Appendix C. Feasibility Evaluation of an Inverted Siphon Memorandum

To	Bob Beduhn, PE, HDR		
From	Matt Redington, PE, Steve McKelvie, PE, HDR		
Date	June 18, 2014	Job No.	BA 153-01

RE: Feasibility Evaluation of an Inverted Siphon

The area between the non-Federal levees along Mid-Barataria Bay and the MR&T levees along the Mississippi River (referred to as the Forced Drainage Area) drains south to the Wilkinson Pump Station. The proposed diversion channel with side levees will prevent flows from areas north of the diversion channel from flowing south to the new Wilkinson Pump Station. This memorandum summarizes an evaluation which was undertaken to determine if an inverted siphon underneath the Mid-Barataria Sediment Diversion channel would be a viable option for conveying flows from the northern part of the Forced Drainage Area to the new Wilkinson Pump Station.

The inverted siphon would convey stormwater and groundwater from north to south, under the diversion channel and associated guide bank levees and maintenance roads. The siphon would normally be used to convey stormwater runoff and groundwater, but would also convey floodwaters in the event of levee overtopping. The main benefit for construction of a siphon would be the elimination of the need for a new pump station to be constructed at the north end of the Forced Drainage Area.

Siphon Design

The approximate location of the siphon is shown in Figure 1 (see attachments). The ends of the siphon would need to be beyond the limits of the guide bank levees. A plan and profile sheet (Figure 2), and typical section sheet (Figure 3), show the typical geometrics that would be encountered by a siphon. It was assumed for the sake of this evaluation that the total length of the siphon would be 1,200 feet. This length would need to be refined during design in order to accommodate access roads, approach and exit channels, and flow transition structures that would be built at each end of the siphon.

The prevailing ground elevation in the vicinity of the siphon is at approximately 0 to 3 feet above sea level. The top of guide bank levees will be at an elevation of 13.4 feet. The bottom of channel is at an elevation of 25.0 feet below sea level (-25 feet). It is assumed that the top of the siphon pipes would be placed at least 3 feet below the channel bottom elevation. This separation reduces the risk of damage occurring to the siphon pipes during construction of the channel or normal channel maintenance activities such as dredging.

The discharge from the siphon would empty into an existing canal, which would direct water to the new Wilkinson Pump Station. This pump station will pump flows into Mid-Barataria Bay. The new Wilkinson Pump Station is already designed assuming the northern portion of the Forced Drainage Area is part of the contributing drainage area. As such, operational or design impacts to the Wilkinson Pump Station due to construction of the siphon are not factored into the Opinion of Probable Construction Cost (OPCC) evaluation for this memorandum. The discharge from the siphon will need to be conveyed to the new Wilkinson Pump Station by open channel. There is an existing ditch that runs in the north-south direction through the southern portion of the Forced Drainage Area. It is assumed that this existing channel will be

widened to accommodate the conveyance of siphon flow to the Wilkinson Pump Station, but that no new right of way will be required. Some limited grading may be required to increase the flow capacity of the ditch, provide for flow transitions near the siphon outlet and the pump station inlet, and to stabilize the existing ditch side slopes. It is assumed that limited channel work will be required upstream of the siphon inlet. In essence, the siphon would convey flow between two level pools on each side of the diversion channel. The outlet channel would primarily be needed to contain siphon discharge water during periods of low flow.

Sedimentation

Inverted siphons are typically installed for sanitary sewer applications, although they are sometimes also used for conveying stormwater. Regardless of application, a primary concern with inverted siphons is the ability to maintain the siphon free of sediment without undue maintenance requirements. A siphon that plugs can lose conveyance capacity or cease to function entirely, resulting in expensive maintenance and upstream flooding. In order to avoid these pitfalls, siphons are designed so that velocities through the pipes are high enough to pass sediment through the entire length of the siphon, rather than settling out within the siphon. Flow velocities are managed through careful selection of pipe sizes and design of flow entry configurations (use of side weirs or other flow splitting methods upstream of the siphon).

The sedimentation characteristics and velocity criteria for a typical sanitary sewer siphon are not applicable for a siphon underneath the diversion channel due to differences in material qualities. The surface soils in the Forced Drainage Area are generally a mix of silts, clays, and organic materials. Figure 1 shows the location of soil borings, penetrometer tests, and well pump tests. Figure D-15 shows the soil boring for location NL-3A which is likely to be most representative of the soils in the vicinity of the siphon (Boring NL-6A is also in close proximity, but may be less representative since it is located within an abandoned distributary channel). The clays in the Forced Drainage Area are highly dispersive. While a minimum flow velocity of 4 feet per second is recommended for use with sanitary sewer siphon applications (Metcalf and Eddy, 1981), lower velocities would be capable of moving finer silts, clays, and organics through the diversion channel siphon. To minimize the probability of sedimentation within the siphon and achieve greater operational certainty, a sedimentation basin could be installed upstream of the siphon inlet as a precaution to settle out any larger sand particles that might have been transported to the upstream side of the siphon. For most operational conditions, it is anticipated that the flow velocities in the upstream channel will be less than the flows in the siphon.

Stokes' Law can be used to estimate the velocity at which a particle settles within a fluid. The attached calculations show the settling velocity for a range of particle sizes that would be anticipated to reach the siphon (clays and silts). It should be noted that Stokes' Law assumes that particles are spheres. The organic material present in the Forced Drainage Area could be present in 'chains', and the clay particles would resemble plates. The settling velocity of plates and chains could vary from Stokes' Law calculated sphere velocities. The calculated values of settling velocity are for reference only. Laboratory testing could be used to refine the accuracy of the settling velocity prior to using the calculated velocities for design purposes.

It should also be noted that the accuracy of Stokes' Law is decreased for larger particle sizes. As discussed in Gregory (2006), the Stokes' Law can over predict velocity by a factor of 10 for particles with a diameter exceeding 1 mm. Gregory (2006) also states that Stokes' Law should not be used for settling velocities in excess of 3 mm/s. As shown in the attached calculation sheet, a velocity of 3 mm/s is reached for a particle size of D=0.06 mm (a silt particle). At the upper end of the silt gradation, Stokes' Law predicts that particles with a D=0.075 mm, there will be a settling velocity of 5.04 mm/s.

Although some of the particle sizes present in the Forced Drainage Area runoff will be larger than the upper limit identified for high accuracy usage of the Stokes' Law, the calculated velocities make it clear that velocities significantly lower than the 4 feet per second recommended for a typical siphon could be used to keep the diversion sediment clear of sediment. As discussed later in this memorandum, preliminary design velocities in excess of 2.0 feet per second (609 mm/s) were used at this feasibility stage evaluation. This velocity is well in excess of the minimum settling velocity of 5.04 mm/s identified above.

There could be periods of time during which there is no stormwater runoff, but there is flow resulting from groundwater traveling from the north side of the Forced Drainage Area and through the siphon to the Wilkinson Pump Station. These periods of low flow could result in flow velocities in the siphon pipes that are less than 2.0 feet per second, or even less than the minimum settling velocity calculated using Stokes' Law. Use of a sedimentation basin (discussed later) could facilitate settling of particles prior to entry of flow into the siphon. Final design will need to evaluate the frequency of seepage only flows as compared to the frequency of higher stormwater flows which would be capable of flushing sediments out of the siphon pipes.

Design Elements

An inverted siphon system would likely have the following components:

- Inlet flow transition structure
- Inlet gate system
- Siphon pipes
- Sedimentation basin
- Air vents
- Manhole access
- Outlet flow transition structure
- Outlet gate system
- Discharge channel

Inlet Flow Transition Structure

An inlet flow transition structure will be required to provide for a hydraulic transition from level pool to channelized flow at the inlet of the siphon pipes. Inlet and outlet structures must be provided to minimize hydraulic losses, prevent erosion, prevent piping along outside of siphon, allow active control of flows depending on flow conditions, allow maintenance of a "seal", provide for personnel safety measures, and allow access for maintenance. The structure would be armored to minimize the suspension of sediments as velocities increase in the direction of flow toward the siphon inlet. The inlet flow transition structure may also need to incorporate use of trash racks in order to prevent debris from entering the siphon, in the event that the siphon is left open or operating during a debris producing event.

Siphon Pipes

Siphon pipe sizes were designed assuming two alternate installation methods: open excavation, and Microtunneling. This evaluation assumes that the downstream tailwater elevation will be maintained at an

elevation of -4 feet below sea level, and that the upstream side can be ponded to a maximum elevation of -1 feet above sea level (a maximum head loss of 3 feet through the system).

The allowable ponding elevation on the upstream side of the siphon will need to be refined during final design. Increased levels of ponding would result in attenuation of flows, and would allow a reduction in flow capacity of the siphon pipes. The attached spreadsheet calculation indicates that a three pipe arrangement (60"-66"-84") will be sufficient for maintaining flow velocities between 2.5 to 6.5 feet per second (fps) for flows ranging from 50 to 500 cubic feet per second (cfs). The calculated pipe sizes result in velocities always exceeding 2.5 fps.

Head loss was calculated assuming the use of either three 45 degree bends (0.4 x velocity head) for the open excavation installation method, or 3-90 degree bends (0.4 x velocity head) for the Microtunneling installation method. An entrance loss (1 x velocity head) and friction losses along pipe were also added. If a minimum velocity greater than 2.5 fps is selected, it is likely that 4 pipes will be required, rather than 3, in order to not exceed 3 feet of head loss from one side of the siphon to the other.

For siphon pipes installed using the open excavation method, the steeply sloped portions of the siphon should have slopes between 2H:1V and 4H:1V.[2] The portion that traverses the channel would need to slope toward a low point at the downstream end (prior to returning to the surface). The slope of the traversing segment should be not flatter than 0.005 ft/ft.[2]

For the sake of this evaluation, it was assumed that concrete pressure pipe would be used to construct the siphon. Concrete pressure pipe and fittings would need to conform to AWWA C300, AWWA C301, or AWWA C303, as applicable for the service requirements, with rubber gasket joints of the type using steel bell and spigot joint rings. Construction of the levees along the diversion channel could cause consolidation, or settling of soils, over the siphon. Excavation of the diversion channel could cause uplift due to removal of overburden. Further geotechnical evaluation will be required to determine the potential impacts of soil movements on pipe material and joint type selection. Further analysis may indicate that welded steel pipe would be preferred over concrete, in order to limit deflection at joints. Regardless of material selected, the conduit would need to be structurally designed to accommodate external pressure during a dewatered pipe condition (assuming pipes are emptied after an event, or are emptied for maintenance or inspection), and an operational condition with full internal hydrostatic pressure. Once construction of the conduit has been completed, hydrostatic testing of the entire installation is normally performed to verify that the leakage rate does not exceed permissible values.[2]

Inlet Gate System

Most siphons with multiple pipes use a system of side weirs within the structure at the entrance of the siphon pipes. During periods of low flow, side weirs force all flow into a single pipe, thus maintaining velocities in excess of desired minimums. Once the capacity of the first pipe is reached, any additional flows would spill over the side weir to the next adjacent pipe of the siphon. As flows to the siphon increase, the first pipe maintains its flow capacity, while additional flows are directed over the side weir to the second pipe. Additional side weirs and siphon pipes can be added to work with the first and second pipes.

One challenge associated with this typical approach for a siphon is that there can be a transitionary period when velocities in the second (or additional) pipe fail to exceed the minimum desired velocity for keeping soil particles suspended. If this occurs, and subsequently greater flows do not occur outside of the transitionary period to flush the siphon clean, deposited sediments can remain after a flow event.

Although there are many examples of siphons with side weirs that are kept clear of sediment regardless of transitionary flow periods, a set of slide gates could be installed at the siphon inlet in order to actively maintain flows and reduce the frequency and duration of transitionary flow periods. These slide gates would connect adjacent cells of the inlet structure, so that when a gate between two adjacent pipes is opened, the total flow from the approaching channel would be immediately split between the two siphon pipes.

Figures 4a and 4b show the relationship between upstream water surface elevation, velocity of flow in the pipe, and flow rate across the siphon for an actively managed (gated) siphon. Figure 4a is for a siphon with sloping approach and exit pipes (the version of the siphon installed by open excavation method). Figure 4b is for a siphon with vertical approach and exit pipes (the version of the siphon installed by tunneling). As an example, in Figure 4a, when there is a flow of 100 cfs approaching the siphon, a single pipe would carry flows (Stage 1), the upstream water surface elevation (indicated on the lower curve) would be -1.5 feet, and the velocity in the pipe (indicated on the upper curve) would be 5 feet per second. Once the flow rate approaching the siphon reached 110 cfs, a gate would be opened, and two pipes would begin carrying water (stage 2). For a flow of 180 cfs, the upstream water surface elevation would be -1 feet, the velocity in the 60” pipe would be 4.1 feet per second, and the velocity in the 66” pipe would be 4.2 feet per second.

Although slide gates to manage flows between adjacent cells within the inlet structure would be an optional feature to minimize maintenance, slide gates to allow closure of the entry should be incorporated into the design to permit maintenance and inspection.

Sedimentation Basin

A sedimentation basin upstream of the siphon could be used to settle out larger sand particles that might be present in stormwater runoff. The settlement basin would consist of a depression in the earth that is in line with the incoming channel. Working pads would be located on at least two sides of the basin to accommodate sediment removal equipment (such as an excavator). The floor of the settlement basin could consist of cement-amended soils to help maintenance personnel locate the floor of the basin when removing sediment. The basin could also be lined with concrete to provide a firm working surface for smaller sediment removal equipment, however, soil modifications or piling supports that would significantly increase cost would be required to prevent differential settling, floatation, or cracking of the basin floor. At this stage of the evaluation, an earthen basin with an unamended floor is assumed. The size of the sedimentation basin would be determined after refinement of ponding elevations and siphon flow rates.

Air Vents

In order to function efficiently, the siphon will need to be ‘sealed’ so that there is no free air movement or trapped air in the system. Air vents would likely be needed immediately downstream of the inlet gates in order to allow venting. An air vent would also be beneficial at the downstream end of the lower portion of the siphon. The air vent at the downstream end would likely be combined with the manhole access.

Manhole Access

A manhole access would be provided at the downstream portion of the siphon (before the upward sloping pipe returns flows to the surface). This access would allow access to the interior of the siphon for maintenance and inspection. The siphon would need to be pumped dry in order to inspect it. A portable pump could be used to draw water from the manhole access point, or a permanent dewatering pump

station could be built. Less frequently used pipes (Stage 2 and Stage 3 pipes) could also be pumped dry after events to limit the amount of fine soil sediment that accumulates in the pipes. Permanent pumps could be installed to allow dewatering to occur without mobilization of portable pump units.

Outlet Flow Transition Structure

An armored transition structure would be required to transition flows from pipes to open channel. This transition would be designed to minimize hydraulic losses, concentrate the flows into a discharge channel, and minimize erosion.

Outlet Gate System

An outlet gate system would be required to allow closure of the siphon pipes for maintenance and inspection. These gates could consist of slide gates.

Discharge Channel

A channel will be needed to carry flow from the outlet of the siphon to the intake of the new Wilkinson Pump Station. Although there is an existing channel through the Forced Drainage Area, it was assumed for cost estimating purposes that a channel excavation consisting of 3H:1V side slopes, a 22 foot bottom width, and an invert of 8 feet below sea level would be required. It is assumed that the channel would be approximately 11,000 feet long.

Installation Approach

A variety of methods could be used to install the siphon. Three methods deemed technically feasible at this stage of evaluation include the following:

Option 1: Open Excavation

Two lines of steel sheet piling, approximately 30 feet apart, would be driven down into the earth. It is assumed for this evaluation that the sheets would be driven 20 feet below the bottom of trench excavation. From the ground surface to the trench bottom, a system of whalers and struts would be used to hold the sheets apart. Once excavation reaches the desired trench bottom elevation, the siphon pipes would be lowered into place and joined, one pipe segment at a time. Aggregate or flowable fill could be used for pipe bedding.

Dewatering would need to be conducted in order to keep the trench bottom dry during installation. The fine soils that will be present at the bottom of trench will make it unpractical for dewatering wells to be used on the exterior of the trench (see attached boring logs and hydrometer data). A more effective approach would likely be dewatering from within the excavated trench bottom. This would be accomplished by having a sloping trench bottom lead to a sump from which water could be pumped to the surface.

Further analysis will be required to determine a trench design. Soils on the outside of the trench will tend to push inwards on the bottom of the sheets. Additional sheeting will be required below the bottom of trench elevation in order to resist this pressure. The greater the depth of sheet pile driving, the more resistance there would be to the sheets being pushed together. As an alternative to driving sheets deeply, grout could be injected into the bottom of the sheeted area, between the sheets, prior to any trench excavation. The injected grout would form a rigid plug which would hold the sheets apart at their base. Although the fine soils are not expected to produce a high rate of flow into the trench, the grout plug

would inhibit upward seepage into the trench bottom. This would help to minimize bottom-heave within the trench. Preliminary cost evaluation indicates that additional sheet pile is likely to be much more cost effective than use of grout.

The bottom of the trench could also be kept full with water during excavation. A tremied concrete floor could be placed in the bottom of the trench. After the floor is cured, the trench could be pumped dry. The tremie floor could potentially be used to reduce sheet pile depth by providing resistance to the sheets collapsing together, while also inhibiting upward seepage into the trench.

Option 2: Microtunneling

Soft ground tunneling methods could be used to install the horizontal portion of the siphon. Vertical shafts would be required at the inlet and outlet ends of the siphon. The tunneling approach would result in greater hydraulic losses due to the introduction of 90 degree bends (rather than the 45 degree bends that would be present if the siphon was installed using open excavation). Although this is not as hydraulically efficient as a siphon with sloping pipes at the upstream and downstream ends, the pipe sizes can be designed to accommodate the additional hydraulic losses created by the 90 degree bends. The tunneling option has the advantage of reducing the amount of open excavation and sheet pile, and limiting the extent of dewatering. A jacking pit and a receiving pit would need to be created using sheet pile. Placement of pipe would progress from the jacking pit to the receiving pit. As the tunneling machine advanced forward toward the receiving pit, pipe would be jacked forward from the jacking pit into the excavated tunnel. An earth-pressure balance method would need to be used to keep the area near the cutting head pressurized during tunneling. It is assumed for the purposes of this evaluation that the siphon pipes would jacked forward as the tunneling machine is advanced, and that a separate liner pipe would not be installed in advance of the siphon pipe installation. It is assumed that soils would be removed from in front of the tunneling machine and would be pumped through the siphon pipe as a slurry back to the jacking pit for removal. If a liner pipe is required, the costs for the tunneling option would increase. Selection of a liner pipe would be based on the desire to protect siphon pipe joints during installation, and the desire to minimize equipment costs for the contractor.

This type of construction requires specialized equipment and experience. Significant set up costs would be incurred by a contractor using this method. One potential concern with this technique is that the soft foundation soils may not support the tunneling machine or the machine would not be able to maintain vertical elevation control causing it to ‘sink’ as it moved forward to the receiving pit. One way to counter this could be to amend soils (through deep soil mixing) or replace soils (through grout injection) in the path of the tunneling operation. In addition, ground improvement could be required around and beneath the jacking and receiving pits to prevent differential settlement between the pipes and the vertical shafts. Ground improvement could also be required to assist with pipe launching and receiving operations.

Option 3: Marine Installation

This method would involve installation of pipes in a trench filled with water. Sheet piles would be installed (similar to Option 1). The trench would be filled with pumped water as the area between the sheets is excavated. Maintaining the trench full of water would increase the pressure on the interior of the trench. This water pressure would work against the soil and water forces pushing the sheets together and reduce the likelihood of bottom heave within the trench. The siphon pipes could be installed within the water filled trench using specialized equipment and divers. Tremied concrete could be used for pipe bedding. Use of a bentonite slurry in place of water could be considered during design if it is determined that a higher density fluid is necessary to ensure that trenches remain stable during construction.

Opinion of Probable Construction Cost (OPCC)

An OPCC was developed for Options 1 and 2. It is assumed for the time being that Option 3 would not be necessary or cost competitive. The estimated cost for the Option 1 installation method is $12.1 million. The estimated cost for the Option 2 installation method is $15.2 million. A preliminary opinion of probable construction cost is attached for Options 1 and 2.

It was assumed for Option 1 costing purposes that sheet pile would be driven a depth of 20 feet below the -35 foot elevation trench bottom. If trench analysis indicates that 20 feet of embedment is not sufficient, each additional foot of sheet pile embedment (across the entire length of the siphon) would add approximately $25,000. This cost of additional sheeting is relatively small in comparison to the cost of a grout plug at the bottom of the sheets which could cost on the order of $2,000,000.

It was assumed for Option 2 that three jacking/receiving pits would be required in order to complete tunneling. An earth-pressure balance system would be required at the face of the drilling machine. For the purposes of cost estimating, it was assumed no soil amendment would be required, and that a machine would be capable of not 'sinking' as it progressed along the siphon alignment. It was also assumed that no tunnel liner would be required. Further analysis of the tunneling option would be required if this option is selected. At this time, the non-tunneling option (Option 1) appears to be less expensive and the preferred method.

Changes to allowable ponding elevations on the north side of the Forced Drainage Area, and the resulting flows required to be conveyed through the siphon, could require changes to the sizes of pipes in the siphons. Minor changes to pipe sizes should not result in significant changes to the cost of the siphon system.

The following items are not included in the OPCC, but still may need to be considered:

1. Operations and maintenance costs
2. Instrumentation and communications equipment
3. Flowage easements for ponding on the upstream side of the Forced Drainage Area.
4. Land acquisition for the discharge channel downstream of the siphon.
5. Disposal of discharge channel materials to another location (estimate assumes the materials are spoiled adjacent to the channel)
6. Land acquisition for the sedimentation basin or other siphon components.

Maintenance

Proper sizing of the siphon pipes, and incorporation of a sedimentation basin upstream of the siphon, would minimize the amount of maintenance required to keep the siphon operating per design conditions. Regular maintenance would include the following activities:

- Periodic removal of sediment from the sedimentation basin
- Periodic dewatering and visual inspection of the interior of siphon pipes
- Vegetation control in downstream channel
- Maintenance of gates (if present)

Conclusion and Additional Considerations

It appears that a siphon is a viable alternative to installation of a pump station at the north end of the Forced Drainage Area. Costs for the siphon would vary between $12.1 million and $15.2 million depending on installation method selected.

While maintenance concerns sometimes discourage owners from selecting a siphon as a design solution, proper design of the siphon (to appropriately manage velocities) would minimize maintenance costs. Furthermore, it should be noted that the north pump station would require active and ongoing maintenance. Any final decision on use of a siphon should factor in the difference in effort and cost for maintaining a pump station vs. maintaining a siphon.

Further evaluation will need to be conducted to refine the design concept, operations requirements, and maintenance requirements. Additional considerations during design will need to include:

1. Hydraulic modeling (determination of system performance, discharge channel design)
2. Spreadsheet evaluation assuming gate operation to control flows to inlets of siphon pipes assumes instantaneous adjustment to upstream level pool water surface elevation. An evaluation would need to be performed to dynamically model (unsteady state) upstream water surface elevations.
3. Refinement of inlet and outlet structure flow transitions
4. Selection of weir or gate flow management
5. Geotechnical evaluation of soil movement that could occur after construction of the levees and excavation of the diversion channel. The results of this evaluation could impact pipe material and joint type selection.
6. Geotechnical evaluation of the shoring support system, and the need for soil improvements at the jacking and receiving pits.
7. Design of upstream sedimentation basin
8. Soft soils will require careful evaluation of pipe segment length, joint type, and bedding material in order to limit joint deflections to acceptable levels
9. Pipe material compatibility with local soils and brackish water
10. Need for thrust blocks at pipe deflections
11. The separation between the tops of the siphon pipes and the bottom of the diversion channel may need to be refined based on risks of damage from channel maintenance activities.
12. Pipe buoyancy countermeasures and precautions to be taken during construction.
13. Evaluation of seepage risks along siphon pipes and at the sedimentation basin location, and design of mitigation if applicable
14. Dewatering well configuration used during installation
15. Site safety measures (such as fences or grates)
16. Operation of gates to close off siphon in the event of impending levee overtopping
17. Use of a backflow preventer or gate operations to mitigate flooding risks in the event the south side of the Forced Drainage Area floods but the north side doesn't
18. Methods and responsibilities for operating and maintaining siphon

19. Requirements for confined space entry and implications on items such as design of closure gates, and diameter of access manholes.
20. Implications of FEMA mapping and drainage requirements on siphon design.
21. Implications of potential NOV Levee and channel realignments on siphon design.

As design progresses, the following sources should be consulted for further information and guidance on siphon design:

- Report No. 141, Design of Sewers to Control Sediment Problems, Construction and Industry Research and Information Association (CIRIA), 1996.
- Wastewater Engineering: Collection and Pumping of Wastewater, Metcalf and Eddy, 1981.
- ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

References

[1] Design of Small Canal Structures, Bureau of Reclamation, 1978

[2] Alberta Transportation Civil Projects Branch, 2004, Water Control Structures, Selected Design Guidelines, Chapter 17, http://www.transportation.alberta.ca/1826.htm

[3] Introduction to Highway Hydraulics, Hydraulic Design Series No. 4, Chapter 7, June 2008

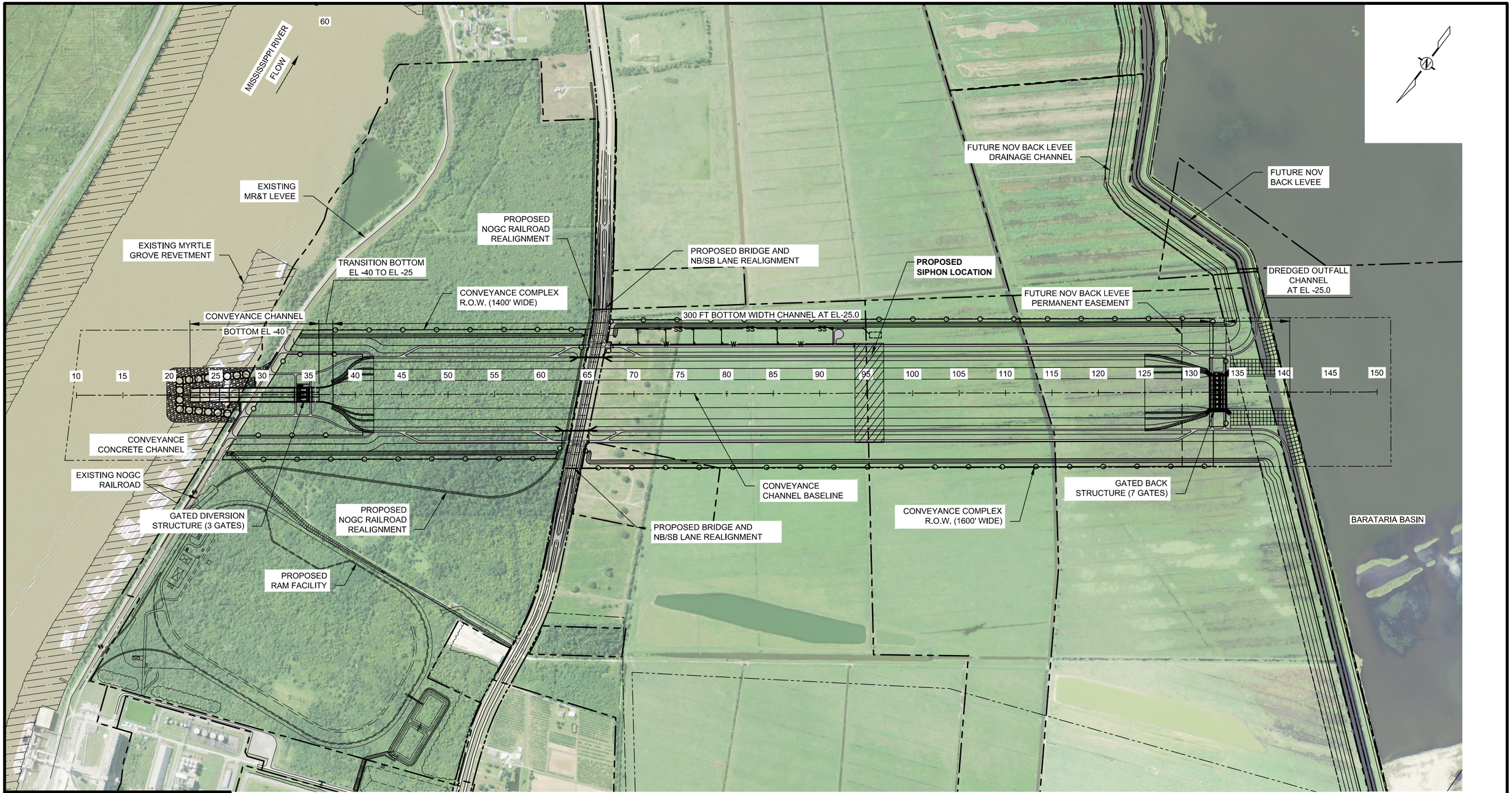
[4] Construction and Industry Research and Information Association (CIRIA) Report No. 141, Design of Sewers to Control Sediment Problems, 1996

[5] Wastewater Engineering: Collection and Pumping of Wastewater, Metcalf and Eddy, 1981.

[6] Particles in Water: Properties and Processes, John Gregory, 2006.

Attachments

- Figures
- Geotechnical Data
- Drilling Log
- Stokes' Law Calculations
- Hydraulics Charts
- Opinion of Probable Construction Cost (OPCC)



CONVEYANCE CHANNEL SITE PLAN

SCALE: 1" = 1000'

0 1" 2"

PRELIMINARY DOCUMENTS

NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE, SALES, OR AS THE BASIS FOR PERMIT ISSUANCE.

GARLAND P. PENNISON, LA20931

ROBERT J. BEDUHN, LA38502

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION & RESTORATION AUTHORITY
ENGINEERING DIVISION
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

MID-BARATARIA SEDIMENT DIVERSION

STATE PROJECT NUMBER: BA-153

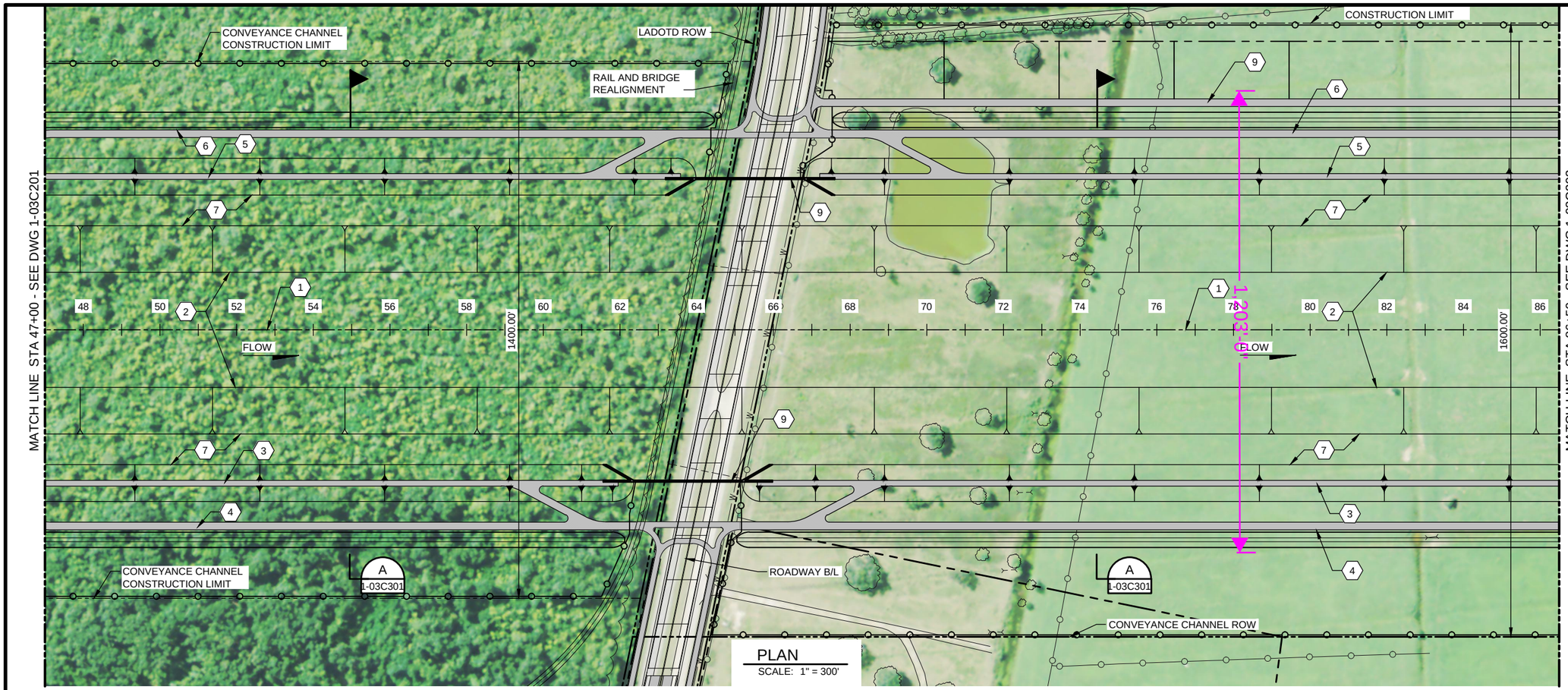
FEDERAL PROJECT NUMBER: BA-153

DRAWN BY: H. GARCIA | DESIGNED BY: G. PENNISON | APPROVED BY:

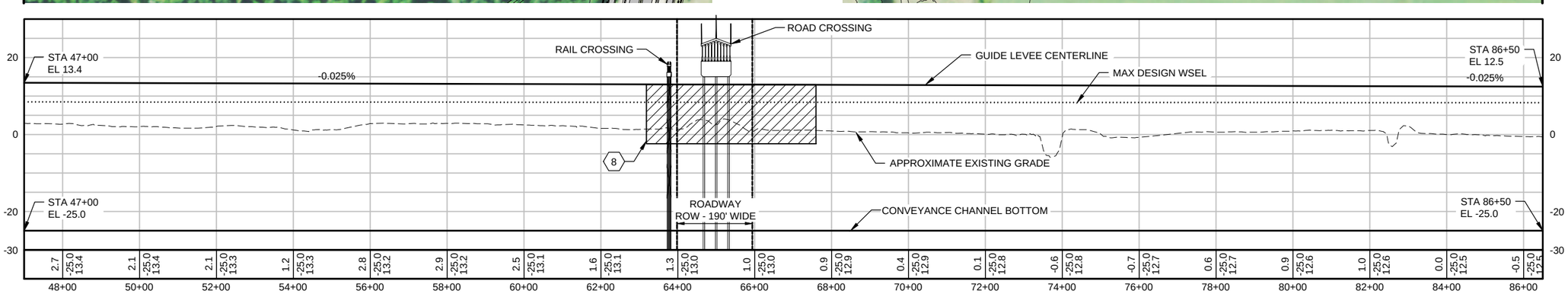
VOLUME 1
CIVIL
CONVEYANCE CHANNEL SITE PLAN

DATE: JULY 2014

DWG FIGURE 1 | SHT 1



PLAN
SCALE: 1" = 300'



PROFILE
HORIZ SCALE: 1" = 300'
VERT SCALE: 1" = 30'

NOTES:

1. SEE VOLUME 4 FOR ROADWAY IMPROVEMENTS AND VOLUME 5 FOR RAILROAD IMPROVEMENTS. SEE DRAWING 1-01E101 FOR RELOCATION OF ELECTRICAL UTILITIES AND DRAWING 1-13C101 FOR RELOCATION OF WATER UTILITIES IN THIS AREA.

KEY NOTES:

1. PROJECT CONVEYANCE BASELINE
2. CONVEYANCE CHANNEL TOE
3. NORTH GUIDE LEVEE
4. NORTH GUIDE LEVEE MAINTENANCE RD
5. SOUTH GUIDE LEVEE
6. SOUTH GUIDE LEVEE MAINTENANCE RD
7. STABILITY BERM
8. FLOODWALL EXTENDING UNDER BRIDGE CROSSING (T-WALL) DESIGN PENDING
9. CONTRACTOR YARD ROAD

LEGEND

APPROX EXISTING GRADE EL -4.2
-25.0 13.0
CONVEYANCE CHANNEL EL
GUIDE LEVEE EL
44+00 STATION VALUE

0 1" 2"

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HDR Engineering, Inc.

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MID-BARATARIA SEDIMENT DIVERSION

STATE PROJECT NUMBER: BA-153

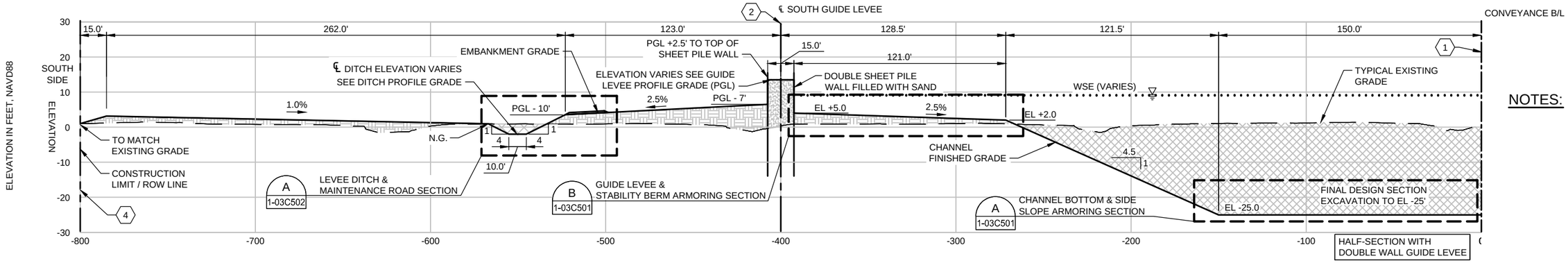
FEDERAL PROJECT NUMBER: BA-153

VOLUME 1
CIVIL
CONVEYANCE CHANNEL
PLAN AND PROFILE

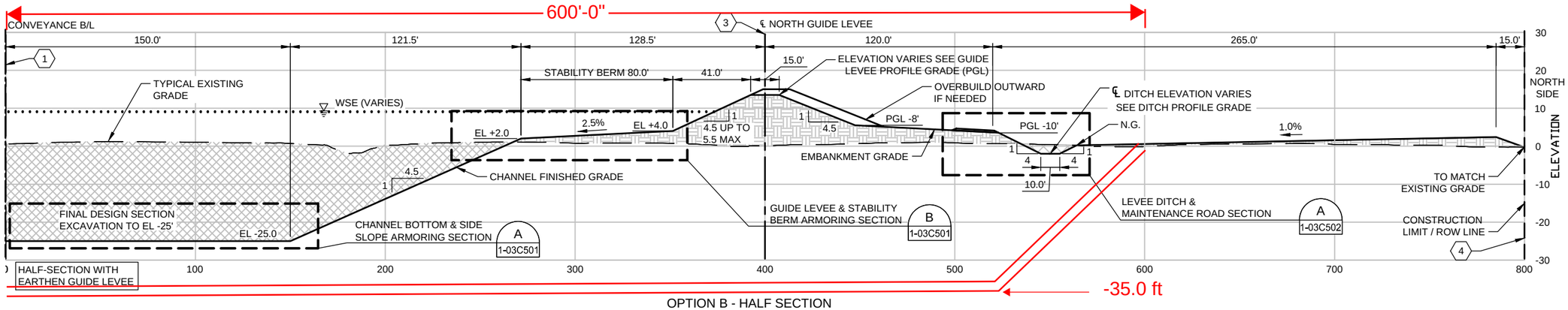
DATE: MARCH 2014

DWG 1-03C202 | SHT 70

FIGURE 2



OPTION A - HALF SECTION



OPTION B - HALF SECTION

PHASE 2 TYPICAL SECTION (LOOKING DOWNSTREAM) FROM STA 42+00 TO STA 125+00

A
-

HORIZ SCALE: 1" = 60'
VERT SCALE: 1" = 30'

NOTES:

KEY NOTES:

1. PROJECT B/L & ℄ CONVEYANCE CHANNEL
2. SOUTH GUIDE LEVEE
3. NORTH GUIDE LEVEE
4. CONSTRUCTION LIMIT / ROW LINE

LEGEND

- EARTHEN FILL AREA
- SAND FILL AREA
- EXCAVATION AREA

0 1" 2"

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW IT IS NOT TO BE USED FOR CONSTRUCTION OR ANY OTHER PURPOSE.

HDR Engineering, Inc.

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY — CPRA

COASTAL PROTECTION & RESTORATION AUTHORITY
ENGINEERING DIVISION
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

DRAWN BY: J. BEAUGH | DESIGNED BY: G. PENNISON | APPROVED BY:

MID-BARATARIA SEDIMENT DIVERSION

STATE PROJECT NUMBER: BA-153
FEDERAL PROJECT NUMBER: BA-153

VOLUME 1
CIVIL
CONVEYANCE CHANNEL TYPICAL SECTIONS

DATE: MARCH 2014
DWG 1-03C301 | SHT 73

FIGURE 3

Geotechnical Data

Boring NL-3A

Sample Description			GR CH4	GR CH4	GR SC w/shells	GR CH3
Depth			23	39	114	116
	in/No	mm	Percent Passing			
Sieve Size/No. (in/mm)	1 1/2 in	37.5				
	1 in	25				
	3/4 in	19				
	1/2 in	12.5				
	3/8 in	9.5				
	4	4.75				
	6					
	10	2				
	12					
	16					
	18					
	20	0.85				
	40	0.425				
	60	0.25				
	80					
	100					
	120					
	140	0.106				
	200	0.075	99.7	99.8	28.1	98.9
		0.035	*96*	*99.5*		
		0.023	*92*	*99.5*		
		0.013	*83*	*99.5*		
		0.009	*79*	*97*		
		0.007	*76*	*94*		
		0.003	*59*	*92.5*		
		0.001	*47*	*66*		

Hydrometer Evaluations

PT-2, 8-10 FT		PZ-4 (S3), 8-10 FT		PZ-8 (SB), 8-10 FT		PZ-11, 8-10 FT		PT-1, 10-12 FT	
Hydrometer Diameter (mm)	% Finer	Hydrometer Diameter (mm)	% Finer	Hydrometer Diameter (mm)	% Finer	Hydrometer Diameter (mm)	% Finer	Hydrometer Diameter (mm)	% Finer
0.0325	*53.0*	*0.028*	*83.0*	*0.03*	*63.0*	*0.03*	*69.0*	*0.03*	*87.0*
0.0225	*37.5*	*0.018*	*77.0*	*0.0215*	*41.5*	*0.0215*	*49.0*	*0.0215*	*76.5*
0.0135	*24.5*	*0.0125*	*67.0*	*0.0135*	*31.5*	*0.0135*	*34.5*	*0.0135*	*64.0*
0.0091	*21.0*	*0.008*	*60.5*	*0.0091*	*26.0*	*0.0091*	*28.5*	*0.0091*	*54.5*
0.0065	*17.0*	*0.005*	*53.0*	*0.0065*	*23.0*	*0.0065*	*24.0*	*0.0065*	*47.5*
0.0047	*13.0*	*0.0042*	*51.0*	*0.0047*	*19.0*	*0.0047*	*21.0*	*0.0047*	*40.5*
0.0033	*12.5*	*0.0029*	*44.5*	*0.0033*	*14.5*	*0.0033*	*18.5*	*0.0033*	*36.5*
0.0014	*12.5*	*0.0013*	*32.0*	*0.0014*	*13.0*	*0.0014*	*14.0*	*0.0014*	*32.0*

DRILLING LOG

DIVISION: N/A	INSTALLATION: N/A	SHEET 1 OF 8 SHEETS	
1. PROJECT: Mid Barataria Diversion (BA-153)	9. COORDINATE SYSTEM: SPCS83	HORIZONTAL: NAD83	VERTICAL: NAVD88
	10. SIZE AND TYPE OF BIT: 6"-3 blade step drag bit		
2. HOLE NUMBER: NL-3A	LOCATION COORDINATES: N 420422.85 E 3709176.05	11. MANUFACTURER'S DESIGNATION OF DRILL: CME850x Serial # 361982 Built 2008	
3. DRILLING AGENCY: Fugro Consultant, Inc.	12. TOTAL SAMPLES	DISTURBED: 3	UNDISTURBED: 32
4. NAME OF DRILLER: Tony Warren	13. TOTAL NUMBER CORE BOXES: 0		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG FROM VERTICAL: ---	BEARING: N/A	14. ELEVATION GROUND WATER: -4.1
	15. DATE BORING	STARTED: 5/21/13	COMPLETED: 5/23/13
6. THICKNESS OF OVERBURDEN: 132.0	16. ELEVATION TOP OF BORING: -4.1		
7. DEPTH DRILLED INTO ROCK: 0.0	17. TOTAL CORE RECOVERY FOR BORING: N/A		
8. TOTAL DEPTH OF BORING: 132.0	18. SIGNATURE AND TITLE OF INSPECTOR		

ELEV	DEPTH	Blows/0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
						CH2, stiff, dark gray & brown, with organics	67	S1						88		*Automatic 140lb hammer, falling 30 inches
-6.1	2.0															
						CHOA, very soft, dark gray, with peat						141	101	101		
														115		
-7.1	3.0					CHOB, very soft, dark gray						160	115	131		
-8.1	4.0													138		
						CH3, very soft, gray, with organics	82	S2								
												61	39	56		
														172		
-10.1	6.0															
						CH2, medium, gray, with silt strata or lenses								47		
-11.1	7.0															
						CH2, very soft, gray, with silt strata or lenses, with sand strata and lenses						51	29	53		C_v = 0.3 ft^2/day
-12.1	8.0													54		
		0				CL6, very soft, gray	100	S3						72		Blows per 0.5 feet is weight of hammer (WOH)
		0														
		0	0													
-14.1	10.0						100	S4						64		
						CH2, very soft, gray, with shells						60	39	67		
														78		
-15.4	11.3													98		
-15.9	11.8					Pt, soft, dark brown, with shells										
						CH2, very soft, gray								78		
							56	S5								
-17.8	13.7															
-18.1	14.0					CH4, very soft, gray, with organics										
						CH4, very soft, gray								89		C_v = 0.075 ft^2/day

0.0 2.5 5.0 7.5 10.0 12.5 15.0

ACE 1836-A (DRILLING LOG)-MVN-NOTES MID-BARATARIA DIVERSION 1.3.14 (2).GPJ USACE WITH RAPID CPT 2013_04_21.GDT 1/24/14

DRILLING LOG (Cont Sheet)

INSTALLATION: N/A

SHEET 2 OF 8 SHEETS

PROJECT: Mid Barataria Diversion (BA-153)

COORDINATE SYSTEM: SPCS83 | HORIZONTAL: NAD83 | VERTICAL: NAVD88

LOCATION COORDINATES: N 420422.85 E 3709176.05

ELEVATION TOP OF BORING: -4.1

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
						CH4, very soft, gray *(continued)*						94	66	95		
														103		
-20.1	16.0															
						CH2, very soft, gray	91	S6								
														93		
-21.1	17.0															
						CH2, very soft, gray, with silt strata or lenses						54	35	49		
														91		
-22.1	18.0															
-22.5	18.4					ML, medium dense, gray										
						CL4, soft, gray, with silt strata or lenses								37		
-23.1	19.0															
-23.6	19.5					ML, medium dense, gray, with clay strata or lenses										
						CL4, soft, gray, with silt strata or lenses						41	18	39		
							75	S7						50		
-25.1	21.0															
-25.4	21.3					CH4, soft, gray						74	50	72		
-25.8	21.7					ML, loose, gray										
						CH4, very soft, gray								83		
														77		
-27.1	23.0															
						CH4, soft, gray			0.0	0.3	99.7			75		%silt = 30; %clay = 69.7
							91	S8						85		
-29.1	25.0															
						CH4, soft, gray, with silt strata or lenses, with shells						99	68	87		C_v = 0.05 ft^2/day
														84		
														70		
														66		
-32.4	28.3						94	S9								
						CH2, soft, gray, with sand strata and lenses								64		
														65		
-34.1	30.0															
						CH4, very soft, gray, with organics, with sand strata and lenses, with silt strata or lenses								61		2-inch sand layer at 30 feet 2-inch sand layer at 30.5 feet 2-inch sand layer at 30.8 feet
												88	61	77		
																2-inch sand layer at 31.7 feet
							91	S10						42		

DRILLING LOG (Cont Sheet)

INSTALLATION: N/A		SHEET 3 OF 8 SHEETS
PROJECT: Mid Barataria Diversion (BA-153)	COORDINATE SYSTEM: SPCS83 / HORIZONTAL: NAD83 / VERTICAL: NAVD88	
LOCATION COORDINATES: N 420422.85 E 3709176.05	ELEVATION TOP OF BORING: -4.1	

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
														37		3-inch sand layer at 33.5 feet
-38.1	34.0					CH4, soft, gray, with sand strata and lenses						83	59	80		1-inch sand layer at 34.3 feet
														76		
-40.1	36.0					CH4, very soft, gray	92	S11						78		
														81		
-41.1	37.0					CH4, very soft, gray								82		
														61		
-43.1	39.0					CH4, soft, gray			0.0	0.7	99.3	101	73	71		%silt = 10; %clay = 89.3
-44.1	40.0					CH4, soft, gray	89	S12				72	50	58		
-44.9	40.8					CH4, soft, gray, with silt strata or lenses								72		
														70		
														67		
							94	S13						75		
-49.1	45.0					CH4, soft, gray						74	51	68		
-49.8	45.7					CH4, soft, gray, with silt strata or lenses								73		
-49.9	45.8					CH4, soft, gray								72		
														74		
							91	S14						70		
														71		
-54.1	50.0					CH4, soft, gray								63		

DRILLING LOG (Cont Sheet)

INSTALLATION: N/A

SHEET 4 OF 8 SHEETS

PROJECT: Mid Barataria Diversion (BA-153)

COORDINATE SYSTEM: SPCS83 | HORIZONTAL: NAD83 | VERTICAL: NAVD88

LOCATION COORDINATES: N 420422.85 E 3709176.05

ELEVATION TOP OF BORING: -4.1

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
						CH4, soft, gray *(continued)*										
							67	S15						54		
														55		
-59.1	55.0															
						CH4, soft, gray						79	55	62		
-60.1	56.0															
						CH4, medium, gray	91	S16						68		
														68		
														68		
-63.3	59.2															
-63.4	59.3					CH4, medium, gray, with silt strata or lenses								52		
						CH4, medium, gray	67	S17						55		
														56		
-67.1	63.0															
						CH4, medium, gray						77	49	56		
														57		C_v = 0.023 ft^2/day
							61	S18								
														58		
														57		
-71.1	67.0															
						CL6, medium, gray								64		
-72.1	68.0															
						CH2, soft, gray	53	S19								

DRILLING LOG (Cont Sheet)

INSTALLATION: N/A		SHEET 5 OF 8 SHEETS
PROJECT: Mid Barataria Diversion (BA-153)	COORDINATE SYSTEM: SPCS83 / HORIZONTAL: NAD83 / VERTICAL: NAVD88	
LOCATION COORDINATES: N 420422.85 E 3709176.05	ELEVATION TOP OF BORING: -4.1	

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
						CH2, soft, gray *(continued)*										
-75.1	71.0													64		
						CH2, medium, gray								52		
							90	S20						60		
														60		
														56		
-80.1	76.0													57		
						CH4, soft, gray	90	S21						64		
-81.1	77.0					CH4, medium, gray								60		
-82.1	78.0					CH4, medium, gray								56		
-83.1	79.0					CH4, medium, gray						94	65	64		
														66		
							80	S22								
-85.1	81.0					CH4, medium, gray, with silt strata or lenses								53		
-86.1	82.0					CH4, medium, gray, with silt strata or lenses						95	64	66		
-87.1	83.0					CH4, medium, gray								65		
							74	S23								
-89.5	85.4													53		
-89.9	85.8					SP, medium dense, gray										
-90.6	86.5					CH4, medium, gray						85	56	50		
-90.7	86.6					CH4, medium, gray, with silt strata or lenses										
-91.1	87.0					CH4, medium, gray										
						CH4, medium, gray, with silt strata or								57		

DRILLING LOG (Cont Sheet)

INSTALLATION	SHEET
N/A	6 OF 8 SHEETS

PROJECT	COORDINATE SYSTEM	HORIZONTAL	VERTICAL
Mid Barataria Diversion (BA-153)	SPCS83	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
N 420422.85 E 3709176.05	-4.1

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
-92.1	88.0					lenses										
						CH4, medium, gray, with silt strata or lenses	88	S24						54		
-93.1	89.0					CH4, medium, gray										
														55		
-94.1	90.0					CH4, stiff, gray										
														60		
							55	S25								
-97.9	93.8					CH4, medium, gray						86	57			
-99.1	95.0					CH4, medium, gray, with silt strata or lenses								59		
-100.1	96.0					CH4, medium, gray	92	S26								
-101.1	97.0					CH4, stiff, gray						90	62	59		
														56		
-103.6	99.5															
-103.8	99.7					CH4, stiff, gray, with silt strata or lenses										
-104.1	100.0					CH4, stiff, gray										
						CH4, medium, gray	85	S27						54		
-105.1	101.0															
-105.2	101.1					CH4, medium, gray, with silt strata or lenses								57		
-106.1	102.0					CH4, medium, gray										
						CH4, medium, gray										
-107.1	103.0															
-107.4	103.3					CH4, medium, gray						85	58	54		
-107.6	103.5					CH4, medium, gray, with silt strata or lenses										
-108.1	104.0					CH4, medium, gray	56	S28								
						CH4, medium, gray										
-110.1	106.0															1-inch sand layer at 105.2 feet 2-inch sand layer at 105.7

90.0
92.5
95.0
97.5
100.0
102.5
105.0

DRILLING LOG (Cont Sheet)

INSTALLATION: N/A

SHEET 7 OF 8 SHEETS

PROJECT: Mid Barataria Diversion (BA-153)

COORDINATE SYSTEM: SPCS83 | HORIZONTAL: NAD83 | VERTICAL: NAVD88

LOCATION COORDINATES: N 420422.85 E 3709176.05

ELEVATION TOP OF BORING: -4.1

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
						CH3, medium, gray, with silt strata or lenses, with shells *(continued)*						72	47	48		feet
-111.1	107.0															2-inch sand layer at 105.8 feet
						CH4, medium, gray										
-112.1	108.0															
						CH3, medium, gray	84	S29						57		
-113.1	109.0															
						CH3, medium, gray						72	42	56		
														52		
-115.1	111.0															
-115.3	111.2					CH3, medium, gray, with silt strata or lenses								53		
-115.9	111.8					CH3, medium, gray										
						SP, loose, gray, with shells	80	S30								2-inch sand layer at 111.8 feet
														35		
-118.1	114.0															
		6				SC, medium dense, gray, with shells		S31	0.0	71.9	28.1			24		
		14												25		
		12	26	39												
-120.1	116.0															
		3				CH4, stiff, gray, with shells	100	S32	0.0	1.1	98.9			58		
		4														
		7	11	17												
-124.1	120.0															
						CH4, stiff, gray, with shells	90	S33								
														63		
-125.1	121.0															
-125.6	121.5					CH4, stiff, gray, with shell fragments						105	74	66		C_v = 0.033 ft^2/day
-125.7	121.6					CH4, stiff, gray, with shell fragments, with silt strata or lenses										
						CH4, stiff, gray, with shell fragments										
-128.1	124.0															
						CH4, stiff, gray	92	S34								

DRILLING LOG (Cont Sheet)

INSTALLATION	SHEET 8 OF 8 SHEETS
N/A	

PROJECT	COORDINATE SYSTEM	HORIZONTAL	VERTICAL
Mid Barataria Diversion (BA-153)	SPCS83	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
N 420422.85 E 3709176.05	-4.1

ELEV	DEPTH	Blows/ 0.5 ft	N_f	N_{60}	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: Gravel	Sand	Fines	LL	PI	MC	ASTM Class	REMARKS
						CH4, stiff, gray *(continued)*										
-130.9	126.8													64		
-131.1	127.0					CH4, stiff, gray, with silt strata or lenses										
						CH4, stiff, gray										
-132.1	128.0															
						CH4, medium, gray, with silt strata or lenses	72	S35								
-134.1	130.0													63		
						CH4, stiff, gray										
-135.1	131.0													62		
						CH4, stiff, gray, with shell fragments						104	76	62		
-136.1	132.0															

125.0
127.5
130.0

Stokes' Law Evaluation

Calculated by: MKR
Date: 23-May-14
Checked by:
Date:

Purpose: This spreadsheet predicts the velocity of a particle settling through a column of fluid

Stokes' Law Assumptions:

1) flow is laminar
2) particles are spherical
3) material is homogeneous
4) surfaces are smooth
5) particles are isolated and do not interfere with each other

significant departures from predicted velocities occur for particles above a size of 100 um and 200 um for high and low density particles (4)
thus if calculated settling exceeds 3 mm/s, it should be assumed Sokes law does not apply (4)
Stokes law is nearly always adequate for particles smaller than about 50 um (4)
Stokes can overestimate settling velocity by a factor of 10 for particle sizes greater than 1mm (4)

$$v_s = \frac{2}{9}\frac{(\rho_p - \rho_f)}{\mu} g\, R^2$$ (1)

v_s	settling velocity (m/s)
g	gravitational acceleration (m/s2)
ρ_p	mass density of the sphere (kg/m^3)
ρ_f	mass density of the fluid (kg/m^3)
μ	dynamic viscosity (kg /m*s) or (Pa s)
R	radius of the spherical object (m)

g =	9.81	m/s2	gravitational constant
S.G.=	2.65		as discussed with Mark Stanley (HDR)
ρ_p =	165.36	lb/ft^3	as discussed with Mark Stanley (HDR)
	2645.248815	kg/m3	calculated based on S.G.
ρ_f =	998.2071	kg/m^3	(3)
μ =	0.001002	Pa s	(2)(need confirmation from original source)
R=	0.002	mm	as discussed with Mark Stanley (HDR); lower limit for clay
	0.000002	m	converted from mm

Settling Velocity (m/s)	Radius of Sphere (m)	Radius of Sphere (mm)	Diameter of Sphere (mm)	Diameter of Sphere (um)	Settling Velocity (mm/s)	Settling Velocity (ft/s)	Settling Velocity (in/s)
0.00000004	0.0000001	0.0001	0.0002	0.20	0.00004	1.2E-07	1.41E-06
0.00000014	0.0000002	0.0002	0.0004	0.40	0.00014	4.7E-07	5.64E-06
0.00000057	0.0000004	0.0004	0.0008	0.80	0.00057	1.9E-06	2.26E-05
0.00000129	0.0000006	0.0006	0.0012	1.20	0.00129	4.2E-06	5.08E-05
0.00000229	0.0000008	0.0008	0.0016	1.60	0.00229	7.5E-06	9.03E-05
0.00000358	0.000001	0.001	0.002	2.00	0.00358	1.2E-05	1.41E-04
0.00001433	0.000002	0.002	0.004	4.00	0.01	4.7E-05	5.64E-04
0.00005733	0.000004	0.004	0.008	8.00	0.06	1.9E-04	2.26E-03
0.00012900	0.000006	0.006	0.012	12.00	0.13	4.2E-04	5.08E-03
0.00022934	0.000008	0.008	0.016	16.00	0.23	7.5E-04	9.03E-03
0.00035834	0.00001	0.010	0.02	20.00	0.36	1.2E-03	1.41E-02
0.00070234	0.000014	0.014	0.028	28.00	0.70	2.3E-03	2.77E-02
0.00116102	0.000018	0.018	0.036	36.00	1.16	3.8E-03	4.57E-02
0.00173436	0.000022	0.022	0.044	44.00	1.73	5.7E-03	6.83E-02
0.00242237	0.000026	0.026	0.052	52.00	2.42	7.9E-03	9.54E-02
0.00322505	0.00003	0.030	0.06	60.00	3.23	1.1E-02	1.27E-01
0.00414239	0.000034	0.034	0.068	68.00	4.14	1.4E-02	1.63E-01
0.00503913	0.0000375	0.038	0.075	75.00	5.04	1.7E-02	1.98E-01

Clays
Silts
Stokes Law Accurate
Stokes Law Less Accurate *

* velocities highlighted in orange exceed 3 mm/s; per (4) the Stokes' Law equation may not predict settlement velocity accurately

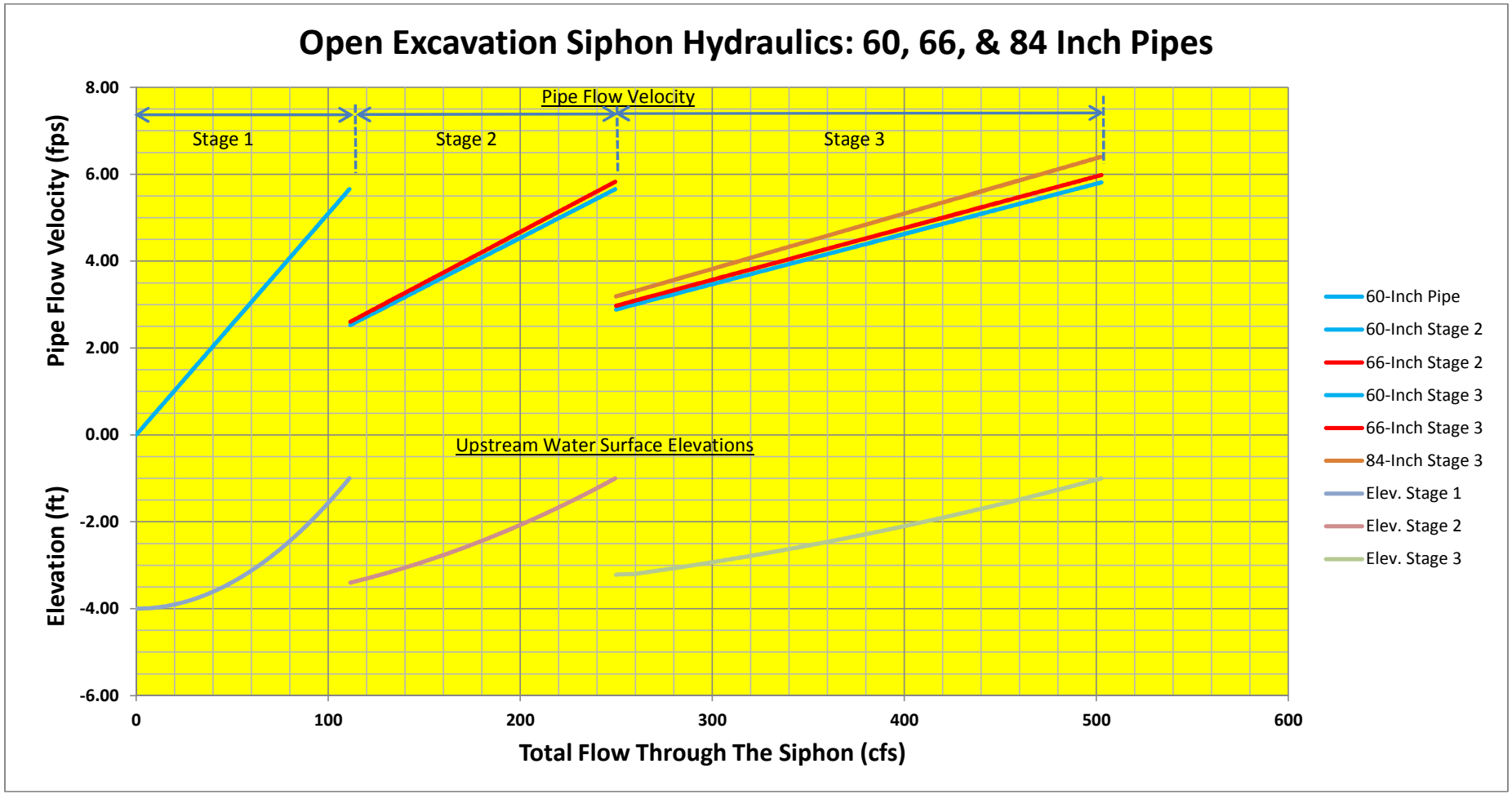
References

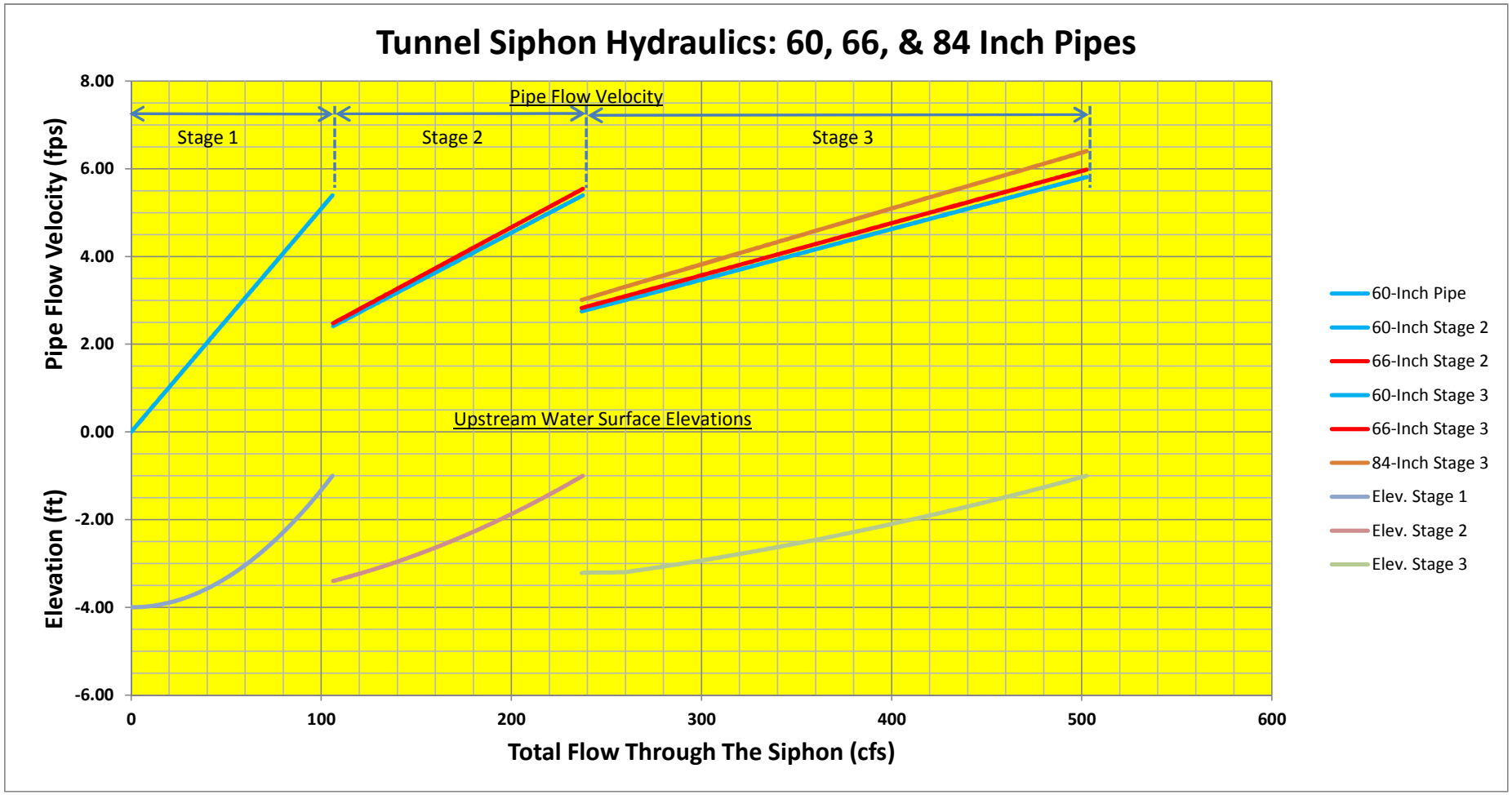
(1) Lamb, H. (1994). *Hydrodynamics* (6th edition ed.). Cambridge University Press. ISBN 978-0-521-45868-9.

(2) Serway, Raymond A. (1996). *Physics for Scientists & Engineers* (4th ed.). Saunders College Publishing. ISBN 0-03-005932-1.

(3) http://www.engineeringtoolbox.com/water-density-specific-weight-d_595.html

(4) Gregory, J. (2006). *Particles in Water: Properties and Processes* , page 24.


Open Excavation Siphon Hydraulics: 60, 66, & 84 Inch Pipes
Pipe Flow Velocity
Stage 1
Stage 2
Stage 3
Upstream Water Surface Elevations
Pipe Flow Velocity (fps)
Elevation (ft)
Total Flow Through The Siphon (cfs)
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
0
100
200
300
400
500
600
60-Inch Pipe
60-Inch Stage 2
66-Inch Stage 2
60-Inch Stage 3
66-Inch Stage 3
84-Inch Stage 3
Elev. Stage 1
Elev. Stage 2
Elev. Stage 3


Tunnel Siphon Hydraulics: 60, 66, & 84 Inch Pipes
Pipe Flow Velocity
Stage 1
Stage 2
Stage 3
Upstream Water Surface Elevations
Pipe Flow Velocity (fps)
Elevation (ft)
Total Flow Through The Siphon (cfs)
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
0
100
200
300
400
500
600
60-Inch Pipe
60-Inch Stage 2
66-Inch Stage 2
60-Inch Stage 3
66-Inch Stage 3
84-Inch Stage 3
Elev. Stage 1
Elev. Stage 2
Elev. Stage 3

ESTIMATE SUMMARY (COSTS)

Bid # / Bid Description	Engr Bid#	Quantity	Unit	Manhrs /Unit	Direct Labor	Perm Matl	Constr Matl	Equip-Ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Biditem U. Cost
10		1,200.000	LF	1,628	71,215	499,200	2,296	67,699		640,410	165,499	805,909	671.59
PCCP PIPE 60"				1.36	59.35	416.00	1.91	56.42		533.67	137.92		
20		1,200.000	LF	1,680	73,488	561,600	2,368	69,873		707,329	182,793	890,122	741.77
PCCP PIPE 66"				1.40	61.24	468.00	1.97	58.23		589.44	152.33		
30		1,200.000	LF	1,825	79,895	705,120	2,572	76,001		863,587	223,174	1,086,761	905.63
PCCP PIPE 84"				1.52	66.58	587.60	2.14	63.33		719.66	185.98		
40		43,301.000	CY	2,887	152,969		4,619	201,010		358,597	92,671	451,268	10.42
EXCAVATION FOR PIPE				0.07	3.53		0.11	4.64		8.28	2.14		
50		78,600.000	SF	17,852	820,298		1,650,244	1,161,343		3,631,885	938,577	4,570,462	58.15
SUPPORT OF EARTH				0.23	10.44		21.00	14.78		46.21	11.94		
60		1,984.000	CY			57,774				57,774	14,930	72,704	36.65
PIPE BEDDING						29.12				29.12	7.53		
70		7,600.000	CY	1,800	87,205	174,637	2,304	63,896		328,042	84,775	412,816	54.32
PIPE SELECT BACKFILL				0.24	11.47	22.98	0.30	8.41		43.16	11.15		
80		30,080.000	CY	1,440	64,204			138,690		202,894	52,433	255,327	8.49
PIPE CHANNEL BACKFILL				0.05	2.13			4.61		6.75	1.74		
90		13,222.000	CY						132,220	132,220	34,169	166,389	12.58
OFF-HAUL EXCESS									10.00	10.00	2.58		
110		3.000	EA						1,500,000	1,500,000	387,640	1,887,640	629,213.48
CONTROL STRUCTURES & GATES									500,000.00	500,000.00	129,213.48		
120		250,000.000	CY	7,694	390,476		192,311	583,914		1,166,702	301,507	1,468,209	5.87
DISCHARGE CHANNEL				0.03	1.56		0.77	2.34		4.67	1.21		
130		1.000	EA						35,000	35,000	9,045	44,045	44,044.94
SEDIMENATATIONS PONDS									35,000.00	35,000.00	9,044.94		
				36,807	1,739,749	1,998,331	1,856,713	2,362,426	1,667,220	9,624,440	2,487,215	12,111,654	
TOTALS:				36,807	1,739,749	1,998,331	1,856,713	2,362,426	1,667,220	9,624,440	2,487,215	12,111,654	

-------- ESTIMATE NOTES: --------

Bid Date: 11/22/2013 Owner: ME-NH DOT Engineering Firm: HDR
Estimator-In-Charge:

Sort= 4 HoldAcct= N Subitems= N NonAdd= N

** in front of the Biditem indicates a Non-Additive item

ESTIMATE SUMMARY (COSTS)

Bid # / Bid Description	Engr Bid#	Quantity	Unit	Manhrs /Unit	Direct Labor	Perm Matl	Constr Matl	Equip-Ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Biditem U. Cost

Last Summary on 05/27/2014 at 3:00 PM.
Last Spread on 05/27/2014 at 3:00 PM.

ESTIMATE SUMMARY (COSTS)

Bid # / Bid Description	Engr Bid#	Quantity	Unit	Manhrs /Unit	Direct Labor	Perm Matl	Constr Matl	Equip-Ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Biditem U. Cost
1000		3,600.000	LF	24,787	1,291,295	1,024,596	4,261,401	849,677	446,600	7,873,569	2,982,510	10,856,079	3,015.58
TUNNEL ALTERNATE 1				6.89	358.69	284.61	1,183.72	236.02	124.06	2,187.10	828.48		
1002		*1.000*	*LS*				*800,000*			*800,000*			
TUNNEL MOBILIZATION							*800,000.00*			*800,000.00*			
1004		*1.000*	*LS*	*290*	*14,427*		*7,378*	*9,158*		*30,963*			
EROSION & SEDIMENTATION				*290.00*	*14,427.43*		*7,377.60*	*9,158.01*		*30,963.04*			
1010		*3,600.000*	*LF*	*17,566*	*914,361*	*70,596*	*2,322,658*	*636,961*	*116,600*	*4,061,176*			
EPB TUNNEL				*4.88*	*253.99*	*19.61*	*645.18*	*176.93*	*32.39*	*1,128.10*			
1020		*3,600.000*	*TF*	*69*	*2,761*		*103,271*	*785*		*106,818*			
RAIL WRITE-OFF AND UNLOAD				*0.02*	*0.77*		*28.69*	*0.22*		*29.67*			
1030		*1.000*	*LS*	*312*	*13,511*		*1,579*	*142*		*15,232*			
VENT SYSTEM IN AND OUT				*312.49*	*13,510.72*		*1,579.36*	*141.50*		*15,231.58*			
1040		*120.000*	*LF*	*95*	*4,103*		*3,005*	*56*		*7,164*			
SIDING AT SHAFT				*0.79*	*34.19*		*25.04*	*0.47*		*59.70*			
1050		*3,600.000*	*LF*	*6,454*	*342,131*	*954,000*	*1,023,510*	*202,574*		*2,522,216*			
PCCP PIPE IN				*1.79*	*95.04*	*265.00*	*284.31*	*56.27*		*700.62*			
1060		*3.000*	*LOC*						*330,000*	*330,000*			
PORTAL DEVELOP									*110,000.00*	*110,000.00*			
1500		3.000	EA	1,613	79,713		140,453	29,144	302,851	552,161	209,159	761,320	253,773.44
SHAFT-SITE ALTERNATE 1				537.76	26,571.14		46,817.59	9,714.61	100,950.46	184,053.80	69,719.64		
1504		*3.000*	*EA*						*300,000*	*300,000*			
PORTAL STABILIZATION									*100,000.00*	*100,000.00*			
1510		*3.000*	*LS*	*486*	*24,963*		*81,560*	*14,854*		*121,377*			
GRADE SITE FOR SHAFT				*161.98*	*8,320.95*		*27,186.82*	*4,951.22*		*40,458.99*			
1560		*7,200.000*	*SF*	*720*	*35,337*		*12,907*	*13,619*		*61,864*			
BOTTOM PLATFORM				*0.10*	*4.91*		*1.79*	*1.89*		*8.59*			
1590		*7,200.000*	*SF*	*407*	*19,413*		*45,985*	*671*	*2,851*	*68,921*			
MUDSLAB-WORK PLATFORM				*0.06*	*2.70*		*6.39*	*0.09*	*0.40*	*9.57*			
2000		1.000		7,694	430,787		203,111	449,322	1,535,000	2,618,220	991,782	3,610,002	3,610,002.14
OTHER FACILITIES				7,694.46	430,787.06		203,111.12	449,321.50	1,535,000.00	2,618,219.68	991,782.46		
2100		*1.000*	*EA*						*35,000*	*35,000*			
SEDIMENATATIONS PONDS									*35,000.00*	*35,000.00*			
2200		*3.000*	*EA*		*1*			*1*	*1,500,000*	*1,500,001*			
CONTROL STRUCTURES & GATES					*0.20*		*0.01*	*0.24*	*500,000.00*	*500,000.44*			
2300		*250,000.000*	*CY*	*7,694*	*430,786*		*203,111*	*449,321*		*1,083,218*			

ESTIMATE SUMMARY (COSTS)

Bid # / Bid Description	Engr Bid#	Quantity	Unit	Manhrs /Unit	Direct Labor	Perm Matl	Constr Matl	Equip-Ment	Sub-Contr	Direct Total	Indirect Charge	Total Cost	Biditem U. Cost
DISCHARGE CHANNEL				*0.03*	*1.72*		*0.81*	*1.80*		*4.33*			
				34,095	1,801,795	1,024,596	4,604,965	1,328,142	2,284,451	11,043,950	4,183,452	15,227,401	
TOTALS:				34,095	1,801,795	1,024,596	4,604,965	1,328,142	2,284,451	11,043,950	4,183,452	15,227,401	
FIELD OVERHEAD				8,698	1,059,500		553,530	158,160		1,771,190			
COST TOTALS	=====>			42,793	2,861,295	1,024,596	5,158,495	1,486,302	2,284,451	12,815,140	2,412,260	15,227,401	

-------- ESTIMATE NOTES: --------

Bid Date: Owner: Engineering Firm:
Estimator-In-Charge:

Sort= 4 HoldAcct= N Subitems= Y NonAdd= N

** in front of the Biditem indicates a Non-Additive item
Last Summary on 05/27/2014 at 2:56 PM.
Last Spread on 05/27/2014 at 2:56 PM.

NOTE: Biditems that are subitems (have a parent biditem) are printed in italics.

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Perm Labor	Constr Material	Equipme Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 10	Land Item	SCHEDULE: 1 100										
Description = PCCP PIPE 60"				Unit = LF		Takeoff Quan: 1,200.000		Engr Quan: 1,200.000				
1000	BUY				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
PRICE RSM PAGE 337												
2PCCP60	PCCP PIPE 60@104	1.00	1,200.00	LF	350.000		436,800					436,800
2PCCPM	MISC FOR PIPE@10	1.00	1,200.00	LF	50.000		62,400					62,400
$499,200.00					[ ]		499,200					499,200
							416.00					416.00
1002	UNLOAD AND HANDLE				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
TRUCK TO ON GROUND												
AABLNK	SET-UP CREW				40.00 CH	Prod: 30.0000 UH		Lab Pcs: 2.00		Eqp Pcs: 1.00		
3ST	Small Tools and Misc	1.00	80.00	CMH	1.600			128				128
8LR980	Caterpillar 980 Loade	1.00	40.00	HR	61.673				1,289	1,178		2,467
L2	Laborer Skilled	1.00	40.00	MH	18.300	1,239						1,239
OPLD	Loader Operator	1.00	40.00	MH	26.150	1,770						1,770
$5,603.29	0.0666 MH/LF		80.0000	MH	[1.63]	3,008		128	1,289	1,178		5,603
30.0000	Units/H*	300.0000	Un/Shift	15.0000	Unit/M	2.51		0.11	1.07	0.98		4.67
1010	LAY PIPE				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
GO TO 5 JOINTS AT 12 FOOT EACH PER SHIFT												
***												
AABLNK	SET-UP CREW				193.54 CH	Prod: 62.0000 US		Lab Pcs: 8.00		Eqp Pcs: 8.00		
3ST	Small Tools and Misc	1.00	1,354.84	CMH	1.600			2,168				2,168
8AC185	Air compressor, 185	1.00	193.55	HR	13.154				732	1,814		2,546
8ACTUG	Air tugger,Dbl.Drm,8	1.00	193.55	HR	8.393				1,320	305		1,624
8BH330	Backhoe, Cat 330 2.0	1.00	193.55	HR	100.482				9,897	9,551		19,448

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 10				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE 60"					Unit = LF	Takeoff Quan: 1,200.000			Engr Quan: 1,200.000			
8CC150	Crane, 150 ton crawle	1.00	193.55	HR	156.953				18,558	11,820		30,378
8MISRT	RT Extendable Boom	1.00	193.55	HR	33.666				3,299	3,217		6,516
8RCRMX	Ramex Roller	1.00	193.55	HR	9.053				1,094	658		1,752
8RCTMP	Hand tamp,vibro plate	1.00	193.55	HR	3.263				275	357		632
8TKPU4	Pickup 4x4	1.00	193.55	HR	12.068				825	1,511		2,336
L2	Laborer Skilled	4.00	774.19	MH	18.300	23,972						23,972
OP1	Operator Foreman	1.00	193.55	MH	40.000	17,774						17,774
OPBH	Backhoe Operator	1.00	193.55	MH	26.150	8,564						8,564
OPCR+	Crane Operator over 6	1.00	193.55	MH	28.500	9,333						9,333
OPLD	Loader Operator	1.00	193.55	MH	26.150	8,564						8,564
$135,606.44	1.2903 MH/LF		1,548.3900	MH	[34.419]	68,206		2,168	36,000	29,233		135,606
6.2003 Units/H	62.0027 Un/Shift *		0.7750	Unit/M		56.84		1.81	30.00	24.36		113.01
=====> Item Totals:	10 - PCCP PIPE 60"											
$640,409.73	1.3569 MH/LF		1,628.39	MH	[36.049]	71,215	499,200	2,296	37,289	30,411		640,410
533.675	1200 LF					59.35	416.00	1.91	31.07	25.34		533.67

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 20				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE 66"					Unit = LF	Takeoff Quan: 1,200.000		Engr Quan: 1,200.000				
1000	BUY				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
2PCCP66	PIPE PCCP 66@104	1.00	1,200.00	LF	400.000		499,200					499,200
2PCCPM	MISC FOR PIPE@10	1.00	1,200.00	LF	50.000		62,400					62,400
$561,600.00					[ ]		561,600					561,600
							468.00					468.00
1002	UNLOAD AND HANDLE				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
												**Unreviewed
TRUCK TO ON GROUND												
AABLNK	SET-UP CREW				40.00 CH	Prod: 30.0000 UH		Lab Pcs: 2.00		Eqp Pcs: 1.00		
3ST	Small Tools and Misc	1.00	80.00	CMH	1.600			128				128
8LR980	Caterpillar 980 Loade	1.00	40.00	HR	61.673				1,289	1,178		2,467
L2	Laborer Skilled	1.00	40.00	MH	18.300	1,239						1,239
OPLD	Loader Operator	1.00	40.00	MH	26.150	1,770						1,770
$5,603.29	0.0666 MH/LF		80.0000	MH	[1.63]	3,008		128	1,289	1,178		5,603
30.0000	Units/H*	300.0000	Un/Shift	15.0000	Unit/M	2.51		0.11	1.07	0.98		4.67
1010	LAY PIPE				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
												**Unreviewed
GO TO 5 JOINTS AT 12 FOOT EACH PER SHIFT												
***												
AABLNK	SET-UP CREW				200.00 CH	Prod: 60.0000 US		Lab Pcs: 8.00		Eqp Pcs: 8.00		
3ST	Small Tools and Misc	1.00	1,400.00	CMH	1.600			2,240				2,240
8AC185	Air compressor, 185	1.00	200.00	HR	13.154				757	1,874		2,631
8ACTUG	Air tugger,Dbl.Drm,8	1.00	200.00	HR	8.393				1,364	315		1,679
8BH330	Backhoe, Cat 330 2.0	1.00	200.00	HR	100.482				10,227	9,869		20,096
8CC150	Crane, 150 ton crawle	1.00	200.00	HR	156.953				19,176	12,214		31,391

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 20				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE 66"					Unit = LF	Takeoff Quan: 1,200.000			Engr Quan: 1,200.000			
8MISRT	RT Extendable Boom	1.00	200.00	HR	33.666				3,409	3,324		6,733
8RCRMX	Ramex Roller	1.00	200.00	HR	9.053				1,131	680		1,811
8RCTMP	Hand tamp,vibro plate	1.00	200.00	HR	3.263				284	369		653
8TKPU4	Pickup 4x4	1.00	200.00	HR	12.068				852	1,561		2,414
L2	Laborer Skilled	4.00	800.00	MH	18.300	24,771						24,771
OP1	Operator Foreman	1.00	200.00	MH	40.000	18,366						18,366
OPBH	Backhoe Operator	1.00	200.00	MH	26.150	8,849						8,849
OPCR+	Crane Operator over 6	1.00	200.00	MH	28.500	9,644						9,644
OPLD	Loader Operator	1.00	200.00	MH	26.150	8,849						8,849
$140,126.00	1.3333 MH/LF		1,600.0000	MH	[35.567]	70,480		2,240	37,200	30,207		140,126
6.0000 Units/H	60.0000 Un/Shift *		0.7500	Unit/M		58.73		1.87	31.00	25.17		116.77
=====> Item Totals:	20 - PCCP PIPE 66"											
$707,329.29	1.4000 MH/LF		1,680.00	MH	[37.197]	73,488	561,600	2,368	38,488	31,385		707,329
589.441	1200 LF					61.24	468.00	1.97	32.07	26.15		589.44

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 30				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE 84"					Unit = LF	Takeoff Quan: 1,200.000		Engr Quan: 1,200.000				
1000	PCCP PIPE 84"				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
2PCCP84	PIPE PCCP 84@104	1.00	1,200.00	LF	515.000		642,720					642,720
2PCCPM	MISC FOR PIPE@10	1.00	1,200.00	LF	50.000		62,400					62,400
$705,120.00					[ ]		705,120					705,120
							587.60					587.60
1002	UNLOAD AND HANDLE				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
												**Unreviewed
TRUCK TO ON GROUND												
AABLNK	SET-UP CREW				40.00 CH	Prod: 30.0000 UH		Lab Pcs: 2.00		Eqp Pcs: 1.00		
3ST	Small Tools and Misc	1.00	80.00	CMH	1.600			128				128
8LR980	Caterpillar 980 Loade	1.00	40.00	HR	61.673				1,289	1,178		2,467
L2	Laborer Skilled	1.00	40.00	MH	18.300	1,239						1,239
OPLD	Loader Operator	1.00	40.00	MH	26.150	1,770						1,770
$5,603.29	0.0666 MH/LF		80.0000	MH	[1.63]	3,008		128	1,289	1,178		5,603
30.0000	Units/H*	300.0000	Un/Shift	15.0000	Unit/M	2.51		0.11	1.07	0.98		4.67
1010	LAY PIPE				Quan: 1,200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
												**Unreviewed
GO TO 5 JOINTS AT 12 FOOT EACH PER SHIFT												
***												
AABLNK	SET-UP CREW				218.18 CH	Prod: 55.0000 US		Lab Pcs: 8.00		Eqp Pcs: 8.00		
3ST	Small Tools and Misc	1.00	1,527.27	CMH	1.600			2,444				2,444
8AC185	Air compressor, 185	1.00	218.18	HR	13.154				826	2,044		2,870
8ACTUG	Air tugger,Dbl.Drm,8	1.00	218.18	HR	8.393				1,488	344		1,831
8BH330	Backhoe, Cat 330 2.0	1.00	218.18	HR	100.482				11,157	10,766		21,923
8CC150	Crane, 150 ton crawle	1.00	218.18	HR	156.953				20,919	13,325		34,244

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 30				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE 84"					Unit = LF	Takeoff Quan: 1,200.000			Engr Quan: 1,200.000			
8MISRT	RT Extendable Boom	1.00	218.18	HR	33.666				3,719	3,626		7,345
8RCRMX	Ramex Roller	1.00	218.18	HR	9.053				1,233	742		1,975
8RCTMP	Hand tamp,vibro plate	1.00	218.18	HR	3.263				310	402		712
8TKPU4	Pickup 4x4	1.00	218.18	HR	12.068				930	1,703		2,633
L2	Laborer Skilled	4.00	872.73	MH	18.300	27,023						27,023
OP1	Operator Foreman	1.00	218.18	MH	40.000	20,035						20,035
OPBH	Backhoe Operator	1.00	218.18	MH	26.150	9,654						9,654
OPCR+	Crane Operator over 6	1.00	218.18	MH	28.500	10,521						10,521
OPLD	Loader Operator	1.00	218.18	MH	26.150	9,654						9,654
$152,863.63	1.4545 MH/LF	1,745.4500		MH	[38.8]	76,887		2,444	40,581	32,952		152,864
5.5000 Units/H	55.0005 Un/Shift *	0.6875		Unit/M		64.07		2.04	33.82	27.46		127.39
=====> Item Totals:	30 - PCCP PIPE 84"											
$863,586.92	1.5212 MH/LF	1,825.45		MH	[40.43]	79,895	705,120	2,572	41,870	34,131		863,587
719.656	1200 LF					66.58	587.60	2.14	34.89	28.44		719.66

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 40				Land Item	SCHEDULE: 1 100							
Description = EXCAVATION FOR PIPE				Unit = CY	Takeoff Quan: 43,301.000		Engr Quan: 43,301.000					
1000	EXCAVATION FOR PIPE		Quan: 43,301.00	CY	Hrs/Shft: 10.00	Cal: 50	WC: WATER					
AABLNK	SET-UP CREW		721.68	CH	Prod: 60.0000 UH	Lab Pcs: 4.00		Eqp Pcs: 3.00				
3ST	Small Tools and Misc	1.00	2,886.73	CMH	1.600			4,619				4,619
8BH345	Backhoe, Cat 345 2.2	1.00	721.68	HR	174.327				55,930	69,878		125,808
8DZ06	Cat D6 Dozer	1.00	721.68	HR	92.135				38,749	27,743		66,492
8TKPU4	Pickup 4x4	1.00	721.68	HR	12.068				3,075	5,634		8,709
L2	Laborer Skilled	1.00	721.68	MH	18.300	22,346						22,346
OP1	Operator Foreman	1.00	721.68	MH	40.000	66,272						66,272
OPBH	Backhoe Operator	1.00	721.68	MH	26.150	31,931						31,931
OPDZ	Dozer Operator	1.00	721.68	MH	26.550	32,420						32,420
$358,596.73	0.0666 MH/CY		2,886.7200	MH	[2.035]	152,969		4,619	97,754	103,255		358,597
60.0003 Units/H*			600.0028 Un/Shift		15.0001 Unit/M	3.53		0.11	2.26	2.38		8.28
=====> Item Totals:	40 - EXCAVATION FOR PIPE											
$358,596.73	0.0666 MH/CY		2,886.72	MH	[2.035]	152,969		4,619	97,754	103,255		358,597
8.281	43301 CY					3.53		0.11	2.26	2.38		8.28

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 50				Land Item	SCHEDULE: 1 100							
Description = SUPPORT OF EARTH				Unit = SF	Takeoff Quan: 78,600.000			Engr Quan: 78,600.000				
1000	MATERIALS		Quan: 107,400.80	SF	Hrs/Shft: 10.00		Cal: 50	WC: WATER				
								**Unreviewed				
BUY 35% OF SHEETPILE AND WRITE-OFF												
ADD 20 FOOT FOR TOE												
**********												
55 foot x 2 x 1,200 lf in length = 3,564,000 and with reuse = 1,188,000 lb buy												
2SPAS500	SHEETPILE AS 500-	1.00	0.00	LB	0.750							
3CO16	COFFERDAM EXPE	1.00	107,400.80	SF	1.000			107,401				107,401
3COF20	COFFERDAM BRA	1.00	0.00	LB	1.010							
3COF30	Spud Pile	1.00	0.00	LB	0.550							
3PS27	SHEETPILE PZ-27	1.00	1,188,000.00	LB	0.750			891,000				891,000
3SPBR	BRACING BUY (35	1.00	535,000.00	LB	1.200			642,000				642,000
3SPTEMP	PILE TEMPLATE-2	1.00	0.00	EA	40,000.000							
3SPTEMP1	STRAIGHT WALL T	1.00	0.00	EA	20,000.000							
$1,640,400.80					[ ]			1,640,401				1,640,401
								15.27				15.27
1100	UNLOAD AND HANDLE LAND		Quan: 2,213.52	TON	Hrs/Shft: 10.00		Cal: 50	WC: WATER				
								**Unreviewed				
PD10	UNL AND HANDLE		368.91	CH	Prod: 1.0000 MU		Lab Pcs: 6.00		Eqp Pcs: 2.00			
3ST	Small Tools and Misc	1.00	2,951.36	CMH	1.600			4,722				4,722
8CC200	Crane 200 ton crawler	1.00	368.92	HR	176.824				39,827	25,407		65,234
8MECR1	Boat, Skiff, 16', twin		0.00	HR	9.201							
8MEMTB	Barge, Material,35x1		0.00	HR	47.500							
8MEPB1	Tug, 700 hp, 50' twin		0.00	HR	90.807							
8MERCB	Barge, Crane 45 x 16		0.00	HR	76.364							
8TKPU4	Pickup 4x4	1.00	368.92	HR	12.068				1,572	2,880		4,452
OPCR+	Crane Operator over 6	1.00	368.92	MH	28.500		17,790					17,790

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 50				Land Item	SCHEDULE: 1 100							
Description = SUPPORT OF EARTH					Unit = SF	Takeoff Quan: 78,600.000			Engr Quan:	78,600.000		
OPTUG	Operator, Tugboat		0.00	MH	27.750							
OPTUG1	Laborer, Tugboat Dec		0.00	MH	18.300							
PD1	Piledriver Foreman	1.00	368.92	MH	29.150	18,196						18,196
PD2	Piledriver	4.00	1,475.68	MH	25.300	63,170						63,170
$173,564.33	1.0000 MH/TON		2,213.5200	MH	[29.122]	99,156		4,722	41,399	28,287		173,564
6.0002 Units/H		60.0016 Un/Shift		1.0000 Unit/M		44.80		2.13	18.70	12.78		78.41
1120	SET TEMPLATE FRAME IN AND OUT		Quan: 763.66	TON	Hrs/Shft: 10.00	Cal: 50	WC: WATER					
												**Unreviewed
PD14	PD DRIVE VIBRO-WET		1,018.21	CH	Prod: 10.0000 MU		Lab Pcs: 7.50		Eqp Pcs: 10.00			
8CC300	Crane, 300 ton crawl (	1.00	1,018.21	HR	280.470				242,982	42,596		285,578
8MECR1	Boat, Skiff, 16', twin	1.00	1,018.21	HR	9.201				3,124	6,245		9,369
8MEPB1	Tug, 700 hp, 50' twin	0.50	509.11	HR	90.807				23,778	22,453		46,231
8MERCB	Barge, Crane 45 x 16	1.00	1,018.21	HR	76.364				75,209	2,546		77,755
8MERMB	Barge, Material 45 x	1.00	1,018.21	HR	59.300				57,855	2,525		60,380
8MESB5	Barge, sect 10 x 40 x	2.00	2,036.43	HR	3.928				7,178	821		7,999
8MITMK	Telescopic Man Lift,	1.00	1,018.21	HR	26.241				17,182	9,536		26,719
8PEV50	Hammer,ICE44-50 *	0.50	509.11	HR	129.407				34,712	31,170		65,883
8TKPU4	Pickup 4x4	1.00	1,018.21	HR	12.068				4,339	7,949		12,288
8WM350	Welding Machine, 35	1.00	1,018.21	HR	12.164				3,905	8,481		12,385
OPCR+	Crane Operator over 6	1.00	1,018.21	MH	28.500	49,100						49,100
OPOIL	Oiler	0.50	509.11	MH	26.150	34,821						34,821
OPTUG	Operator, Tugboat	0.50	509.11	MH	27.750	23,904						23,904
OPTUG1	Laborer, Tugboat Dec	0.50	509.11	MH	18.300	15,764						15,764
PD1	Piledriver Foreman	1.00	1,018.21	MH	29.150	50,220						50,220
PD2	Piledriver	4.00	4,072.85	MH	25.300	174,349						174,349
$952,743.27	10.0000 MH/TON		7,636.6000	MH	[285.927]	348,158			470,263	134,322		952,743
0.7500 Units/H		7.5000 Un/Shift		0.1000 Unit/M		455.91			615.80	175.89		1,247.60

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 50		Land Item	SCHEDULE: 1 100									
Description = SUPPORT OF EARTH				Unit = SF		Takeoff Quan: 78,600.000			Engr Quan: 78,600.000			
1200	STICK AND DRIVE SHEETPILE-DRY			Quan: 1,600.41 EA		Hrs/Shft: 10.00		Cal: 50	WC: WATER			
												**Unreviewed
***												
go to 5 shift per each coffer including stick and drive all minor obstructions												
***												
PD15	PD DRIVE VIBRO-DRY			738.64 CH	Prod: 3.0000 MU		Lab Pcs: 6.50		Eqp Pcs: 4.50			
8CC300	Crane, 300 ton crawl (	1.00	738.65 HR	280.470					176,268	30,901		207,169
8MECR1	Boat, Skiff, 16', twin		0.00 HR	9.201								
8MERCB	Barge, Crane 45 x 16		0.00 HR	76.364								
8MERMB	Barge, Material 45 x		0.00 HR	59.300								
8MESB5	Barge, sect 10 x 40 x		0.00 HR	3.928								
8MITMK	Telescopic Man Lift,	1.00	738.65 HR	26.241					12,465	6,918		19,383
8PEV50	Hammer,ICE44-50 *	0.50	369.32 HR	129.407					25,181	22,612		47,793
8TKPU4	Pickup 4x4	1.00	738.65 HR	12.068					3,147	5,767		8,914
8WM350	Welding Machine, 35	1.00	738.65 HR	12.164					2,833	6,152		8,985
OPCR+	Crane Operator over 6	1.00	738.65 MH	28.500		35,619						35,619
OPOIL	Oiler	0.50	369.32 MH	26.150		25,260						25,260
PD1	Piledriver Foreman	1.00	738.65 MH	29.150		36,432						36,432
PD2	Piledriver	4.00	2,954.60 MH	25.300		126,479						126,479
$516,033.60	2.9999 MH/EA		4,801.2200 MH	[87.285]		223,790			219,894	72,349		516,034
2.1667 Units/H		21.6670 Un/Shift		0.3333 Unit/M		139.83			137.40	45.21		322.44
2200	PULL PILE			Quan: 1,600.41 EA		Hrs/Shft: 10.00		Cal: 50	WC: WATER			
												**Unreviewed
***												
go to 5 shift per each coffer including stick and drive all minor obstructions												
***												
PD15	PD DRIVE VIBRO-DRY			492.43 CH	Prod: 2.0000 MU		Lab Pcs: 6.50		Eqp Pcs: 4.50			
3ST	Small Tools and Misc	1.00	3,200.82 CMH	1.600				5,121				5,121

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 50				Land Item	SCHEDULE: 1 100							
Description = SUPPORT OF EARTH					Unit = SF	Takeoff Quan: 78,600.000			Engr Quan: 78,600.000			
8CC300	Crane, 300 ton crawl (	1.00	492.43	HR	280.470				117,512	20,600		138,112
8MECR1	Boat, Skiff, 16', twin		0.00	HR	9.201							
8MERCB	Barge, Crane 45 x 16		0.00	HR	76.364							
8MERMB	Barge, Material 45 x		0.00	HR	59.300							
8MESB5	Barge, sect 10 x 40 x		0.00	HR	3.928							
8MITMK	Telescopic Man Lift,	1.00	492.43	HR	26.241				8,310	4,612		12,922
8PEV50	Hammer,ICE44-50 *	0.50	246.22	HR	129.407				16,788	15,075		31,863
8TKPU4	Pickup 4x4	1.00	492.43	HR	12.068				2,098	3,844		5,943
8WM350	Welding Machine, 35	1.00	492.43	HR	12.164				1,888	4,101		5,990
OPCR+	Crane Operator over 6	1.00	492.43	MH	28.500	23,746						23,746
OPOIL	Oiler	0.50	246.22	MH	26.150	16,840						16,840
PD1	Piledriver Foreman	1.00	492.43	MH	29.150	24,288						24,288
PD2	Piledriver	4.00	1,969.73	MH	25.300	84,319						84,319
$349,143.43	1.9999 MH/EA		3,200.8100	MH	[58.19]	149,193		5,121	146,596	48,233		349,143
3.2500 Units/H		32.5003 Un/Shift		0.5000 Unit/M		93.22		3.20	91.60	30.14		218.16
=====> Item Totals:	50 - SUPPORT OF EARTH											
$3,631,885.43	0.2271 MH/SF		17,852.15	MH	[6.56]	820,298		1,650,244	878,152	283,191		3,631,885
46.207	78600 SF					10.44		21.00	11.17	3.60		46.21

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 60	Land Item	SCHEDULE: 1 100										
Description = PIPE BEDDING				Unit = CY		Takeoff Quan: 1,984.000		Engr Quan: 1,984.000				
1000	BUY		Quan: 3,968.00	TON	Hrs/Shft: 10.00	Cal: 50	WC: WATER					
COST WITH PIPE TO INSTALL												
2AGGBED	AGG BEDDING-BA	1.00	3,968.00	TON	14.000		57,774					57,774
=====> Item Totals:	60	- PIPE BEDDING										
$57,774.08					[ ]		57,774					57,774
29.120	1984 CY						29.12					29.12

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 70				Land Item	SCHEDULE: 1 100							
Description = PIPE SELECT BACKFILL				Unit = CY	Takeoff Quan: 7,600.000			Engr Quan: 7,600.000				
1000	BUY		Quan: 15,265.45	TON	Hrs/Shft: 10.00		Cal: 50	WC: WATER				
2ABBFILL	SELECT BACKFILL	1.00	15,265.45	TON	11.000		174,637					174,637
1010	BACKFILL IN, AROUND PIPE		Quan: 7,600.00	CY	Hrs/Shft: 10.00		Cal: 50	WC: WATER				
AABLNK	SET-UP CREW		359.98	CH	Prod: 35.9983 S		Lab Pcs: 5.00		Eqp Pcs: 5.00			
3ST	Small Tools and Misc	1.00	1,439.93	CMH	1.600			2,304				2,304
8BH330	Backhoe, Cat 330 2.0	1.00	359.98	HR	100.482				18,408	17,764		36,171
8LR966	Caterpillar 966 Loade	1.00	359.98	HR	46.842				9,388	7,474		16,862
8RCRMX	Ramex Roller	2.00	719.97	HR	9.053				4,070	2,448		6,518
8TKPU4	Pickup 4x4	1.00	359.98	HR	12.068				1,534	2,810		4,344
L2	Laborer Skilled	2.00	719.97	MH	18.300	22,293						22,293
OP1	Operator Foreman	1.00	359.98	MH	40.000	33,057						33,057
OPBH	Backhoe Operator	1.00	359.98	MH	26.150	15,928						15,928
OPLD	Loader Operator	1.00	359.98	MH	26.150	15,928						15,928
$153,404.65	0.2368 MH/CY		1,799.9100	MH	[6.716]	87,205		2,304	33,400	30,496		153,405
21.1123	Units/H		211.1228	Un/Shift	4.2224 Unit/M	11.47		0.30	4.39	4.01		20.18
=====> Item Totals:	70	- PIPE SELECT BACKFILL										
$328,041.40	0.2368 MH/CY		1,799.91	MH	[6.716]	87,205	174,637	2,304	33,400	30,496		328,041
43.163	7600 CY					11.47	22.98	0.30	4.39	4.01		43.16

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 80	Land Item	SCHEDULE: 1 100										
Description = PIPE CHANNEL BACKFILL		Unit = CY		Takeoff Quan: 30,080.000		Engr Quan: 30,080.000						
1000	BACKFILL ABOVE SELECT	Quan: 30,080.00	CY	Hrs/Shft: 10.00		Cal: 50	WC: WATER					
AABLNK	SET-UP CREW	720.03	CH	Prod: 72.0035 S		Lab Pcs: 2.00			Eqp Pcs: 2.00			
8BH330	Backhoe, Cat 330 2.0	1.00	720.03	HR	100.482				36,819	35,531		72,350
8DZ06	Cat D6 Dozer	1.00	720.03	HR	92.135				38,661	27,679		66,340
OPBH	Backhoe Operator	1.00	720.03	MH	26.150	31,858						31,858
OPDZ	Dozer Operator	1.00	720.03	MH	26.550	32,346						32,346
$202,893.66	0.0478 MH/CY	1,440.0600		MH	[1.388]	64,204			75,480	63,210		202,894
41.7760 Units/H	417.7604 Un/Shift	20.8880		Unit/M		2.13			2.51	2.10		6.75
=====> Item Totals:	80 - PIPE CHANNEL BACKFILL											
$202,893.66	0.0478 MH/CY	1,440.06		MH	[1.388]	64,204			75,480	63,210		202,894
6.745	30080 CY					2.13			2.51	2.10		6.75

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 90	Land Item	SCHEDULE: 1 100										
Description = OFF-HAUL EXCESS		Unit = CY		Takeoff Quan: 13,222.000		Engr Quan: 13,222.000						
1000	DISPOSE EXCESS	Quan: 13,222.00		CY	Hrs/Shft: 10.00	Cal: 50	WC: WATER					
4DISP	DISPOSE EXCESS	1.00	13,222.00	CY	10.000						132,220	132,220

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 110	Land Item	SCHEDULE: 1 100										
Description = CONTROL STRUCTURES & GATES		Unit = EA	Takeoff Quan: 3.000		Engr Quan: 3.000							
1000	STRUCTURES AND GATES		Quan: 3.00	EA	Hrs/Shft: 10.00	Cal: 50	WC: WATER					
4STR	GATES AND STRU	1.00	3.00	EA	500,000.000						1,500,000	1,500,000

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total

BID ITEM = 120 Land Item SCHEDULE: 1 100
Description = DISCHARGE CHANNEL Unit = CY Takeoff Quan: 250,000.000 Engr Quan: 250,000.000

1000 EXCAVATION FOR PIPE Quan: 250,000.00 CY Hrs/Shft: 10.00 Cal: 50 WC: WATER

**Unreviewed

11,000 FOOT OF CHANNEL
+3 TO MINUS 8
22 FOOT BOTTOM AND 3:1 SIDE SLOPES, NO ARMORING
***

AABLNK	SET-UP CREW		1,388.88	CH	Prod: 180.0000 UH		Lab Pcs: 5.00		Eqp Pcs: 4.00			
3MAT	CRANE MATS	1.00	20.00	EA	1,500.000			30,000				30,000
3ST	Small Tools and Misc	1.00	6,944.44	CMH	1.600			11,111				11,111
8BH345	Backhoe, Cat 345 2.2	1.00	1,388.89	HR	174.327				107,639	134,482		242,121
8DZ06	Cat D6 Dozer	2.00	2,777.78	HR	92.135				149,147	106,783		255,930
8TKPU4	Pickup 4x4	1.00	1,388.89	HR	12.068				5,918	10,843		16,761
L2	Laborer Skilled	1.00	1,388.89	MH	18.300		43,005					43,005
OP1	Operator Foreman	1.00	1,388.89	MH	40.000		127,542					127,542
OPBH	Backhoe Operator	1.00	1,388.89	MH	26.150		61,453					61,453
OPDZ	Dozer Operator	2.00	2,777.78	MH	26.550		124,785					124,785
$912,707.57	0.0277 MH/CY		6,944.4500	MH	[0.841]		356,784		41,111	262,704	252,108	912,708
180.0012	Units/H*		1,800.0115	Un/Shift	36.0000 Unit/M		1.43		0.16	1.05	1.01	3.65

1010 GRADE SPOIL Quan: 75.00 ACRE Hrs/Shft: 10.00 Cal: 50 WC: WATER

SPOIL FIGURED TO BE LOST ALONG LENGTH OF PIPE
****
11,000 X 300 = 75 ACRES

AABLNK	SET-UP CREW		750.00	CH	Prod: 1.0000 US		Lab Pcs: 1.00		Eqp Pcs: 1.00			
3SEED	SEEDING	1.00	75.00	ACRE	2,000.000			150,000				150,000
3ST	Small Tools and Misc	1.00	750.00	CMH	1.600			1,200				1,200
8DZ06	Cat D6 Dozer	1.00	750.00	HR	92.135				40,270	28,831		69,101

Direct Cost Report

Activity / Resource	Description	Quantity / Pcs	Unit / Unit	Unit Cost	Labor	Perm Material	Constr MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 120			Land Item	SCHEDULE: 1 100							
Description = DISCHARGE CHANNEL			Unit = CY	Takeoff Quan: 250,000.000		Engr Quan: 250,000.000					
OPDZ	Dozer Operator	1.00	750.00 MH	26.550	33,692						33,692
$253,992.97	10.0000 MH/ACRE		750.0000 MH	[292.05]	33,692		151,200	40,270	28,831		253,993
0.1000 Units/H		1.0000 Un/Shift *	0.1000 Unit/M		449.23		2,016.00	536.93	384.42		3,386.57
=====> Item Totals:	120 - DISCHARGE CHANNEL										
$1,166,700.54	0.0307 MH/CY		7,694.45 MH	[0.928]	390,476		192,311	302,974	280,939		1,166,701
4.667		250000 CY			1.56		0.77	1.21	1.12		4.67

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 130				Land Item	SCHEDULE: 1 100							
Description = SEDIMENATATIONS PONDS					Unit = EA	Takeoff Quan: 1.000		Engr Quan: 1.000				
1000	POND IN AND SITE				Quan: 1.00 EA	Hrs/Shft: 10.00		Cal: 50	WC: WATER			
4POND	SED POND	1.00	3,500.00	CY	10.000						35,000	35,000 **Unreviewed

Direct Cost Report

Activity / Resource	Description	Quantity Pcs	Unit	Unit Cost	Labor	Perm Material	Constr MatlI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
$9,624,437.78	*** Report Totals ***	36,807.13	MH		1,739,749	1,998,331	1,856,713	1,505,407	857,017	1,667,220	9,624,438

>>> indicates Non Additive Activity
------Report Notes:------
The estimate was prepared with BID Quantities.
This report shows TAKEOFF Quantities with the resources.

"Unreviewed" Activities are marked.

Bid Date: 11/22/13 Owner: ME-NH DOT Engineering Firm: HDR
Estimator-In-Charge:

JOB NOTES

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Estimate created on: 11/26/2013 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1356

************Estimate created on: 12/25/2013 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1356

************Estimate created on: 01/23/2014 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1401

************Estimate created on: 05/13/2014 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1401A
```

* on units of MH indicate average labor unit cost was used rather than base rate.
[ ] in the Unit Cost Column = Labor Unit Cost Without Labor Burdens
In equipment resources, rent % and EOE % not = 100% are represented as XXX%YYY where XXX=Rent% and YYY=EOE%
------Calendar Codes------

Direct Cost Report

Activity / Resource	Description	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
40	40 hr week 5 - 8 hr. days										
45	45 hr. week 5 - 9 hr. days										
50	50 hr. week 5 - 10 hr. days (Default Calendar)										
60	60 hr. week 6 - 10 hr. days										
C	5 EACH X 10										
CL	TAFFIC CLOSURE										

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total

PARENT ITEM 1000
Description = TUNNEL ALTERNATE 1 Unit = LF Takeoff Quan: 3,600.000 Engr Quan: 3,600.000

Listing of Sub-Biditems of Parent Item 1000:

BID ITEM = 1002 Land Item SCHEDULE: 1 100
Description = TUNNEL MOBILIZATION Unit = LS Takeoff Quan: 1.000 Engr Quan: 0.000

1000 TUNNEL MOBILIZATION Quan: 1.00 LS Hrs/Shft: 10.00 Cal: 50 WC: 10

**Unreviewed

GO TO 4.0 % AS SOME SET-UP IN DIRECT COST
BASED ON DIRECT COST OR $17M
***

3MOB1	TUNNEL MOBE	1.00	1.00 $$	800,000.000			800,000					800,000
=====> Item Totals:	1002 - TUNNEL MOBILIZATION											
$800,000.00					[ ]		800,000					800,000
800,000.000	1 LS						800,000.00					800,000.00

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1004				Land Item	SCHEDULE: 1 100							
Description = EROSION & SEDIMENTATION				Unit = LS	Takeoff Quan: 1.000		Engr Quan: 0.000					
1000	SILT FENCE		Quan: 800.00	LF	Hrs/Shft: 10.00	Cal: 50	WC: 10					
AABLNK	NEW CREW		10.00	CH	Prod: 0.0500 MU	Lab Pcs: 4.00		Eqp Pcs: 1.00				
3ESSILT	SILT FENCE@106%		800.00	LF	1.000			848				848
3STS	Small Tools-Sup~4@		40.00	MH	4.000			170				170
8TKPU4	Pickup 4x4	1.00	10.00	HR	11.531				43	73		115
L1	Laborer Foreman	1.00	10.00	MH	30.000	456						456
L2	Laborer Skilled	3.00	30.00	MH	23.450	1,129						1,129
$2,718.03	0.0500 MH/LF		40.0000	MH	[1.38]	1,585		1,018	43	73		2,718
80.0000	Units/H		800.0000	Un/Shift	20.0000 Unit/M	1.98		1.27	0.05	0.09		3.40
1100	SED PONDS AND MISC		Quan: 1.00	EA	Hrs/Shft: 10.00	Cal: 50	WC: 10					
AABLNK	NEW CREW		50.00	CH	Prod: 5.0000 S	Lab Pcs: 5.00		Eqp Pcs: 3.00				
3POND	MISC FOR PONDS		1.00	EA	5,000.000			5,300				5,300
3STS	Small Tools-Sup~5@		250.00	MH	4.000			1,060				1,060
8BH330	Backhoe, Cat 330 2.0	1.00	50.00	HR	93.166				2,710	2,228		4,938
8DZ06	Caterpillar D6	1.00	50.00	HR	70.567				1,847	1,682		3,528
8TKPU4	Pickup 4x4	1.00	50.00	HR	11.531				213	364		577
L2	Laborer Skilled	2.00	100.00	MH	23.450	3,763						3,763
OP1	Operator Foreman	1.00	50.00	MH	39.660	3,173						3,173
OPBH	Backhoe Operator	1.00	50.00	MH	36.050	2,953						2,953
OPDZ	Dozer Operator	1.00	50.00	MH	36.050	2,953						2,953
$28,245.00	250.0000 MH/EA		250.0000	MH	[8726.3]	12,842		6,360	4,770	4,273		28,245
0.0200	Units/H		0.2000	Un/Shift	0.0040 Unit/M	12,842.31		6,360.00	4,769.85	4,272.84		28,245.00
=====> Item Totals:	1004 - EROSION & SEDIMENTATION											
$30,963.03	290.0000 MH/LS		290.00	MH	[9830.15]	14,427		7,378	4,812	4,346		30,963

Direct Cost Report

Activity / Resource	Description	Quantity / Pcs	Unit / Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1004			Land Item	SCHEDULE: 1 100							
Description = EROSION & SEDIMENTATION			Unit = LS	Takeoff Quan: 1.000			Engr Quan: 0.000				
30,963.030		1 LS			14,427.43	7,377.60	4,812.46	4,345.54			30,963.03

Direct Cost Report

Activity / Resource	Description	Quantity Pcs	Quantity Unit	Unit Cost	Perm Labor	Constr Material	Equipme MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1010			Land Item	SCHEDULE: 1 100							
Description = EPB TUNNEL				Unit = LF	Takeoff Quan: 3,600.000		Engr Quan: 0.000				
1000	PLANT			Quan: 1.00 LS	Hrs/Shft: 10.00		Cal: 50	WC: 10			
											**Unreviewed
liner = 8 inch thick and say 1,000 cy = $25.sf delivered to site											
***											
2CONGRT	GROUT@106%	1.00	444.00 CY	150.000		70,596					70,596
2PCLIN	PRECAST LINER@1	1.00	0.00 CY	1,000.000							
3POUR	POUR EXPENDABL	1.00	444.00 CY	5.000			2,353				2,353
3TBM10	TBM Write-Off@106	1.00	1.00 SS	1,000,000.000			1,060,000				1,060,000
3TUCOMM	TUNNEL COMMUN	1.00	3,600.00 LF	3.000			11,448				11,448
3TUCOMP	COMPRESSOR HOU	1.00	1.00 LS	20,000.000			21,200				21,200
3TUELEC	ELECTRIC INFRAS	1.00	1.00 LS	100,000.000			106,000				106,000
3TUELEL10	TUNNEEL ELECTRI	1.00	3,600.00 LF	100.000			381,600				381,600
3TUHOIST	MAN HOIST@106%	1.00	60.00 VF	1,000.000			63,600				63,600
3TULGHT	TUNNEL LIGHTIN	1.00	3,600.00 LF	8.000			30,528				30,528
3TUMUCK	MUCK HOPPER AN	1.00	1.00 EA	20,000.000			21,200				21,200
3TUNAIR	AIR PIPING-WRITE	1.00	3,600.00 LF	20.000			76,320				76,320
3TUNAIR1	RECIEVER AND VA	1.00	1.00 LS	40,000.000			42,400				42,400
3TURIG	SPECIAL RIGGING	1.00	1.00 LS	10,000.000			10,600				10,600
3TUVENT	VENT PIPING@106	1.00	3,600.00 LF	40.000			152,640				152,640
3TUVENT1	FITTINGS AND CO	1.00	1.00 LF	50,000.000			53,000				53,000
3TUWAT	WATER PIPING@10	1.00	3,600.00 LF	5.000			19,080				19,080
4ELLGHT	YARD LIGHTING	1.00	1.00 LS	50,000.000						50,000	50,000
4WATER	WATER TO SITE	1.00	1.00 LS	25,000.000						25,000	25,000
8TBMBUY	==> PURCHASE TB		0.00 EA	6,000,000.000							
8TBMDR	==> TBM MISC EX		0.00 EA	500,000.000							
8TBMSAL	==> SALVAGE TBM		0.00 EA	-3,000,000.000							
$2,197,565.20				[ ]		70,596	2,051,969			75,000	2,197,565
						70,596.00	2,051,969.20			75,000.00	2,197,565.20

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1010				Land Item	SCHEDULE: 1 100							
Description = EPB TUNNEL				Unit = LF	Takeoff Quan: 3,600.000			Engr Quan: 0.000				
1100	SET UP TBM AND TRAILING GEAR	Quan: 1.00	EA	Hrs/Shft: 10.00	Cal: 50 WC: 10							
												**Unreviewed
AABLNK	NEW CREW	200.00	CH	Prod: 20.0000 S	Lab Pcs: 15.00			Eqp Pcs: 4.00				
3MISC2110	MISC FOR SET-UP	1.00 1.00	EA	100,000.000				106,000				106,000
3STS	Small Tools-Sup~15	1.00 3,000.00	MH	4.000				12,720				12,720
8AC375	Air compressor, 375	1.00 200.00	HR	14.086					795	2,022		2,817
8CC200	Crane 200 ton crawler	1.00 200.00	HR	170.126					22,886	13,180		36,067
8WM350	Welding Machine, 35	2.00 400.00	HR	9.690					796	3,080		3,876
L1	Laborer Foreman	2.00 400.00	MH	30.000		18,245						18,245
L2	Laborer Skilled	6.00 1,200.00	MH	23.450		45,160						45,160
OPCR+	Crane Operator over 3	1.00 200.00	MH	37.660		12,204						12,204
OPMECH	Operator, Mechanic	6.00 1,200.00	MH	36.050		70,873						70,873
$307,961.63	3,000.0000 MH/EA	3,000.0000	MH	[100025.2]		146,482		118,720	24,477	18,282		307,962
0.0050	Units/H 0.0500 Un/Shift	0.0003	Unit/M			146,481.72		118,720.00	24,477.46	18,282.45		307,961.63
2000	DRIVE TBM TUNNEL	Quan: 3,600.00	LF	Hrs/Shft: 10.00	Cal: 50 WC: 10							
												**Unreviewed

TOTAL EXCAVATION = 5204, MACHINE CAPACITY THEORETICAL = 60 CY PER HOUR, GO TO 40% = 24 CY PER HOUR = 216 HOUR =
16.67 LF PER HOUR OR 167 SHIFT AT 10 HOUR DAY, WITH TRAVEL, MOVES AND OTHER DOWNTIME SAY 5 HOUR OF 10 PRODUCTIVE
= 80 LF PER SHIFT
EQUATES TO 45 SHIFT AND ADD 15 FOR SHAFT MOVE == 60 SHIFT
**

***
CREW = HEADING 5
MUCK AND VENT 8
SHAFT 11
RING AND BOLTS 8 = 32

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Equipme MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1010				Land Item	SCHEDULE: 1 100							
Description = EPB TUNNEL					Unit = LF	Takeoff Quan: 3,600.000		Engr Quan: 0.000				
***												
INCLUDES GROUT BEHIND PRECAST												
***												
AABLNK	NEW CREW		600.00	CH	Prod: 60.0000 S			Lab Pcs: 13.00	Eqp Pcs: 27.00			
3STS	Small Tools-Sup~12	1.00	7,200.00	MH	4.000			30,528				30,528
8AC375	Air compressor, 375	1.00	600.00	HR	14.086				2,386	6,065		8,452
8GL100	Generator, 85-100 kw		0.00	HR	30.496							
8GL250	Generator, 250 kw	2.00	1,200.00	HR	57.938				17,728	51,798		69,526
8LR950	Caterpillar 950 Loade	1.00	600.00	HR	64.129				22,159	16,318		38,477
8MISRT	RT Extendable Boom	1.00	600.00	HR	32.685				10,227	9,384		19,611
8PU04	Pump, 4" Sub Elect. 5		0.00	HR	3.292							
8PU06E	6" Pump Elec 30 HP	2.00	1,200.00	HR	9.265				6,818	4,300		11,118
8TURR10	Locomotive 10T	2.00	1,200.00	HR	51.950				48,000	14,340		62,340
8TURRCF	Flat Car 16 Ft	4.00	2,400.00	HR	5.550				9,600	3,720		13,320
8TURRMA	Man Car	2.00	1,200.00	HR	6.570				4,800	3,084		7,884
8TURRMU5	Muck Car 5 CY	8.00	4,800.00	HR	6.810				19,200	13,488		32,688
8TUV050	Vent Fan 50 HP	2.00	1,200.00	HR	10.025				4,200	7,830		12,030
8TUV100	Vent Fan 100 HP	1.00	600.00	HR	16.800				4,200	5,880		10,080
8WM350	Welding Machine, 35	1.00	600.00	HR	9.690				1,193	4,621		5,814
L1	Laborer Foreman	1.00	600.00	MH	30.000	27,367						27,367
LTUN	Laborer, Tunnel Supp	7.00	4,200.00	MH	26.000	201,597						201,597
OPAC	Compressor Operator		0.00	MH	36.050							
OPLD	Loader Operator		0.00	MH	36.050							
OPLOCO	Operator, Locomotive	2.00	1,200.00	MH	36.050	70,873						70,873
OPTUNNEL	Operator, Tunnel Hea	2.00	1,200.00	MH	36.390	71,370						71,370
ZSURVPC	Tunnel Surveyor	1.00	600.00	MH	30.000	24,925						24,925
$717,999.11	2.1666 MH/LF		7,800.0000	MH	[70.928]	396,132		30,528	150,512	140,828		717,999
6.0000 Units/H			60.0000 Un/Shift		0.4615 Unit/M	110.04		8.48	41.81	39.12		199.44

Direct Cost Report

Activity / Resource	Description	Quantity / Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1010			Land Item	SCHEDULE: 1 100							
Description = EPB TUNNEL			Unit = LF	Takeoff Quan: 3,600.000				Engr Quan: 0.000			
2005	CLEAN INVERT AND OTHER			Quan: 3,600.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
											**Unreviewed
***** Copied and adjusted from C:\HEAVYBID\EST\1031 *****											
AABLNK	NEW CREW			90.00 CH	Prod: 400.0000 US		Lab Pcs: 7.00		Eqp Pcs: 5.00		
3STS	Small Tools-Sup~7@	1.00	630.00 MH	4.000			2,671				2,671
8AC175	Air compressor, 175	1.00	90.00 HR	8.529				179	589		768
8CEWBL	Water blaster, dsl, 10	1.00	90.00 HR	34.545				1,406	1,703		3,109
8TURR10	Locomotive 10T	1.00	90.00 HR	51.950				3,600	1,076		4,676
8TURRCF	Flat Car 16 Ft	1.00	90.00 HR	5.550				360	140		500
8TURRMA	Man Car	1.00	90.00 HR	6.570				360	231		591
L1	Laborer Foreman	1.00	90.00 MH	30.000	4,105						4,105
LTUN	Laborer, Tunnel Supp	4.00	360.00 MH	26.000	17,280						17,280
OPLOCO	Operator, Locomotive	1.00	90.00 MH	36.050	5,315						5,315
OPTUNNEL	Operator, Tunnel Hea	1.00	90.00 MH	36.390	5,353						5,353
$44,367.15	0.1750 MH/LF		630.0000 MH	[5.677]	32,053		2,671	5,905	3,738		44,367
40.0000 Units/H		400.0000 Un/Shift *		5.7143 Unit/M	8.90		0.74	1.64	1.04		12.32
2010	TUNNEL PLANT OPERATING			Quan: 3,600.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
											**Unreviewed
AABLNK	NEW CREW			736.13 CH	Prod: 0.0000		Lab Pcs: 0.00		Eqp Pcs: 0.00		
3TU100	CUTTER COST@10	1.00	5,200.00 CY	14.000			77,168				77,168
3TUNBEN	BENTONITE FOR S	1.00	113.50 TON	160.000			19,250				19,250
3TUNBEN1	DISPOSE SLURRY	1.00	0.58 LS	2,500.000			1,537				1,537
4DISPOSE	MUCK DISPOSAL	1.00	5,200.00 CY	8.000						41,600	41,600
$139,554.60				[ ]			97,955			41,600	139,555
4.8904 Units/H		48.9044 Un/Shift					27.21			11.56	38.77
2020	SUPPORT PERSONNEL AT SHAFT			Quan: 60.00 SHIF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
											**Unreviewed

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1010				Land Item	SCHEDULE: 1 100							
Description = EPB TUNNEL					Unit = LF	Takeoff Quan: 3,600.000		Engr Quan: 0.000				
AABLNK	NEW CREW		613.63	CH	Prod: 61.3636 S	Lab Pcs: 10.00		Eqp Pcs: 12.00				
3STS	Small Tools-Sup~8@	1.00	4,909.09	MH	4.000			20,815				20,815
8AC12E	Air compressor, 1200	1.00	613.64	HR	21.602				6,276	6,980		13,256
8CC200	Crane 200 ton crawler	1.00	613.64	HR	170.126				70,220	40,440		110,660
8GLLPL	Light tower, 6000 wat	4.00	2,454.55	HR	4.989				5,091	7,155		12,246
8LR966	Caterpillar 966 Loade	1.00	613.64	HR	82.264				29,636	20,845		50,480
8TKAGITOR	Agitor Truck 10 CY	1.00	613.64	HR	52.650				20,327	13,920		34,247
8TKMCH	Mechanics Truck, 1T	1.00	613.64	HR	16.650				4,707	5,510		10,217
8TKPU4	Pickup 4x4	1.00	613.64	HR	11.531				2,615	4,461		7,076
8TUNCON	Tunnel, Concrete Plan	1.00	613.64	HR	80.000				30,682	18,409		49,091
8WM350	Welding Machine, 35	1.00	613.64	HR	9.690				1,221	4,726		5,946
ELTUN	Tunnel Electrician	2.00	1,227.27	MH	34.950	70,385						70,385
L1	Laborer Foreman	1.00	613.64	MH	30.000	27,989						27,989
LTUN	Laborer, Tunnel Supp	2.00	1,227.27	MH	26.000	58,908						58,908
OPAC	Compressor Operator	1.00	613.64	MH	36.050	36,242						36,242
OPCR+	Crane Operator over 3	1.00	613.64	MH	37.660	37,445						37,445
OPLD	Loader Operator	1.00	613.64	MH	36.050	36,242						36,242
OPMECH	Operator, Mechanic	2.00	1,227.27	MH	36.050	72,483						72,483
$653,728.25	102.2728 MH/SHIF		6,136.3700	MH	[3754.804]	339,695		20,815	170,773	122,446		653,728
0.0978	Units/H		0.9778 Un/Shift		0.0098 Unit/M	5,661.58		346.91	2,846.22	2,040.76		10,895.47
=====> Item Totals:	1010 - EPB TUNNEL											
$4,061,175.94	4.8795 MH/LF		17,566.37	MH	[166.97]	914,361	70,596	2,322,658	351,668	285,294	116,600	4,061,176
1,128.104	3600 LF					253.99	19.61	645.18	97.69	79.25	32.39	1,128.10

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1020				Land Item	SCHEDULE: 1 100							
Description = RAIL WRITE-OFF AND UNLOAD				Unit = TF	Takeoff Quan: 3,600.000			Engr Quan: 0.000				
1000	BUY		Quan: 3,600.00	TF	Hrs/Shft: 10.00		Cal: 50	WC: 10				
												**Unreviewed
use 45 LB/YD Rail												
***												
3RR10	RAIL WRITE-OFF@	1.00	109,566.21	LB	0.250			29,035				29,035
3RR20	TIES@106%	1.00	1,826.09	EA	20.000			38,713				38,713
3RR30	SPLICE PL AND BO	1.00	4,689.54	LB	1.500			7,456				7,456
3RR40	SPIKES@106%	1.00	4,001.77	EA	0.750			3,181				3,181
3RR42	CALIFORNIA SWIT	1.00	0.58	EA	40,000.000			24,592				24,592
$102,977.94					[ ]			102,978				102,978
								28.60				28.60
1010	UNLOAD AND HANDLE		Quan: 55.38	TON	Hrs/Shft: 8.00		Cal: 40	WC: 10				
												**Unreviewed
RR10	UNLOAD AND HANDLE SMALL		11.53	CH	Prod: 1.2501 MU		Lab Pcs: 6.00		Eqp Pcs: 1.00			
3STS	Small Tools-Sup~6@	1.00	69.23	MH	4.000			294				294
8CCR45	R.T. Crane, 45 ton	1.00	11.54	HR	68.031				410	375		785
L1	Laborer Foreman	1.00	11.54	MH	30.000	488						488
L2	Laborer Skilled	4.00	46.15	MH	23.450	1,617						1,617
OPCR+	Crane Operator over 3	1.00	11.54	MH	37.660	656						656
$3,839.95	1.2500 MH/TON		69.2300	MH	[33.641]	2,761		294	410	375		3,840
4.8031 Units/H	38.4250 Un/Shift		0.7999	Unit/M		49.86		5.30	7.40	6.78		69.34
=====> Item Totals:	1020 - RAIL WRITE-OFF AND UNLOAD											
$106,817.89	0.0192 MH/TF		69.23	MH	[0.518]	2,761		103,271	410	375		106,818
29.672	3600 TF					0.77		28.69	0.11	0.10		29.67

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1030				Land Item	SCHEDULE: 1 100							
Description = VENT SYSTEM IN AND OUT					Unit = LS	Takeoff Quan: 1.000		Engr Quan: 0.000				
1010	UNLOAD AND HANDLE				Quan: 10.00 TON	Hrs/Shft: 8.00		Cal: 40	WC: 10			
												**Unreviewed
RR10	UNLOAD AND HANDLE SMALL		2.08	CH	Prod: 1.2491 MU	Lab Pcs: 6.00		Eqp Pcs: 1.00				
3STS	Small Tools-Sup~6@	1.00	12.49	MH	4.000			53				53
8CCR45	R.T. Crane, 45 ton	1.00	2.08	HR	68.031				74	68		141
L1	Laborer Foreman	1.00	2.08	MH	30.000	88						88
L2	Laborer Skilled	4.00	8.33	MH	23.450	292						292
OPCR+	Crane Operator over 3	1.00	2.08	MH	37.660	118						118
$692.57	1.2490 MH/TON		12.4900	MH	[33.607]	498		53	74	68		693
4.8077	Units/H		38.4615	Un/Shift	0.8006 Unit/M	49.81		5.30	7.39	6.76		69.26
1100	VENT SYSTEM IN SHAFT				Quan: 200.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed
AABLNK	NEW CREW		60.00	CH	Prod: 6.0000 S	Lab Pcs: 5.00		Eqp Pcs: 0.00				
3STS	Small Tools-Sup~6@		360.00	MH	4.000			1,526				1,526
L1	Laborer Foreman	1.00	60.00	MH	30.000	2,737						2,737
L2	Laborer Skilled	2.00	120.00	MH	23.450	4,516						4,516
LTUN	Laborer, Tunnel Supp	2.00	120.00	MH	26.000	5,760						5,760
$14,539.00	1.5000 MH/LF		300.0000	MH	[42.537]	13,013		1,526				14,539
3.3333	Units/H		33.3333	Un/Shift	0.6667 Unit/M	65.06		7.63				72.70
=====> Item Totals:	1030 - VENT SYSTEM IN AND OUT											
$15,231.57	312.4900 MH/LS		312.49	MH	[8843.47]	13,511		1,579	74	68		15,232
15,231.570	1 LS					13,510.72		1,579.36	73.86	67.63		15,231.57

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1040				Land Item	SCHEDULE: 1 100							
Description = SIDING AT SHAFT					Unit = LF	Takeoff Quan: 120.000		Engr Quan: 0.000				
1000	BUY				Quan: 120.00 TF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed
3RR10	RAIL WRITE-OFF@		3,600.00	LB	0.250			954				954
3RR20	TIES@106%		61.00	EA	20.000			1,293				1,293
3RR30	SPLICE PL AND BO		156.00	LB	1.500			248				248
3RR40	SPIKES@106%		134.00	EA	0.750			107				107
3RR44	SIDING SWITCH@1		0.00	EA	10,000.000							
$2,601.77					[ ]			2,602				2,602
								21.68				21.68
1010	UNLOAD AND HANDLE				Quan: 4.00 TON	Hrs/Shft: 8.00		Cal: 40	WC: 10			
												**Unreviewed
RR10	UNLOAD AND HANDLE SMALL		0.83	CH	Prod: 1.2491 MU			Lab Pcs: 6.00		Eqp Pcs: 1.00		
3STS	Small Tools-Sup~6@		5.00	MH	4.000			21				21
8CCR45	R.T. Crane, 45 ton	1.00	0.83	HR	68.031				29	27		56
L1	Laborer Foreman	1.00	0.83	MH	30.000	35						35
L2	Laborer Skilled	4.00	3.33	MH	23.450	117						117
OPCR+	Crane Operator over 3	1.00	0.83	MH	37.660	47						47
$276.63	1.2475 MH/TON		4.9900	MH	[33.563]	199		21	29	27		277
4.8193	Units/H		38.5542	Un/Shift	0.8016 Unit/M	49.75		5.30	7.37	6.74		69.16
1100	RAIL IN				Quan: 120.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed
AABLNK	NEW CREW		18.00	CH	Prod: 1.8000 S			Lab Pcs: 5.00		Eqp Pcs: 0.00		
3STS	Small Tools-Sup~5@		90.00	MH	4.000			382				382
L1	Laborer Foreman	1.00	18.00	MH	30.000	821						821
L2	Laborer Skilled	2.00	36.00	MH	23.450	1,355						1,355
LTUN	Laborer, Tunnel Supp	2.00	36.00	MH	26.000	1,728						1,728

Direct Cost Report

Activity / Resource	Description	Quantity / Pcs	Unit / Unit	Unit Cost	Labor	Perm Material	Constr MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1040			Land Item	SCHEDULE: 1 100							
Description = SIDING AT SHAFT			Unit = LF	Takeoff Quan: 120.000		Engr Quan: 0.000					
$4,285.38	0.7500 MH/LF	90.0000	MH	[21.269]	3,904		382				4,285
6.6667	Units/H	66.6667	Un/Shift	1.3333 Unit/M	32.53		3.18				35.71
=====> Item Totals:	1040 - SIDING AT SHAFT										
$7,163.78	0.7915 MH/LF	94.99	MH	[22.387]	4,103		3,005	29	27		7,164
59.698	120 LF				34.19		25.04	0.25	0.22		59.70

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1050				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE IN					Unit = LF	Takeoff Quan: 3,600.000		Engr Quan: 0.000				
1000	BUY PCCP AND OTHER				Quan: 3,600.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed
2PCCP60	PIPE PCCP 60@106	1.00	1,200.00	LF	350.000		445,200					445,200
2PCCP66	PIPE PCCP 66@106	1.00	1,200.00	LF	400.000		508,800					508,800
2TUNLIN	Tunnel Liner@106%	1.00	0.00	LF	411.000							
3PCCP84	PIPR PCCP 84@106	1.00	1,200.00	LF	515.000			655,080				655,080
3PIPEJ	PIPE JACKING EQU	1.00	1.00	LS	250,000.000			265,000				265,000
3TUNLIN	Misc Tunnel In@106	1.00	3,600.00	LF	20.000			76,320				76,320
3TUNSK1	Skid Members@106	1.00	0.00	LB	1.200							
3WELD	Weld Expendables@1	1.00	0.00	LB	3.000							
3WELD1	Weld Set-Up@106%	1.00	0.00	LS	20,000.000							
$1,950,400.00					[ ]		954,000	996,400				1,950,400
							265.00	276.78				541.78
1010	UNLOAD AND HANDLE				Quan: 1,212.07 TON	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed
AABLNK	NEW CREW			181.81	CH Prod: 0.7500 MU		Lab Pcs: 5.00		Eqp Pcs: 1.00			
3STS	Small Tools-Sup~5@	1.00	909.05	MH	4.000			3,854				3,854
8CC200	Crane 200 ton crawler	1.00	181.81	HR	170.126				20,805	11,981		32,786
L1	Laborer Foreman	1.00	181.81	MH	30.000		8,293					8,293
LTUN	Laborer, Tunnel Supp	3.00	545.43	MH	26.000		26,180					26,180
OPCR+	Crane Operator over 3	1.00	181.81	MH	37.660		11,094					11,094
$82,208.04	0.7499 MH/TON		909.0500	MH	[24.034]		45,567	3,854	20,805	11,981		82,208
	6.6667 Units/H		66.6669 Un/Shift		1.3333 Unit/M		37.59	3.18	17.16	9.89		67.82
1020	PIPE IN TUNNEL				Quan: 3,600.00 LF	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed

GO TO 10 PIECE PER SHIFT, 6344 LF =

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1050				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE IN				Unit = LF	Takeoff Quan: 3,600.000				Engr Quan: 0.000			
26 FOOT EACH 244 PIECE = AT 9 PER SAHIT = 28 SHIFT												
***												
SUPPORT CREW IN WITH TUNNEL TOTAL SHIFTS FOR THAT												
***												
AABLNK	NEW CREW			158.89 CH	Prod: 15.8890 S		Lab Pcs: 2.00		Eqp Pcs: 2.00			
3STS	Small Tools-Sup~2@	1.00	317.78 MH	4.000			1,347					1,347
8TURR10	Locomotive 10T	1.00	158.89 HR	51.950					6,356	1,899		8,254
8TURRCF	Flat Car 16 Ft	1.00	158.89 HR	5.550					636	246		882
LTUN	Laborer, Tunnel Supp	1.00	158.89 MH	26.000		7,627						7,627
OPLOCO	Operator, Locomotive	1.00	158.89 MH	36.050		9,384						9,384
$27,494.30	0.0882 MH/LF		317.7800 MH	[3.013]		17,011		1,347	6,991	2,145		27,494
22.6572	Units/H		226.5718 Un/Shift	11.3286 Unit/M		4.73		0.37	1.94	0.60		7.64
2020	SUPPORT PERSONNEL AT SHAFT			Quan: 60.00	SHIF Hrs/Shft: 10.00		Cal: 50	WC: 10				
												**Unreviewed
AABLNK	NEW CREW			600.00 CH	Prod: 60.0000 S		Lab Pcs: 7.10		Eqp Pcs: 4.10			
3STS	Small Tools-Sup~7@	1.00	4,200.00 MH	4.000			17,808					17,808
8AC12E	Air compressor, 1200	1.00	600.00 HR	21.602					6,136	6,825		12,961
8CC200	Crane 200 ton crawler	1.00	600.00 HR	170.126					68,659	39,541		108,200
8LR966	Caterpillar 966 Loade	0.10	60.00 HR	82.264					2,898	2,038		4,936
8TKAGITOR	Agitor Truck 10 CY		0.00 HR	52.650								
8TKMCH	Mechanics Truck, 1T	1.00	600.00 HR	16.650					4,602	5,388		9,990
8TKPU4	Pickup 4x4	1.00	600.00 HR	11.531					2,557	4,362		6,919
8TUNCON	Tunnel, Concrete Plan		0.00 HR	80.000								
8WM350	Welding Machine, 35		0.00 HR	9.690								
ELTUN	Tunnel Electrician	1.00	600.00 MH	34.950		34,411						34,411
L1	Laborer Foreman	1.00	600.00 MH	30.000		27,367						27,367
LTUN	Laborer, Tunnel Supp	2.00	1,200.00 MH	26.000		57,599						57,599
OPAC	Compressor Operator	1.00	600.00 MH	36.050		35,436						35,436
OPCR+	Crane Operator over 3	1.00	600.00 MH	37.660		36,613						36,613

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1050				Land Item	SCHEDULE: 1 100							
Description = PCCP PIPE IN					Unit = LF	Takeoff Quan: 3,600.000		Engr Quan: 0.000				
OPLD	Loader Operator	0.10	60.00	MH	36.050	3,544						3,544
OPMECH	Operator, Mechanic	1.00	600.00	MH	36.050	35,436						35,436
$391,219.89	71.0000 MH/SHIF		4,260.0000	MH	[2533.465]	230,406		17,808	84,852	58,154		391,220
0.1000 Units/H		1.0000 Un/Shift		0.0141 Unit/M		3,840.10		296.80	1,414.20	969.23		6,520.33
3000	GROUT LINER				Quan: 483.55 CY	Hrs/Shft: 10.00		Cal: 50	WC: 10			
												**Unreviewed
AABLNK	NEW CREW			138.15 CH	Prod: 2.0000 MU	Lab Pcs: 7.00		Eqp Pcs: 4.00				
3STS	Small Tools-Sup~7@	1.00	967.10	MH	4.000			4,101				4,101
8CEPU2	Conc.Pump trlr mtd.1	1.00	138.16	HR	47.106				3,140	3,368		6,508
8CEPUG	Grout Pump,20 GPM,	1.00	138.16	HR	23.116				2,952	242		3,194
8TURR10	Locomotive 10T	1.00	138.16	HR	51.950				5,526	1,651		7,177
8TURRCF	Flat Car 16 Ft	1.00	138.16	HR	5.550				553	214		767
L1	Laborer Foreman	1.00	138.16	MH	30.000	6,302						6,302
LTUN	Laborer, Tunnel Supp	4.00	552.63	MH	26.000	26,526						26,526
OPCP	Concrete Pump Opera	1.00	138.16	MH	36.050	8,160						8,160
OPLOCO	Operator, Locomotive	1.00	138.16	MH	36.050	8,160						8,160
$70,893.70	2.0000 MH/CY		967.1100	MH	[64.775]	49,147		4,101	12,171	5,475		70,894
3.5002 Units/H		35.0018 Un/Shift		0.5000 Unit/M		101.64		8.48	25.17	11.32		146.61
=====> Item Totals:	1050 - PCCP PIPE IN											
$2,522,215.93	1.7927 MH/LF		6,453.94	MH	[62.029]	342,131	954,000	1,023,510	124,819	77,756		2,522,216
700.616	3600 LF					95.04	265.00	284.31	34.67	21.60		700.62

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1060				Land Item	SCHEDULE: 1 100							
Description = PORTAL DEVELOP				Unit = LOC	Takeoff Quan: 3.000		Engr Quan: 0.000					
1000	DEVELOP SITE	Quan: 3.00	EA	Hrs/Shft: 10.00	Cal: 50 WC: 10							
												**Unreviewed
SAY AREA 500 X 500 FOOT = 250,000 SF												
***												
4FC1000	FENCE AND GATE	1.00	3,000.00	LF	30.000						90,000	90,000
4SITE10	SITE GRADING	1.00	225,000.00	SF	0.500						112,500	112,500
4SITE20	SURFACING	1.00	1,500.00	TON	25.000						37,500	37,500
4SITE90	RESTORE SITE	1.00	1.80	LS	50,000.000						90,000	90,000
$330,000.00					[ ]						330,000	330,000
											110,000.00	110,000.00
=====> Item Totals:	1060 - PORTAL DEVELOP											
$330,000.00					[ ]						330,000	330,000
110,000.000	3 LOC										110,000.00	110,000.00

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
Total of Above Sub-Biditems												
=====> Item Totals:	1000 - TUNNEL ALTERNATE 1											
$7,873,568.14	6.8852 MH/LF	24,787.02		MH	[235.45]	1,291,295	1,024,596	4,261,401	481,812	367,865	446,600	7,873,568
2,187.102	3600 LF					358.69	284.61	1,183.72	133.84	102.18	124.06	2,187.10

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
PARENT ITEM 1500												
Description = SHAFT-SITE ALTERNATE 1				Unit = EA	Takeoff Quan: 3.000			Engr Quan: 3.000				
Listing of Sub-Biditems of Parent Item 1500:												
BID ITEM = 1504				Land Item	SCHEDULE: 1 100							
Description = PORTAL STABILIZATION				Unit = EA	Takeoff Quan: 3.000			Engr Quan: 0.000				
1000	PORTAL GROUND STABILIZATION		Quan: 6.00 EA		Hrs/Shft: 10.00 Cal: 50 WC: 10							
4STAB	GROUT-STABILIZE	1.00	6.00 EA		50,000.000						300,000	300,000

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1510				Land Item	SCHEDULE: 1 100							
Description = GRADE SITE FOR SHAFT				Unit = LS	Takeoff Quan: 3.000		Engr Quan: 0.000					
1000	GRADE SITE WITH IN AND OUT		Quan: 6,000.00	CY	Hrs/Shft: 10.00		Cal: 50	WC: 10				**Unreviewed
AABLNK	NEW CREW		97.19	CH	Prod: 9.7192 S		Lab Pcs: 5.00		Eqp Pcs: 2.00			
3STS	Small Tools-Sup~5@	1.00	485.96	MH	4.000		2,060					2,060
8DZ06	Caterpillar D6	1.00	97.19	HR	70.567				3,589	3,269		6,858
8LR966	Caterpillar 966 Loade	1.00	97.19	HR	82.264				4,694	3,301		7,995
L2	Laborer Skilled	2.00	194.38	MH	23.450	7,315						7,315
OP1	Operator Foreman	1.00	97.19	MH	39.660	6,167						6,167
OPDZ	Dozer Operator	1.00	97.19	MH	36.050	5,740						5,740
OPLD	Loader Operator	1.00	97.19	MH	36.050	5,740						5,740
$41,876.92	0.0809 MH/CY		485.9500	MH	[2.827]	24,963		2,060	8,283	6,570		41,877
61.7347	Units/H		617.3475	Un/Shift	12.3470 Unit/M	4.16		0.34	1.38	1.10		6.98
1010	FENCES-SAFETY AT SHAFT		Quan: 3.00	LS	Hrs/Shft: 10.00		Cal: 50	WC: 10				
3SHAFT1	BARRIER-WALLS E	1.00	3.00	LS	25,000.000			79,500				79,500
=====> Item Totals:	1510 - GRADE SITE FOR SHAFT											
$121,376.92	161.9833 MH/LS		485.95	MH	[5654.06]	24,963		81,560	8,283	6,570		121,377
40,458.973	3 LS					8,320.95		27,186.82	2,761.07	2,190.13		40,458.97

Direct Cost Report

Activity / Resource	Description	Quantity / Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1560			Land Item	SCHEDULE: 1 100							
Description = BOTTOM PLATFORM			Unit = SF	Takeoff Quan: 7,200.000			Engr Quan: 0.000				
1000	FINE GRADE AND SURFACING	Quan: 7,200.00	SF	Hrs/Shft: 10.00	Cal: 50	WC: 10					
											**Unreviewed
AABLNK	NEW CREW		119.99	CH Prod: 0.1000 MU		Lab Pcs: 6.00		Eqp Pcs: 3.00			
3AGGBED	AGG SURFACING@	1.00	488.82	TON 20.000			10,363				10,363
3STS	Small Tools-Sup~5@	1.00	600.00	MH 4.000			2,544				2,544
8BH302	Backhoe, Cat .12 cy	1.00	120.00	HR 25.536				1,734	1,514		3,248
8BH325	Backhoe, Cat325L,1.5	1.00	120.00	HR 74.894				5,114	3,874		8,987
8TKPU4	Pickup 4x4	1.00	120.00	HR 11.531				511	872		1,384
L2	Laborer Skilled	3.00	360.00	MH 23.450		13,548					13,548
OP1	Operator Foreman	1.00	120.00	MH 39.660		7,615					7,615
OPBH	Backhoe Operator	2.00	240.00	MH 36.050		14,175					14,175
$61,863.63	0.1000 MH/SF		720.0000	MH [3.339]		35,337		12,907	7,359	6,260	61,864
60.0050	Units/H	600.0500	Un/Shift	10.0000 Unit/M		4.91		1.79	1.02	0.87	8.59
=====> Item Totals:	1560 - BOTTOM PLATFORM										
$61,863.63	0.1000 MH/SF		720.00	MH [3.339]		35,337		12,907	7,359	6,260	61,864
8.592	7200 SF					4.91		1.79	1.02	0.87	8.59

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 1590				Land Item	SCHEDULE: 1 100							
Description = MUDSLAB-WORK PLATFORM				Unit = SF	Takeoff Quan: 7,200.000			Engr Quan: 0.000				
1000	PURCHASE	Quan: 7,200.00	SF		Hrs/Shft: 10.00			Cal: 50	WC: 10			
												**Unreviewed
3RM30	C ONCRETE 3000@	1.00 203.67	CY		110.000			23,748				23,748
3RS	REINFORCING@10	1.00 30,551.64	LB		0.600			19,431				19,431
$43,178.76					[ ]			43,179				43,179
								6.00				6.00
1010	SLAB IN	Quan: 203.67	CY		Hrs/Shft: 10.00			Cal: 50	WC: 10			
												**Unreviewed
AABLNK	NEW CREW			58.19 CH	Prod: 2.0000 MU			Lab Pcs: 7.00	Eqp Pcs: 1.00			
3POUR	POUR EXPENDABL	1.00 203.67	CY		5.000			1,079				1,079
3STS	Small Tools-Sup~7@	1.00 407.34	MH		4.000			1,727				1,727
4PUMP	CONCRETE PUMP	1.00 203.67	CY		14.000						2,851	2,851
8TKPU4	Pickup 4x4	1.00 58.19	HR		11.531				248	423		671
L1	Laborer Foreman	1.00 58.19	MH		30.000	2,654						2,654
LTUN	Laborer, Tunnel Supp	6.00 349.15	MH		26.000	16,759						16,759
$25,741.99	2.0000 MH/CY	407.3400	MH		[58.457]	19,413		2,807	248	423	2,851	25,742
3.5001 Units/H	35.0009 Un/Shift	0.5000	Unit/M			95.32		13.78	1.22	2.08	14.00	126.39
=====> Item Totals:	1590 - MUDSLAB-WORK PLATFORM											
$68,920.75	0.0565 MH/SF	407.34	MH		[1.654]	19,413		45,985	248	423	2,851	68,921
9.572	7200 SF					2.70		6.39	0.03	0.06	0.40	9.57

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
Total of Above Sub-Biditems												
=====> Item Totals:	1500 - SHAFT-SITE ALTERNATE 1											
$552,161.30		537.7633		MH/EA	1,613.29 MH [17635.553]	79,713	140,453	15,891	13,253	302,851	552,161	
184,053.767		3		EA		26,571.14	46,817.59	5,296.88	4,417.69	100,950.46	184,053.77	

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
PARENT ITEM 2000												
Description = OTHER FACILITIES				Unit =		Takeoff Quan:	1.000	Engr Quan:	1.000			
Listing of Sub-Biditems of Parent Item 2000:												
BID ITEM = 2100				Land Item	SCHEDULE: 1 100							
Description = SEDIMENATATIONS PONDS				Unit = EA		Takeoff Quan:	1.000	Engr Quan:	0.000			
1000	POND IN AND SITE				Quan: 1.00 EA	Hrs/Shft: 10.00		Cal: 50	WC: 10			
4POND	SED POND	1.00	3,500.00	CY	10.000						35,000	35,000

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 2200	Land Item	SCHEDULE: 1	100									
Description = CONTROL STRUCTURES & GATES		Unit =	EA	Takeoff Quan:	3.000	Engr Quan:	0.000					
1000	STRUCTURES AND GATES	Quan:	3.00	EA	Hrs/Shft: 10.00	Cal: 50	WC: 10					
												**Unreviewed
4STR	GATES AND STRU	1.00	3.00	EA	500,000.000						1,500,000	1,500,000
1010	GRADE SPOIL	Quan:	3.00	ACRE	Hrs/Shft: 10.00	Cal: 50	WC: 10					
												**Unreviewed
SPOIL FIGURED TO BE LOST ALONG LENGTH OF PIPE												
****												
11,000 X 300 = 75 ACRES												
AABLNK	NEW CREW			0.00	CH Prod: 0.0000 US		Lab Pcs: 1.00		Eqp Pcs: 1.00			
3SEED	SEEDING@106%	1.00	0.00	ACRE	2,000.000							
3ST	Small Tools and Misc	1.00	0.01	CMH	1.600							
8DZ06	Caterpillar D6	1.00	0.01	HR	70.567							1
OPDZ	Dozer Operator	1.00	0.01	MH	36.050	1						1
$1.28	0.0033 MH/ACRE		0.0100	MH	[0.133]	1						1
			300.0003	Unit/M		0.20		0.01	0.12	0.10		0.43
=====> Item Totals:	2200 - CONTROL STRUCTURES & GATES											
$1,500,001.28	0.0033 MH/EA		0.01	MH	[0.133]	1					1,500,000	1,500,001
500,000.427	3 EA					0.20		0.01	0.12	0.10	500,000.00	500,000.43

Direct Cost Report

Activity / Resource	Description	Pcs	Quantity	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 2300				Land Item	SCHEDULE: 1 100							
Description = DISCHARGE CHANNEL				Unit = CY	Takeoff Quan: 250,000.000			Engr Quan: 0.000				
1000	EXCAVATION FOR PIPE				Quan: 250,000.00 CY Hrs/Shft: 10.00 Cal: 50 WC: 10							
												**Unreviewed
11,000 FOOT OF CHANNEL												
+3 TO MINUS 8												
22 FOOT BOTTOM AND 3:1 SIDE SLOPES, NO ARMORING												
***												
AABLNK	NEW CREW			1,388.88 CH	Prod: 180.0000 UH		Lab Pcs: 5.00		Eqp Pcs: 4.00			
3MAT	CRANE MATS@106	1.00	20.00 EA	1,500.000			31,800					31,800
3ST	Small Tools and Misc	1.00	6,944.44 CMH	1.600			11,111					11,111
8BH345	Backhoe, Cat 345 2.2	1.00	1,388.89 HR	125.226					105,398	78,963		184,361
8DZ06	Caterpillar D6	2.00	2,777.78 HR	70.567					102,589	93,431		196,020
8TKPU4	Pickup 4x4	1.00	1,388.89 HR	11.531					5,918	10,097		16,015
L2	Laborer Skilled	1.00	1,388.89 MH	23.450		52,268						52,268
OP1	Operator Foreman	1.00	1,388.89 MH	39.660		88,136						88,136
OPBH	Backhoe Operator	1.00	1,388.89 MH	36.050		82,029						82,029
OPDZ	Dozer Operator	2.00	2,777.78 MH	36.050		164,058						164,058
$825,797.51	0.0277 MH/CY		6,944.4500 MH	[1.047]		386,491		42,911	213,905	182,491		825,798
180.0012 Units/H*	1,800.0115 Un/Shift		36.0000 Unit/M			1.55		0.17	0.86	0.73		3.30
1010	GRADE SPOIL				Quan: 75.00 ACRE Hrs/Shft: 10.00 Cal: 50 WC: 10							
												**Unreviewed
SPOIL FIGURED TO BE LOST ALONG LENGTH OF PIPE												
****												
11,000 X 300 = 75 ACRES												
AABLNK	NEW CREW			750.00 CH	Prod: 1.0000 US		Lab Pcs: 1.00		Eqp Pcs: 1.00			
3SEED	SEEDING@106%	1.00	75.00 ACRE	2,000.000			159,000					159,000
3ST	Small Tools and Misc	1.00	750.00 CMH	1.600			1,200					1,200
8DZ06	Caterpillar D6	1.00	750.00 HR	70.567					27,699	25,226		52,925

Direct Cost Report

Activity / Resource	Description	Quantity / Pcs	Quantity / Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
BID ITEM = 2300	Land Item	SCHEDULE: 1	100								
Description = DISCHARGE CHANNEL		Unit = CY	Takeoff Quan: 250,000.000	Engr Quan: 0.000							
OPDZ	Dozer Operator	1.00	750.00 MH	36.050	44,296						44,296
$257,420.78	10.0000 MH/ACRE		750.0000 MH	[396.55]	44,296		160,200	27,699	25,226		257,421
0.1000 Units/H		1.0000 Un/Shift *	0.1000 Unit/M		590.61		2,136.00	369.32	336.35		3,432.28
=====> Item Totals:	2300 - DISCHARGE CHANNEL										
$1,083,218.29	0.0307 MH/CY		7,694.45 MH	[1.166]	430,786		203,111	241,604	207,717		1,083,218
4.333	250000 CY				1.72		0.81	0.97	0.83		4.33

Direct Cost Report

Activity / Resource	Description	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Material	Constr Matl/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
	Total of Above Sub-Biditems											
=====> Item Totals:	2000 - OTHER FACILITIES											
$2,618,219.57	7,694.4600	MH/		7,694.46	MH [291389.09]	430,787		203,111	241,604	207,717	1,535,000	2,618,220
2,618,219.570	1					430,787.06		203,111.12	241,604.33	207,717.06	1,535,000.00	2,618,219.57

Direct Cost Report

Activity / Resource	Description	Quantity Pcs	Unit	Unit Cost	Labor	Perm Material	Constr MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total
$11,043,949.01	*** Report Totals ***	34,094.77	MH		1,801,795	1,024,596	4,604,965	739,307	588,835	2,284,451	11,043,949

>>> indicates Non Additive Activity
------Report Notes:------
The estimate was prepared with BID Quantities.
This report shows TAKEOFF Quantities with the resources.

"Unreviewed" Activities are marked.

Bid Date: Owner: Engineering Firm:
Estimator-In-Charge:

JOB NOTES

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Estimate created on: 03/05/2012 by User#: 0 -
Source used: F:\1031.zip (a backup) from 08/12/2010  2:31:44 PM

************Estimate created on: 04/25/2012 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1031

************Estimate created on: 09/12/2013 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1031A

************Estimate created on: 05/27/2014 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1355

************Estimate created on: 05/27/2014 by User#: 0 -
Source estimate used: C:\HEAVYBID\EST\1355
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* on units of MH indicate average labor unit cost was used rather than base rate.
[ ] in the Unit Cost Column = Labor Unit Cost Without Labor Burdens

Direct Cost Report

Activity / Resource	Description	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Material	Constr MatI/Ex	Equipme Ownershi	Equipme Operatio	Sub-Contract	Total

In equipment resources, rent % and EOE % not = 100% are represented as XXX%YYY where XXX=Rent% and YYY=EOE%

------Calendar Codes------

40	40 hr week 5 - 8 hr. days
45	45 hr. week 5 - 9 hr. days
50	50 hr. week 5 - 10 hr. days (Default Calendar)
60	60 hr. week 6 - 10 hr. days