Discharge Wall	=	1.0	EA				
Discharge Wall Width	=	2.0	FT				
Discharge Wall Length	=	157.0	FT				

Discharge Wall Height	=	39.0	FT			
Volume	=	33,586.8	CF	=	1,244.0	CY
Beam Cross-Section	=	6.0	SF		Taken from Plans	
Beam Length	=	137.0	FT			
volume of elevated beam	=	822.0	CF	=	30.4	CY
Cross-Section of Bridge and Ctrl Bldg Slab	=	162.0	SF			
Width	=	153.0	FT			
Volume	=	24,786.0	CF	=	918.0	CY
Wing Walls						
Number	=	2.0	EA			
Depth	=	12.5	FT		Average depth	
Length	=	47.2	FT		Taken from Plans	
Width	=	2.0	FT		Taken from Plan View	
Volume	=	2,360.0	CF	=	87.4	
Control Building						
Building Cross-Section	=	308.5	SF		Taken from Plans	
Building Length	=	193.0	FT		Taken from Plans	
Outside Wall Width	=	76.0	FT		Taken from Plans	
Outside Wall Thickness	=	1.0	FT		Taken from Plans	
Outside Wall Height	=	40.0	FT		Taken from Plans	
Volume	=	62,580.5	CF	=	2,317.8	
CONCRETE	TOTAL			=	11,015.5	CY Concrete
Steel Rebar					Assumed 1.2% volume of concrete	
STEEL REBAR	TOTAL			=	132.2	CY Rebar
					873.7	TONS

Discharge Piping

12' Dia. Pipes	=	4.0	EA	
10' Dia. Pipes	=	2.0	EA	
8' Dia. Pipes	=	3.0	EA	
Length of Pipes	=	408.0	LF	Assume all pipes equal length to discharge
Total 12' Dia. Pipes	=	1,632.0	LF	All piping 0.75" thick steel with x4 45 degree bends per pipe run
Total 10' Dia. Pipes	=	816.0	LF	
Total 8' Dia. Pipes	=	1,224.0	LF	
Total 12' Dia. Pipes 45 degree bends	=	16.0	EA	x4 per pipe for going over levee
Total 10' Dia. Pipes 45 degree bends	=	8.0	EA	x4 per pipe for going over levee
Total 8' Dia. Pipes 45 degree bends	=	12.0	EA	x4 per pipe for going over levee

Pumps

800 CFS Pumps	=	4.0	EA	Per Design
400 CFS Pumps	=	2.0	EA	Per Design
200 CFS Pumps	=	3.0	EA	Per Design

RIP RAP

Lengths and depths assumed, and similar on US and DS

Number	=	1.0	EA			
Length	=	137.0	FT		Assume riprap will extend full canal per Plans	
Width	=	274.0	FT		Per Plans	
Depth	=	3.0	FT		Average depth	
Volume	=	112,614.0	CF	=	4,170.9	CY Riprap

Geotextile Filter Fabric	=	40,278.0	SF	Fabric

Boat Barrier

Number	=	1.0	EA	
Piles for Buoys	=	3.0	EA	Assume barrier has 3 points (2 at shore, 1 at canal)
Length	=	172.0	FT/EA	
Total Length	=	172.0	FT	Buoy style barrier
Total Piles	=	3.0	EA	

Station and Building Equipment

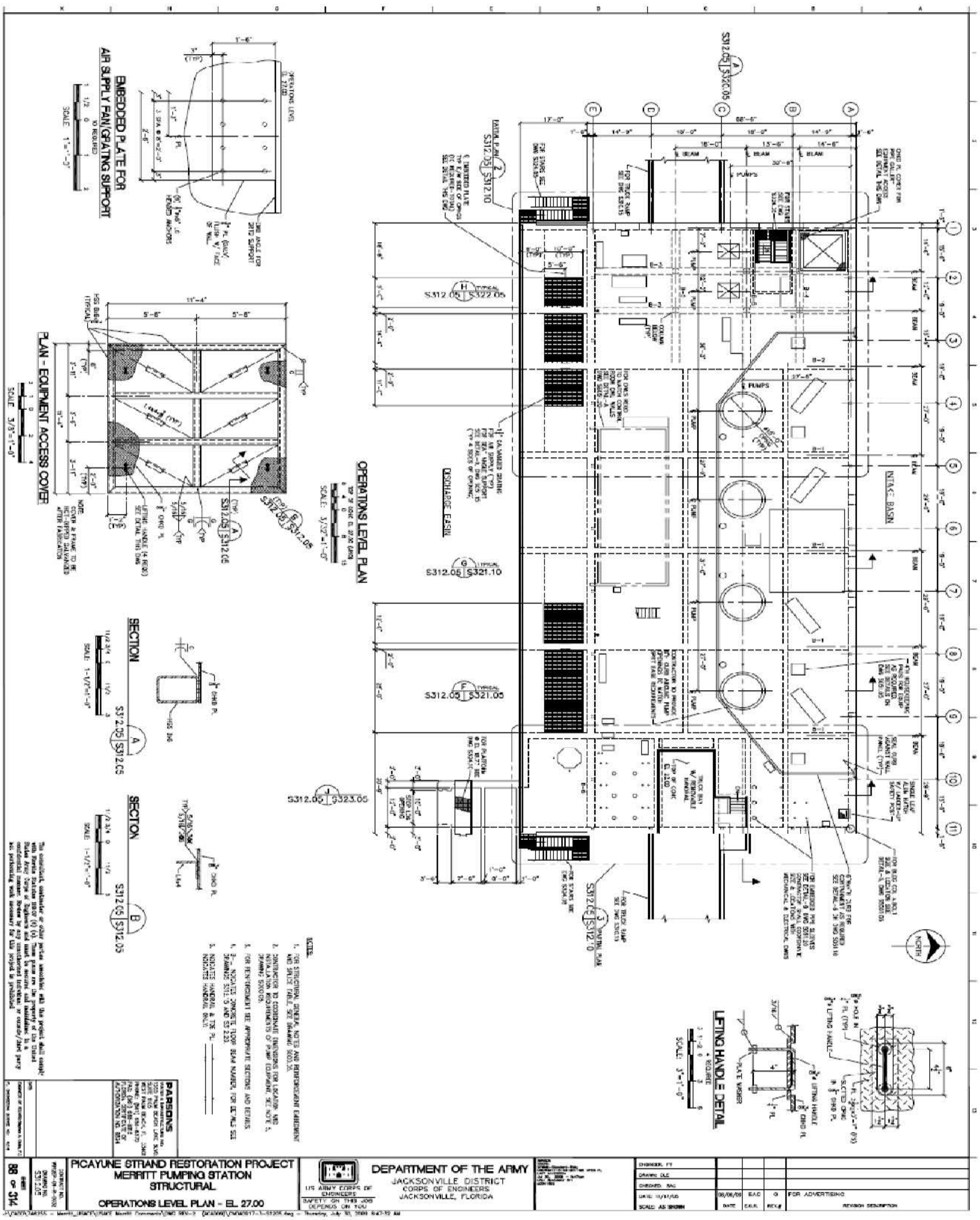
Trash Rack Surface Area (total)	=	9,180.0	SF	Assume Trash rake is 60 ft tall and covers the width of the operating floor (153')
Roll Up Garage Door	=	168.0	SF	Assume Roll up garage door 12'x14'
# of Doors	=	4.0	ea	Assume 1 set of double doors and two other doors
# louver openings	=	8.0	ea	Assume 8 louver openings 7'-4" square
Overhead Crane	=	2.0	ea	Assume 2 overhead cranes @ 25 tons each
Power Line Connection	=	2,500.0	LF	Assume power available 2500 lf from site
Septic tank system	=	1.0	ea	Assume 1 septic tank system
Potable water	=	1.0	ea	Assume 1 potable water well will be required
Generator Fuel Tank	=	2000 Gallon	ea	Assume five 2000 gallon fuel tanks required
Fuel Pad dimensions	=	2,000.0	SF	Assume two 100'x20'x8" thick reinforced concrete slab on grade pad
		1,333.3	CF	= 49.4 CY
Floor Steel Grating	=	548.0	SF	Assume Wdith Bay (13'x5+18'x4) by 4'
Ladders	=	342.0	VLF	Assume 38 ft per pump bay (9 bays) of the operating floor
Concrete bollard	=	14.7	CF	8" DIA. Bollard, 56" tall, x1 per bay
Concrete barrier	=	419.6	CF	FDOT Inex 415, N.J. Shape Barrier
	SUM	434.3	CF	= 16.1 CY
CONCRETE		TOTAL		= 65.5 CY Concrete
Chain link Fence	=	2,280.0	LF	Assume Similar to Merritt Pump Station
Silt Fence	=	3,700.0	LF	Assume similar to Merritt Pump Station
Silt Boom	=	600.0	LF	Assume similar to Merritt Pump Station
Conduit Boxes	=	1.0	EA/DOOR	
Lock Boxes	=	1.0	EA/DOOR	
Fire Extinguishers	=	2.0	EA	
20" Exhaust Fan	=	1.0	EA	Coolair CBA20L, 1 HP, 4702 CFM @ 3/8" SP
12" Exhaust Fan	=	1.0	EA	Coolair CDU12F17, 1/6 HP, 1210 CFM @ 1/4" SP

Quantities Summary

Coffer dam:	22.6	LF	
Coffer dam:	2.0	SF	
Excavation:	54,164.6	CY	
Concrete:	11,015.5	CY	
Steel Rebar:	132.2	CY (?)	
Steel Rebar:	873.7	TONS	
Backfill:	67,705.8	LCY	
12' Discharge Pipe	1,632.0	LF	0.75" thick
10' Discharge Pipe	816.0	LF	0.75" thick
8' Discharge Pipe	1,224.0	LF	0.75" thick
12' Steel 45-bend	16.0	EA	0.75" thick
10' Steel 45-bend	8.0	EA	0.75" thick
8' Steel 45-bend	12.0	EA	0.75" thick
800 CFS Pump	4.0	EA	
400 CFS Pump	2.0	EA	
200 CFS Pump	3.0	EA	
Rip-rap:	4,170.9	CY	
Geofabric:	40,278.0	SF	
Boat Barrier:	172.0	LF	
Barrier Piles:	3.0	EA	
Control bld.:	65.5	CY	Concrete
Trash Rack	9,180.0	SF	
Roll Up Garage Door:	168.0	SF	12' x 14'
Total Doors	4.0	EA	Size 4'-0" x 7'-0"
Conduit Boxes	1.0	EA/DOOR	
Lock Boxes	1.0	EA/DOOR	
Louver Openings	8.0	EA	
Overhead Crane	2.0	EA	
Power Line Connection	2,500.0	LF	Assume available 2500LF
Generator Fuel Tank	2,000.0	GALLONS	
Septic Tank System	1.0	EA	
Potable Water Well	1.0	EA	
Steel Grate	548.0	SF	
Ladders	9.0	EA	38' EA
Concrete:	65.5	CY	Fuel pad, bollards, barrier
Chainlink Fence	2,280.0	LF	
Silt Fence	3,700.0	LF	
Silt Boom	600.0	LF	
Fire Extinguishers	2.0	EA	
20" Exhaust Fan	1.0	EA	
12" Exhaust Fan	1.0	EA	

Feature of Work:	STRUCTURE G-200: 300 CFS PUMP STATION (DEMOLITION AND RE-CONSTRUCTION)
Scope Given:	Demo existing Pump Station G-200 and construct C-2 discharge channel (bottom elev. -14.50) between South end of structure C-2 and Miami Canal. Reconstruct G-200 South of C-2 discharge channel and connect G-200 intake to Miami Canal and connect G-200 discharge to Holey Land Distribution Canal.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to structure Pump Station 356. – Assume given dimensions in the engineering appendix govern over provided design documents for similar structure if no dimensions are given in the engineering appendix all dimensions will come from the similar structure. – Assume new pump station will be installed South of C-2 discharge channel with intake from Miami Canal and discharge to Holey Land Distribution Canal. – Assume there will be a total of three 100 cfs electric pumps. – Assume demolition of the existing pump station will occur before the new pump station is constructed. – Assume the discharge structure will consist of a concrete headwall full height of the canal 30 ft wide 18 inch thick reinforced concrete, 20'x30' apron 18 inch thick reinforced concrete, wing walls extending 30ft up and downstream of the discharge point sloping from full height of the canal to bottom of canal 18 inch thick reinforced concrete and riprap lining 136 ft beyond the concrete apron. – Assume the excavation will extend 3 feet below the canal bottom elevation. – Assume pump station will be constructed of reinforced concrete below grade and a Combination of cast-in-place columns and reinforced CMU walls. – Assume a fuel pad will be required for storage tanks for the diesel pump and the diesel generator. – Assume Power provided from local utilities. – Assume a temporary 200 CFS pump will be utilized to pass water around the feature in lieu of a bypass canal. – Assume intake will require driven piers and suction screen. – Assume pump will be set on a 12'x12' 1' thick concrete slab and the suction and discharge piping will be contained by piers driven into the canal and supported every 25 ft along the length of pipe.
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	Install sheet pile/cofferdam up and downstream of structure. Assume pumping will be required 24/7. Cap slab will be placed in bottom of excavation. Structure will be built and excavation for the inlet basin will commence. Suction apron will be placed along with excavation for discharge piping and discharge headwall/discharge apron. Excavate out discharge piping and backfill levee.
Key Outstanding Questions/Issues:	

Representative Drawings/Photos: G-200



Feature of Work:	STRUCTURE G-200: 300 CFS PUMP STATION (DEMOLITION AND RE-CONSTRUCTION)
Quantity Take Off:	

Assume similar to Pump Station 356

FEB Seepage Pump Station Excavation

Length	=	105.0	FT						
Total Depth	=	21.5	FT						
Thickness of Organic	=	7.0	FT						
Thickness of Rippable Rock	=	14.5	FT						
Slope1	=	1.0	:1						
Slope2	=	1.0	:1						
Bottom Width	=	15.0	FT						
Top Width	=	58.0	FT						
Cross Section	=	784.8	SF						
Cross Section Organic	=	357.0	SF						
Cross Section of Cap Rock	=	427.8	SF						
Organic Volume	=	37,485.0	CF	=	1,388.3	BCY	=	1,735.4	LCY
Cap Rock Volume	=	44,913.8	CF	=	1,663.5	BCY	=	2,495.2	LCY
Backfill	=	8,239.9	CF	=	305.2	BCY	=	423.1	LCY
Assume Backfill is 10% of excavated quantity.									
Assume Clear and Grub similar to work area for the Merritt Pumping Station	=	18.0	ACRE	=	87,120.0	SY			

Inflow and Outflow Canal Excavation

Length	=	700.0	FT						
Total Depth	=	17.0	FT						
Thickness of Organic	=	7.0	FT						
Thickness of Common	=	-	FT						
Thickness of Cap Rock	=	10.0	FT						
Slope1	=	2.0	:1						
Slope2	=	2.0	:1						
Bottom Width	=	40.0	FT						
Top Width	=	108.0	FT						
Surface Area of Canal	=	75,600.0	SF	=	1.7	ACRE	=	8,400.0	SY
Organic Volume	=	460,600.0	CF	=	17,059.3	BCY	=	21,324.1	LCY
Cap Rock Volume	=	420,000.0	CF	=	15,555.6	BCY	=	23,333.3	LCY

Levee Degrade

Assume Degrade of levee required due to location of new pump station

Length		730.0	FT						
Height		10.4	FT						
Slope1		2.0	:1						
Slope2		2.0	:1						
Top width		10.0	FT						
Bottom width		51.6	FT						
Cross Section	=	320.3	SF						
Surface Area of Levee	=	39,946.6	SF	=	0.9	ACRE			
Volume	=	233,833.6	CF	=	8,660.5	BCY	=	9,786.4	LCY
base area of levee	=	37,668.0	SF	=	4,185.3	SY	=	0.9	Acre
side slopes of levee	=	32,646.6	SF	=	3,627.4	SY	=	0.7	Acre
roadway area	=	7,300.0	SF	=	811.1	SY	=	0.2	Acre

Removal of existing S-356 Temporary Pump Station and backfill of Temporary Pump Station Intake

Excavation volume for removal of Piping = 67,240.0 CF — Assume excavation area is 6,724 SF and excavation is 10 ft deep.

	=	2,490.4	BCY	=	3,113.0	LCY			
Intake Backfill									
Length	=	142.5	FT		Assume averaged length is 142.5 ft				
Height	=	10.0	FT		Assume average depth is 10 ft				
Slope1	=	2.0	:1		assume side slope of 2:1				
Slope2	=	2.0	:1						
Bottom Width	=	30.0	FT		Assume Bottom width of 30 ft with top width at 70 ft.				
Top Width	=	70.0	FT						
Cross Section	=	500.0	SF						
Backfill Volume	=	71,250.0	CF	=	2,638.9	ECY	=	2,981.9	LCY
new surface area of backfill	=	9,975.0	SF	=	1,108.3	SY	=	0.2	Acre
Total Backfill removed temp. pump station	=	5,642.2	ECY	=	6,375.7	LCY			

Care and Diversion of Water

Construction Sequence:

1 Construct perimeter concrete ring beam and rock anchors.
2 Place Sheet piling and connect piling to concrete ring beam. Excavate. Assume sheet pile length of 36 ft
3 3Install rock anchors for concrete seal slab. Anchor length 17'-6" slab rock anchor.
4 Place Concrete Seal slab. 6'-0" thick and dimensions of sheet pile
5 Dewater cofferdam and prepare top of concrete base mat slab
6 Place concrete walls to elevation 9'-0" at pump structure monolith prior to abandoning or removing in place cofferdam sheet piles. Remove ring beams in inlet and outlet.
7 install lateral bracing for walls.
8 Construct service bridge slab. Remainder of walls and operating floor slab.
9 Install sheet pile wing walls.

# of pump station Bays	=	4.0						
Cofferdam width per pump station bay	=	15.0	ft		Assume Per S-101			
Total width length	=	60.0	ft					
Length (Up and downstream) of Cofferdam	=	90.0	ft		Assume per S-101			
Area of Cofferdam sheet pile to remain in place	=	10,800.0	SF					
Area of cofferdam to be removed	=	7,200.0	SF					
Total Perimeter Length								
(length of sheet pile/ring beam)	=	300.0	ft					
Length of Sheet pile to Be utilized as wing wall	=	186.0	ft					
Volume of ring beam (Reinforced Concrete	=	70.4	CY		Per detail S-103			
# of 54' ring beam anchors @ 10' OC	=	30.0	ea		Per detail S-101			
# of 17'-6" uplift slab rock anchors	=	54.0	ea					
Volume of Concrete seal/uplift slab	=	1,200.0	CY		Assume 6' thick			
Width of each Bay	=	15.0	ft		Assumed per similar PS-357			
Length of Operating Floor	=	45.0	ft					
Width of Operating Floor	=	60.0	ft					
Horizontal concrete volume	=	800.0	CY					
Vertical Concrete	=	1,500.0	CY					
Service Bridge Elevated Flatwork	=	190.1	CY		Total Elevated Flatwork		=	446.4 CY
Operating Floor (Elevated Flatwork	=	225.0	CY					
Elevated Vertical Work								
(Operating floor to service bridge)	=	31.3	CY					
Roof slab / Metal Deck	=	220.0	CY					
Loading Truck Ramp (horizontal Concrete)	=	4,903.0	SF	=	272.4 CY	Assumed From Merritt Pump Station		
SF of Generator, Electric and Office/Control	=	900.0	SF		Assume Gen/Elec/Office room is 20ftx45ft			
Volume of Concrete for Gen, Elec and Office	=	1,500.0	CF	=	55.6 CY		Assume 1.67 ft thick	
Assume 10 18"x18"x26" Tall Columns	=	43.3	CY					

Tilt Up 7-1/2" Thick Precast Panels	=	5,250.0	SF	Assume similar to Merritt Pump Station
CMU Wall Dimension (Exterior Surface Area)	=	8,500.0	SF	
Roof 32" Double tee units 56 ft long required	=	8.0	each	
Intake Basin Concrete	=	89.0	CY	
Discharge Basin Concrete Apron	=	133.3	CY	Assume 36" thick concrete
Stone Protection Riprap discharge	=	1,688.9	CY	Assume 5 ft thick layer of riprap lining the C-625W canal upstream 60 ft and downstream 60 ft
Stone Protection inlet	=	750.0	CY	Assume 36" thick layer of riprap lining the sides and bottom for 150' upstream
Trash Rack Surface Area (total)	=	1,680.0	SF	Assume Trash rake is 28 ft tall and covers the width of the operating floor each individual covers the width of the bays (14 ft)
Roll Up Garage Door	=	168.0	SF	Assume Roll up garage door 12'x14'
# of Doors	=	4.0	ea	Assume 1 set of double doors and two other doors
# louver openings	=	8.0	ea	Assume 8 louver openings 7'-4" square
Overhead Crane	=	2.0	ea	Assume 2 overhead cranes @ 25 tons each
Power Line Connection	=	2,500.0	LF	Assume power available 2500 lf from site
Septic tank system	=	1.0	ea	Assume 1 septic tank system
Potable water	=	1.0	ea	Assume 1 potable water well will be required
Generator Fuel Tank	=	2000 Gallon	ea	Assume five 2000 gallon fuel tanks required
Fuel Pad dimensions	=	2,000.0	SF	Assume two 100'x20'x8" thick reinforced concrete slab on grade pad
		49.4	CY	
Discharge Piping				
48" discharge pipe		15.0	LF/ea	Assume Pumps will have a 48" Discharge Pipe
Concrete Encasement		146.6	CY	Assume 2 ft of concrete to encase piping
Floor Grating	=	240.0	SF	Assume 14' x4 ft wide for each pump bay.
Ladders	=	120.0	VLF	Assume 30 ft per pump bay
Railings	=	180.0	LF	Assume a handrail on the up and downstream side and one a width of the operating floor
Haul road length	=	21,120.0	FT	
Haul road width	=	14.0	FT	
Haul road thickness	=	1.0	FT	
Area	=	295,680.0	SF	= 32,853.3 SY
Chain link Fence	=	2,280.0	LF	Assume Similar to Merritt Pump Station
Silt Fence	=	3,700.0	LF	Assume similar to Merritt Pump Station
Silt Boom	=	600.0	LF	Assume similar to Merritt Pump Station

Assume Halu road will require no maintenance only traffic control at exit of the site onto HW 41 and entrance to the processor located near S-333

Feature of Work:	STRUCTURE P-2: APPROX. 300CFS PUMP STATION
Scope Given:	Pump Station will discharge water at East end of Holey Land .Distribution Canal during construction.
Reference for Scope Basis:	
Scope Assumptions:	– Assume similar to farming pump systems, with steel structure – Assume approximately 300 CFS capacity
Class of Estimate	Class 3 -Baseline (Feasibility/DPR/LRR)
Estimate Methodology:	When possible a corollary approach to the estimate development was utilized. Plans and specifications for recent similar work were utilized to capture the necessary scope and assumptions to construct the feature. The scope and assumptions were documented and sent to the design team for review. After reaching consensus on the scope and major assumptions, the labor, equipment, materials, and production rates were developed for the estimate.
Sequence of Work:	
Key Outstanding Questions/Issues:	

Pump Quotes

From: Steve McIntyre [mailto:smcintyre@pattersonpumps.com]
Sent: Friday, January 19, 2018 1:27 PM
To: Kile, Van
Subject: [EXTERNAL] SFWMD - 800 CFS UNITS BUDGET PER UNIT

VAN;
Budget price is rough budget and includes Pump with FSI, R/A Gear w/cooler, Engine w/Keel cooler, mounting sole plate, freight to 1st point of delivery S. FL., Dynamic Analysis, Performance accepted based on prior approved model test for different project, up to 3-trips and 6-days on site by PPC Field Service for installation assistance/direction, verification, start-up support, and Owner/Operator training.

OPTION 1 – with Tier 4 rated Engine
Qty – 3 units, BUDGET PRICE EACH $10,300,000.00ea, Total for 3-pumps $30,900,000.00.

OPTION 2 – with Tier 2 rated Engine
Qty – 3 units, BUDGET PRICE EACH $8,040,000.00ea, Total for 3-pumps $24,120,000.00.

I am moving forward on the balance of the pumps.

Best Regards,
C. Steve McIntyre
Custom Pump Regional Sales Manager
Patterson Pump Company
smcintyre@pattersonpumps.com
706-297-2877 Direct
706-886-2101 Main
706-886-0023 Fax

Patterson
A Gorman-Rupp Company
The Pump People

From: Steve McIntyre [mailto:smcintyre@pattersonpumps.com]
Sent: Tuesday, February 27, 2018 10:13 AM
To: Kile, Van
Subject: [EXTERNAL] RE: SFWMD - 400 & 200 CFS UNITS BUDGET PER UNIT

Van;
As noted before budget pricing includes pump with FSI, mounting sole plate, freight to 1st point of delivery S. FL, Analysis, and performance accepted based on model test for a different project, up to 3-trips and 6-days on site by PPC field service for installation assistance/direction, verification, start-up support, and Owner/Operator training.

ITEM 1 – 400CFS - 66X72TMF PUMPS
Budget price also includes R/A Gear and Engine w/keel cooler drive Budget price
Ea. $2,400,900.00ea, Total for 2-pumps $4,801,800.00

Item 2 – 200CFS – 48X48TMF PUMPS
Budget price also includes vertical gearmotor arrangement drive Budget price
Ea. $600,000.00ea, Total for 3-pumps $!,800,000.00

I had to make some assumptions on the 400CFS due to lack of Engine information, however I am confident we can come in under the budget unless there are significant changes and/or upgrades in the final bid package.

Best Regards,
C. Steve McIntyre
Custom Pump Regional Sales Manager
Patterson Pump Company
smcintyre@pattersonpumps.com
706-297-2877 Direct
706-886-2101 Main
706-886-0023 Fax

Creel Pump Inc.
Lake Placid, Florida 33862-0907
Phone 863-465-5757
Fax 863-248-2891 RUC # 59-249-1195

PROPOSAL

DATE	ESTIMATE NO.
7/1/2015	3856

NAME / ADDRESS
Tetra Tech, Inc. Stuart E. McGahee E McGahee 759 South Federal Highway (#314) Stuart, FL 34994

P.O. NO.	TERMS	REP	FOB	PROJECT
			Factory	New 24" Hydraulic pu...

DESCRIPTION	QTY	COST	TOTAL
24" Axial Flow Pumphead System, Consisting Of: (24AX-850D-LS)			
24" Submersible Axial Flow Pumphead, with:	2	31,054.63	62,109.26T
24" vertical discharge			
Vane type Hyd. Motor			
Hyd. Motor Requires 108 GPM @ 2,500 PSI			
Stainless steel blades propeller			
Pump specs: 21,500 GPM @ 5' TDH, 17,250 GPM @ 20' TDH			
850 Power unit, skid-mounted, with:	2	59,067.83	118,135.66T
270- Gallon fuel tank			
108 GPM - Oil 2,500 PSI			
Vane Type Hyd. Pump			
John Deere 6068-225 Tier lll Diesel Engine			
Engine Oil and Temp. Shut-down instrument			
193 BHP @ 1,800RPM			
1 1/2" & 1 1/2" x 50' Lineset, with Quick Disconnects	2	2,417.135	4,834.27T
100' of 24" Discharge pipe with flanges, sand blast and coal tar coating.10' riser pipe with a 45 degree.	2	12,000.00	24,000.00T
Sales Tax, Florida State and County		7.00%	14,635.54

TOTAL	$223,714.73

SIGNATURE ______________________

Phone #
863-465-5757

Creel Pump Inc.

Lake Placid, Florida 33862-0907
Phone 863-465-5757
Fax 863-248-2891 RUC # 59-249-1195

PROPOSAL

DATE	ESTIMATE NO.
7/1/2015	3857

NAME / ADDRESS
Tetra Tech, Inc. Stuart E. McGahee E McGahee 759 South Federal Highway (#314) Stuart, FL 34994

P.O. NO.	TERMS	REP	FOB	PROJECT
			Factory	24" Rental pumps 7/15

DESCRIPTION	QTY	COST	TOTAL
Rental Quotation for Two 24" Hydraulic Pumps 9 Months.			
First Months Rental			
24" Hydraulic Pumps: Complete with Diesel Drive Units, 50' Set of Hydraulic Hoses, 45 Degree Elbow, 10' Riser Pipe and 100' of Steel Discharge with fastening hardware.	2	17,500.00	35,000.00T
Each Month After the Rental will be.	2	12,500.00	25,000.00T
Sales Tax, Florida State and County		7.00%	4,200.00

	TOTAL	$64,200.00

SIGNATURE ______________________

Phone #
863-465-5757

To: Tetra Tech

Date: 6/24/2015

Attention: Stuart

From: Eric McKendree

Job: Bolles Canal

Re: COST ESTIMATE FOR 2 24" HYDRAFLO PUMPS

We are pleased to quote the following equipment and/or service for your consideration:

Description	Quantity	Unit	Price Each	Monthly Rate
HAC 24 HydrafloPump	2	ea.	$2,600.00	$5,200.00
2400D Diesel Hydraulic Drive Unit (skid)	2	ea.	$3,900.00	$7,800.00
50' Set of Hydraulic Hoses	2	set	$150.00	$300.00
24" HPDE Pipe with Flanges	200	lf.	$12.00	$2,400.00
24" Steel Raiser Pipe	20	lf.	$12.00	$240.00
45 Degree Elbows	2	ea.	$75.00	$150.00
90 Degree Elbows	2	ea	$75.00	$150.00

Note: Each drive unit will burn about 7 GPH under full load.
At 10 feet of lift (from the water level to top of bank) each pump will do about 19,000 GPM

Delivery and Pick up…………………………………………………$150.00 each way per truck.

LABOR TO DO INITAL INSTALL AND FINAL REMOVAL OF ABOVE EQUIPMENT IS $100.00 PER HOUR PER MAN

- MWI TO SUPPLY ALL BOLTS, NUTS AND HARDWARE
- CUSTOMER WILL SUPPLY EQUIPMENT AND OPERATOR FOR INSTALLATION AND REMOVAL OF EQUIPMENT
- PUMP REQUIRES A MINNIMUIM OF 8' WATER DEPTH TO MEET CURVE
- CUSTOMER SUPPLIES FUEL TANK AND FILLS TANK AS NEEDED

PRICES DO NOT INCLUDE ANY APPLICABLE TAXES
Quoted prices are good for 30days

I f you have any questions or need any further information please feel free to call me at –cell (772) 321-0493 or office (772) 770- 0004

Sincerely,

Eric McKendree

To: Tetra Tech

Date: 6/23/2015

Attention: Stuart

From: Eric McKendree

Job: Bolles Canal

Re: COST ESTIMATE FOR 2 30" HYDRAFLO PUMPS

We are pleased to quote the following equipment and/or service for your consideration:

Description	Quantity	Unit	Price Each	Monthly Rate
HAC 30 HydrafloPump	2	ea.	$3,400.00	$6,800.00
3000D Diesel Hydraulic Drive Unit (skid)	2	ea.	$5,100.00	$10,200.00
50' Set of Hydraulic Hoses	2	set	$150.00	$300.00
30" HPDE Pipe with Flanges	200	lf.	$15.00	$3,000.00
30" Steel Raiser Pipe	20	lf.	$15.00	$300.00
45 Degree Elbows	2	ea.	$100.00	$200.00
90 Degree Elbows	2	ea	$100.00	$200.00

Note: Each drive unit will burn about 8 GPH under full load.
At 10 feet of lift (from the water level to top of bank) each pump will do about 32,000 GPM

Delivery and Pick up……………………………………………………$150.00 each way per truck.

LABOR TO DO INITAL INSTALL AND FINAL REMOVAL OF ABOVE EQUIPMENT IS $100.00 PER HOUR PER MAN

- MWI TO SUPPLY ALL BOLTS, NUTS AND HARDWARE
- CUSTOMER WILL SUPPLY EQUIPMENT AND OPERATOR FOR INSTALLATION AND REMOVAL OF EQUIPMENT
- PUMP REQUIRES A MINNIMUIM OF 8' WATER DEPTH TO MEET CURVE
- CUSTOMER SUPPLIES FUEL TANK AND FILLS TANK AS NEEDED

PRICES DO NOT INCLUDE ANY APPLICABLE TAXES
Quoted prices are good for 30days

I f you have any questions or need any further information please feel free to call me at –cell (772) 321-0493 or office (772) 770- 0004

Sincerely,

Eric McKendree

BETTER PUMPS, BETTER SERVICE, BEST VALUE

TRU-FLO CORPORATION
924 NW 13TH STREET
PO BOX 248
BELLE GLADE, FLORIDA 33430
TELS (561) 996-5850 (561) 996-3082
FAX (561) 996-0782

June 17, 2015

Tetra Tech
759 S. Federal Highway, Suite 314
Stuart, FL 34994

Attention: Stuart E. McGahee, Senior Project Engineer

RE: Quote for mobile pump

We are pleased to offer the Tru-Flo 24" Mobile Pump as follows:

The Tru-Flo 24" Mobile Pump consists of one standard Tru-Flo 24" 45 Degree Angle Pump with DeRan TG75 gearbox, 80HP minimum continuous duty John Deere diesel power unit, engine drip pan, V-belt drive, belt guard, fuel tank (24 Hrs running capacity), winches and cables, two 24" corrugated aluminum discharge pipes 20 feet long with flanges, a 24" flexible rubber coupling, and all related fittings and accessories needed to provide a fully functional and complete installation. All of the preceding are mounted on a single axle trailer, equipped with slides and winches in order to facilitate the transport and installation of the pump.

This unit, equipped with a standard Tru-Flo 24" pump, is capable of pumping between 12,000 GPM and 17,000 GPM depending on the total dynamic head and the engine RPM. Average expected flow is about 15,000 GPM.

Total Price (one unit): $47,500.00 FOB Belle Glade, FL

Note above price is subject to stock availability of Tier 3 John Deere Power Unit Model MP4045HF2853115. For regulatory reasons the stock is being depleted. If it is necessary to use a Tier 4 engine the price will be significantly higher.

Julio Sanchez
Tru-Flo Corporation

BETTER PUMPS, BETTER SERVICE, BEST VALUE

TRU-FLO CORPORATION
924 NW 13TH STREET
PO BOX 248
BELLE GLADE, FLORIDA 33430
TELS (561) 996-5850 (561) 996-3082
FAX (561) 996-0782

June 17, 2015

Tetra Tech
759 S. Federal Highway, Suite 314
Stuart, FL 34994

Attention: Stuart E. McGahee, Senior Project Engineer

We are pleased to offer the Tru-Flo 24" x 30” Straight Bore Mobile Pump as follows:

The Tru-Flo 24” x 30” Straight Bore Mobile Pump consists of one Straight Bore Tru-Flo 24" 45 Degree Angle Pump with DeRan M16AH gearbox, 100HP minimum continuous duty John Deere diesel power unit, engine drip pan, V-belt drive, belt guard, fuel tank (24 Hrs running capacity), winches and cables, two 30" corrugated aluminum discharge pipes 20 feet long with flanges and 24” x30” adapter, a 24" flexible rubber coupling, and all related fittings and accessories needed to provide a fully functional and complete installation. All of the preceding are mounted on a single axle trailer, equipped with slides and winches in order to facilitate the transport and installation of the pump.

This unit, equipped with a Straight Bore Tru-Flo 24" pump, is capable of pumping between 18,000 GPM and 22,000 GPM depending on the total dynamic head and the engine RPM. Average expected flow is about 20,000 GPM.

Total Price: $58,255.00 FOB Belle Glade, FL

Note above price is subject to stock availability of Tier 3 John Deere Power Unit Model MP4045HF2853115. For regulatory reasons the stock is being depleted. If it is necessary to use a Tier 4 engine the price will be significantly higher.

Julio Sanchez
Tru-Flo Corporation