Delaware Creek Channel Improvements
Alignment Study

PREPARED FOR:

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IRV11446
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EXECUTIVE SUMMARY

The City of Irving (City) is undertaking a significant capital improvement project along Delaware Creek. The proposed project includes approximately 6,000 linear feet (LF) of Delaware Creek channel improvements from approximately 1,000 LF downstream of MacArthur Boulevard upstream (northwest) to State Highway (SH) 183. Appendix A, Figure 1 is a Project Location Map. The purpose of the proposed channel improvements is to accommodate upstream stormwater discharge from the SH 183 freeway widening project currently under construction and to remove existing adjacent structures from the 100-year floodplain. To gain hydraulic capacity, the Delaware Creek channel is generally proposed to be widened and deepened. There are seven proposed Delaware Creek vehicular bridge and culvert crossings removal and enlargements and two pedestrian bridge removal and replacements intact for this project. Table 1 – Bridge and Culvert Table lists the roadway bridge and culvert crossings that are proposed to be enlarged. There are no proposed improvements to the existing MacArthur Boulevard/Grauwyler Road culvert. The MacArthur Boulevard /Grauwyler Road roadways are overtopped by the 100-year floodplain for both the existing and proposed Delaware Creek channel conditions. The proposed channel geometry and alignment are included in Appendix A, Figure 2 – Project Conceptual Plan and Profile Sheets. Detailed proposed channel improvements are also included in Appendix A, Figure 3 – Channel Strip Map.

The project also includes approximately 5,000 LF of sanitary sewer main improvements from just upstream (west) of Live Oak Drive to the upstream (north) side of SH 183. The proposed sanitary sewer improvements are to replace an existing undersized line with a sanitary sewer main as part of the City’s wastewater master plan and to eliminate existing siphons on the existing system. Detailed proposed sanitary sewer improvements are included in Appendix A, Figure 4 – Sanitary Sewer Strip Map.

The intent of this alignment study is to outline the steps involved with the permitting and design of the project and to conceptually align the proposed channel and sanitary sewer main improvements to minimize impacts to existing adjacent structures and utilities. The opinion of probable construction cost (OPCC) for the channel, bridge, culvert and paving improvements is approximately $9,479,000 and is included in Appendix C of this report. The OPCC for the sanitary sewer main improvements is approximately $2,332,000. The total project cost is estimated at approximately $11,811,000. The design of the proposed channel and sanitary sewer improvements is scheduled for the beginning of 2013 with anticipated construction to begin in the spring of 2013.

1.0 INTRODUCTION

Freese and Nichols, Inc. (FNI) was contracted by the City of Irving (City) to design channel and sanitary sewer improvements for Delaware Creek. The proposed Delaware Creek channel improvements are approximately 6,000 linear feet (LF) and extend from approximately 1,000 LF
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downstream of MacArthur Boulevard upstream (northwest) to State Highway (SH) 183. The purpose of the proposed channel improvements is to accommodate upstream stormwater discharge from the SH 183 freeway widening project currently under construction. The Delaware Creek channel is proposed to be deepened and widened to increase hydraulic capacity and to reduce existing 100-year floodplain limits on adjacent properties. The project also includes seven (7) proposed bridge/culvert replacements. The proposed Delaware Creek sanitary sewer improvements are approximately 5,000 LF and extend from just upstream (west) of Live Oak Drive to the upstream (north) side of SH 183. The proposed sanitary sewer improvements are to replace an existing undersized line with a sanitary sewer main as part of the City’s wastewater master plan and to eliminate existing siphons on the system. Figure 1 is a Project Location Map and is included in Appendix A.

2.0 ALIGNMENT STUDY

2.1 DATA COLLECTION
FNI began data collection by walking the length of the project to observe and photograph existing conditions. Project site photographs are included in Appendix B. Level B subsurface utility engineering (SUE) was performed by Gorrondona and Associates (December, 2011) to locate existing utilities along the project corridor. A detailed design survey was performed by Spooner and Associates (December, 2011) to field survey the channel limits, adjacent structures, bridge/culvert/roadway crossings, utilities, and Jaycee Park. Record construction plans were used as supplemental data. Electronic design survey data is included in Appendix D of this report.

2.2 ENVIRONMENTAL PERMITTING
On January 17, 2012, environmental scientists from FNI conducted a pedestrian survey within the proposed channel improvement project area of Delaware Creek. During the survey, a stream assessment was completed utilizing the Texas Rapid Assessment Method (TXRAM) Streams Module developed by the Fort Worth District U.S. Army Corps of Engineers (USACE) Regulatory Branch in cooperation with private consultants and state and federal agencies. Preliminary results using TXRAM indicate that there is limited ecological value within the proposed project area of Delaware Creek. The limited ecological value is likely due to the bed and banks of this reach of the creek being armored with concrete and the surrounding riparian area being predominantly residential in nature.

In addition to conducting a stream assessment, an assessment of potential USACE Section 404 permitting requirements was also evaluated during the pedestrian survey. During the pedestrian survey, two potential waters of the U.S. (Delaware Creek and a man-made detention pond on Delaware Creek) were identified within the proposed project area. No wetlands or other waters of the U.S. were observed during the survey. Delaware Creek can be described as
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an ephemeral, concrete-lined trapezoidal channel with subsequent downstream connectivity to the West Fork Trinity River. The Trinity River is classified as a Traditional Navigable Water (TNW) from the point of intersection of Houston, Madison, and Walker counties upstream to Riverside Drive in Fort Worth, Tarrant County, Texas. Based on this downstream connectivity, Delaware Creek as well as the detention pond would be considered jurisdictional and the discharge of dredged or fill material below the ordinary high water mark would require a Section 404 permit.

Based on the current description of the proposed project, it appears that it could be constructed to meet the terms and conditions of Nationwide Permit (NWP) 3 – Maintenance. NWP-3 authorizes the repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure, or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for it in the original permit or the most recently authorized modification. Minor deviations in the structure's configuration or filled area, including those due to changes in materials, construction techniques, or current construction codes or safety standards that are necessary to make the repair, rehabilitation, or replacement are authorized.

Although it appears that the proposed project could be constructed to meet the terms and conditions of NWP-3, it is recommended that the City request a pre-application meeting with the Fort Worth District USACE Regulatory Branch to discuss the project and other potential permitting requirements, if any. If the proposed project could be authorized under NWP-3, it would likely require the preparation and submittal of a pre-construction notification (PCN) (including a preliminary jurisdictional determination report) to the USACE to obtain authorization.

2.3 HYDROLOGIC ANALYSIS

Per City directive no additional hydrologic analysis of the Delaware Creek watershed was performed for this study. Current effective FEMA discharges were used for hydraulic analysis for the FEMA accepted NDM CLOMR and for this study. The drainage area is approximately 3.4 square miles (sm) at the downstream project limits approximately 1,000 LF downstream of MacArthur Boulevard and approximately 1.1 sm at the upstream project limits at SH 183. Stormwater discharges may be affected by changes in hydraulic routing storage due to the enlarged SH 183 culverts and proposed enlarged Delaware Creek channel.

2.4 HYDRAULIC ANALYSIS

The City instructed FNI to use a Conditional Letter of Map Revision (CLOMR) for Delaware Creek prepared by Nathan D. Maier (NDM, 2010) as a basis for conceptual design. The NDM CLOMR was approved by FEMA. The NDM CLOMR was based on a HEC-RAS model prepared by NDM to reflect their conceptual channel modeling. FNI updated the NDM HEC-RAS model with recent
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(December 2011) design field survey data. FNI refined the NDM horizontal channel alignment to optimize the proposed channel location within the existing City easements and to avoid conflicts with existing adjacent structures. The proposed FNI vertical channel alignment is the same as the proposed NDM vertical channel alignment. The proposed FNI channel alignment is included in Appendix A, Figure 2 – Project Conceptual Plan and Profile Sheets and in Figure 3 Channel Strip Map. No floodway modeling was performed for this alignment study.

During the alignment study, design constraints were identified that caused some proposed changes to the NDM conceptual channel design. FNI proposed a 30-foot wide concrete-lined rectangular channel from Green Oaks Drive to William Brewster Drive due to existing structures and pools on both sides of the channel, both east and west of Oak Meadow Drive. Due to channel width and vertical top of road constraints, the proposed 4-barrel 10’x10’ culvert crossings were reduced to 3-barrel 10’x9’ culvert crossings at Green Oaks Drive, Oak Meadow Drive, William Brewster Drive and to a 3-barrel 10’x8’ at Puritan Drive. The existing Jaycee Park spillway was added to the FNI hydraulic model. Cursory hydraulic modeling results indicate that the FNI revised hydraulic model has 100-year computed water surface elevations (WSEL) that are generally lower than the NDM 100-year WSEL except in the Jaycee Park area where the existing spillway was added to the hydraulic model. The FNI conceptual hydraulic modeling indicates that the proposed condition Delaware Creek 100-year floodplain is contained within the proposed channel banks from Live Oak Drive to Puritan Drive and within Jaycee Park. Both the NDM and FNI conceptual hydraulic modeling indicates that the proposed condition Delaware Creek 100-year floodplain is not contained within the existing MacArthur Boulevard and Grauwyler Road culverts and overtops the roadway. The NDM existing and proposed conditions and the FNI proposed conditions electronic hydraulic models are included in Appendix D of this report.

2.5 CONCEPTUAL DESIGN

Channel Improvements
To gain hydraulic capacity, the Delaware Creek channel is generally proposed to be widened and deepened. The existing concrete-lined channel is anticipated to be replaced or modified and will remain a trapezoidal concrete lined channel with the exception of a proposed rectangular channel from Green Oaks Drive to William Brewster Street. The existing channel walls will be maintained downstream of Live Oak Drive and the existing south wall between Live Oak Drive and Cripple Creek Drive will be incorporated into the new channel design. Where the existing channel walls are being maintained a step in the channel will be constructed to maintain the existing slope stability. The channel flowline is proposed to be lowered from approximately 1,000 downstream of MacArthur Boulevard to Cripple Creek Drive. An approximate 2.2 foot deep sloped drop structure is proposed downstream of MacArthur Boulevard. The existing MacArthur Boulevard to Grauwyler road culverts are to remain intact.
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The channel flowline is proposed to be lowered approximately 2 feet at Live Oak Drive and approximately 4 feet at Cripple Creek Drive.

Proposed channel improvements include removing and replacing the existing concrete lining in the remaining sections of the channel. The narrow channel corridor width between Cripple Creek and William Brewster Street and the proposed channel widening make saving the existing wall challenging. The space required to maintain the stability of the walls, to allow for construction equipment and water diversion make keeping the existing walls challenging from a constructability standpoint and will likely not be cost effective. The channel flowline is proposed to be lowered approximately 4 feet from Cripple Creek Drive to William Brewster Street.

Some sections of the channel will require vertical retention in order to protect the existing site improvements of the adjacent property owners. The retention systems will consist of both cantilevered and tie-back systems depending on the existing soil conditions and the proximity of the channel edge to the property/easement limit. It is also anticipated that the channel will have continuous vertical walls from Green Oaks Drive to William Brewster Street. The vertical walls are proposed to be constructed with a combination of cantilevered “H” pile walls and permanent soil anchored retaining walls with a cast-in-place or shotcrete facing.

The channel flowline is proposed to be lowered approximately 4 feet from William Brewster Street to Puritan Drive. The channel walls between William Brewster Street and Puritan Drive are proposed to be replaced with stamped concrete channel walls. An approximate 3 foot deep sloped drop structure is proposed upstream of Puritan Drive and downstream of the Jaycee Park pond spillway. No modifications are proposed for the Jaycee Park pond spillway.

Proposed channel improvement limits and typical channel cross sections are included in Appendix A, Figure 2 Conceptual Plan and Profile Sheets. A detailed Channel Strip Map of the proposed channel alignment plan and profile is included in Appendix A, Figure 3. Photos of the existing channel are included in Appendix B.

Bridge, Culvert and Paving Improvements
There are seven proposed Delaware Creek vehicular bridge and culvert crossings removal and enlargements and two pedestrian bridge removal and replacements intact for this project. Table 1 is a Bridge and Culvert Table identifying the existing and proposed sizes of each Delaware Creek bridge and culvert crossing within the project reach, the top of road elevation, the proposed conditions computed 100-year water surface elevation (WSEL) and the difference between the computed 100-year WSEL and the top of road elevation to determine the amount of freeboard or overtopping of the roadways.
The proposed channel, bridge and culvert improvements result in lowering the existing 100-year floodplain elevations from approximately 1 to 5 feet through the project reach and removing approximately 6 of the existing roadways from being overtopped by the 100-year floodplain. There are no proposed improvements to the existing MacArthur Boulevard/Grauwyler Road culvert. The MacArthur Boulevard/Grauwyler Road roadways are overtopped by the 100-year floodplain for both the existing and proposed Delaware Creek channel conditions.
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The proposed Delaware Creek road crossings will consist of precast concrete box culverts or precast concrete crown span bridges designed with cast in place headwalls. The crown span bridges will be supported on either drilled piers or spread footings pending recommendations from the geotechnical report. The roadways are proposed to be reconstructed at existing grade with comparable or improved aesthetic features. The proposed Delaware Creek road crossings will specify traffic rated railing that is anticipated to be attached to the cast-in-place headwall structure below. The concrete-lined channel walls will transition at each crossing from a trapezoidal concrete-lined channel to vertical walls at the street crossings. The vertical section of the walls is proposed to extend approximately 15 feet from the face of each culvert/bridge then transition to the trapezoidal shape on both the upstream and downstream side of the crossing.

There are two pedestrian bridge crossings in the project, one near Canyon Oaks Drive between Sunnybrook Drive and Green Oaks Drive and the other on Pilgrim Drive between William Brewster Street and Puritan Drive. The existing bridge abutments lie outside the proposed channel improvements, so the existing pedestrian bridge can be removed, stored and replaced at the end of construction. Some minor repairs to the bridge or abutment should be expected for the bridge on Pilgrim Drive due to the apparent age of the bridge.

The opinion of probable construction cost (OPCC) for the channel, bridge, culvert and paving improvements is approximately $9,479,000 and is included in Appendix C of this report.

**Sanitary Sewer Improvements**
In accordance with the current City of Irving Wastewater Master Plan, the size of the proposed sanitary sewer main for the Delaware Creek interceptor will be 36-inch for the majority of the alignment from SH 183 to Cripple Creek Drive. The proposed sewer main will enlarge to a 42-inch pipe when it picks up the existing 18-inch sewer flowing from Cripple Creek Drive downstream to tie-in upstream of Live Oak Drive. The proposed 42-inch and 36-inch sanitary sewer main replaces the existing 21-inch and 18-inch interceptor. The existing line is located within the limits of the channel beginning west of Sunnybrook Drive and continuing west to and through Jaycee Park. The proposed line is to be constructed beneath the proposed Delaware Creek channel. The proposed sanitary sewer main will eliminate existing siphons within the project limits. All lines connected to the existing sewer are proposed to be reconnected to the new sanitary sewer main. The portion of existing sewer that deviates from the channel (east of Sunnybrook Drive) will be abandoned pending verification by the construction contractor that no services exist on the line.

The alignment for the proposed sewer line begins at the manhole just west of the Live Oak Drive culvert and runs upstream near the center of the proposed Delaware Creek channel. At the downstream connection, the existing 21-inch sewer is located south of the channel minimizing potential conflicts with the new alignment. As the alignment continues upstream,
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the proposed sewer interceptor will pick up flow from collection lines along Cripple Creek Drive (18-inch) and Sunnybrook Drive (8-inch). West of Sunnybrook Drive the proposed alignment crosses the existing 21-inch interceptor. The existing line remains within the north bank of the channel, while the proposed alignment continues near the center of the proposed channel limits. Continuing upstream, the proposed line will pick up flow from Colony Court (6-inch), Green Oaks Drive (6-inch), Oak Meadow Drive (6-inch) and the collection line east of William Brewster Street (8-inch). It is the intent for the alignment of the proposed sewer to minimize bypass pumping requirements; however, as the proposed interceptor approaches William Brewster Street, the existing sewer interceptor begins to converge toward the center of the channel onto the same alignment path. The alignments are in close proximity to each other in the section between Puritan Drive and William Brewster Street which may require bypass pumping. In order to minimize bypass pumping, an alternate alignment was considered for this segment. The depth of line is minimized for the proposed alignment because of the location in the center of the channel; however, since the proposed alignment is in the center of the channel, significant bypass pumping is required. The alternate alignment has the advantage of requiring no bypass pumping, however, the alternate alignment will be deeper, have increased disruption to residents along Pilgrim Drive, and a significant increase in pavement repair. As the proposed alignment enters Jaycee Park, effort was made to eliminate the removal of trees although some removal will be required. In addition, the alignment is in close proximity to the Jaycee Park memorial; however the intent is to install this section by bore. This bore will be extended under SH 183 to the existing system on the north side of the highway.

Manholes are proposed to be placed adjacent to the proposed culverts as required to pick up sewer flow from the intersecting collector lines. Bolted and sealed manholes will be required for any manhole placed inside the Delaware Creek channel to minimize stormwater inflow into the interceptor system. Based on the Texas Commission on Environmental Quality (TCEQ) regulations, every third manhole in the proposed Delaware Creek channel will be required to be vented. The vents will be placed outside of the channel and one foot above the floodplain elevation.

The proposed sanitary sewer main alignment along the Delaware Creek channel is included in in Appendix A, Figure 2 – Project Conceptual Plan and Profile Sheets. A detailed proposed sanitary sewer alignment plan and profile is included in Appendix A, Figure 4 – Sanitary Sewer Strip Map. The OPCC for the sanitary sewer main improvements is approximately $2,332,000 and is included in Appendix C of this report.

Construction/Maintenance Access and Easements
Potential construction or maintenance access locations are at the upstream (north) face of Grauwyler Road, at Canyon Oaks Drive or the downstream (south) face of Puritan Drive. The proposed channel and sanitary sewer improvements were aligned to be located within existing
3.0 CONCLUSIONS AND RECOMMENDATIONS

This alignment study outlines the steps involved with the permitting and design of the Delaware Creek channel improvements project and conceptually aligns the proposed channel and sanitary sewer main improvements to minimize impacts to existing adjacent structures and utilities. FNI recommends following the permitting approach outlined in this study, with the first step having the City request a pre-application meeting with the Fort Worth District USACE Regulatory Branch to discuss the project and other potential permitting requirements.

The proposed channel improvements include widening and deepening the Delaware Creek concrete-lined channel. There are seven proposed bridge and culvert enlargements at existing roadway crossings. Table 1 – Bridge and Culvert Table lists the roadway bridge and culvert crossings that are proposed to be enlarged. The proposed channel, bridge and culvert improvements result in lowering the existing 100-year floodplain elevations from approximately 1 to 5 feet through the project reach and removing approximately 6 of the existing roadways from being overtopped by the 100-year floodplain. There are no proposed improvements to the existing MacArthur Boulevard/Grauwyler Road culvert. The MacArthur Boulevard/Grauwyler Road roadways are overtopped by the 100-year floodplain for both the existing and proposed Delaware Creek channel conditions. The proposed channel geometry and alignment are included in Appendix A, Figure 2 – Project Conceptual Plan and Profile Sheets. Detailed proposed channel improvements are also included in Appendix A, Figure 3 – Channel Strip Map.

The proposed sanitary sewer improvements are to replace an existing undersized line with a 36-inch to 42-inch sanitary sewer main as part of the City’s wastewater master plan and to eliminate existing siphons on the system. Detailed proposed sanitary sewer improvements are included in Appendix A, Figure 4 – Sanitary Sewer Strip Map. The opinion of probable construction cost (OPCC) for the channel, bridge, culvert and paving improvements is approximately $9,479,000 and is included in Appendix C of this report. The OPCC for the sanitary sewer main improvements is approximately $2,332,000. The total project cost is estimated at approximately $11,811,000. The design of the proposed channel and sanitary sewer improvements is scheduled for the beginning of 2013 with anticipated construction to begin in the spring of 2013.
APPENDIX A

FIGURES
Figure 1: Project Location Map

- Proposed Channel Improvement Limits
- Proposed Sanitary Sewer
APPENDIX B

PROJECT SITE PHOTOGRAPHS
Live Oak Drive looking downstream

Live Oak Drive looking downstream after 4” (2-year) rain event 1/25/12
Live Oak Drive Upstream Face

Upstream face Live Oak Drive after 4” (2-year) rain event 1/25/12
Confluence of Delaware Creek and Embassy Channel – Power pole in Embassy Channel

Cripple Creek Drive Looking downstream toward Live Oak Drive
Cripple Creek Drive downstream face

Cripple Creek Drive
Cripple Creek Drive upstream face

Cripple Creek Drive looking upstream toward Sunnybrook Drive
Sunnybrook Drive looking downstream toward Cripple Creek Drive

Sunnybrook Drive downstream face
Sunnybrook Drive looking upstream

Looking downstream from pedestrian bridge at Canyon Oaks
Pedestrian bridge abutment on west side of channel at Canyon Oaks

Pedestrian Bridge abutment on east side of channel at Canyon Oaks to allow for channel widening
New pedestrian bridge at Canyon Oaks. New park where home was removed

New pedestrian bridge at Canyon Oaks
Potential staging area and flume at Canyon Oaks on west side of channel

Looking upstream from pedestrian bridge at Canyon Oaks
Looking downstream from Green Oaks

Downstream face Green Oaks culverts
Upstream face of Green Oaks culverts after 4" (2-year) rain event 1/25/12
Looking upstream from Green Oaks

Looking upstream from Green Oaks after 4” (2-year) rain event 1/25/12
Looking upstream from Green Oaks at Oak Meadow after 4” (2-year) rain event 1/25/12

Looking downstream from Oak Meadow
Upstream face Oak Meadow culverts

Looking upstream from Oak Meadow
Looking upstream from Oak Meadow

Looking upstream from Oak Meadow
Looking upstream from Oak Meadow

Looking downstream from William Brewster
Downstream face of William Brewster culverts

Upstream face of William Brewster culverts. Sanitary sewer “spine” in channel
Pedestrian Bridge between Puritan and William Brewster

Pedestrian Bridge between Puritan and William Brewster after 4” rain event
Stamped concrete example for proposed channel from Puritan to William Brewster

Looking downstream from Puritan Drive
Looking downstream from Puritan Drive after 4” (2-year) rain event 1/25/12

Downstream face Puritan Drive culverts
Puritan Drive looking downstream

Pilgrim Drive near Puritan after 4'' rain event
Upstream face Puritan Drive culverts after 4" (2-year) rain event 1/25/12
Jaycee Park Delaware Creek spillway upstream of Puritan Drive
Jaycee Park Delaware Creek spillway after 4” (2-year) rain event 1/25/12

Jaycee Park hippo statues
Jaycee Park hippo statues submerged after 4” (2-year) rain event 1/25/12

Old SH 183 Culverts
New SH 183 Frontage Road Culverts

New SH 183 Frontage Road Culverts after 4” (2-year) rain event 1/25/12
New SH 183 Frontage Road Culverts transition to Delaware Creek pond in Jaycee Park
APPENDIX C

OPINION OF PROBABLE CONSTRUCTION COST
## Item Description and Costs

### General Items
- **Mobilization**: 1 LS, $495,000.00
- **SWPPP Execution and Administration**: 1 LS, $5,500.00
- **Erosion and Sedimentation Control**: 1 LS, $22,000.00
- **Barricades**: 1 LS, $82,500.00
- **Arrow Display Boards**: 4 EA, $4,400.00
- **Staging Area**: 2 EA, $2,750.00
- **Project Sign**: 2 EA, $1,320.00
- **Permanent Shoring (Cantilevered)**: 8500 SF, $77.00
- **Permanent Shoring (With Tie-Backs)**: 3750 SF, $77.00
- **Care of Water**: 1 LS, $132,000.00

### Site Work
- **Remove and Re-Install Pedestrian Bridge (56'X10')**: 2 EA, $25,000.00
- **Remove and Dispose Chain Link Fence**: 600 LF, $5,500.00
- **Remove and Replace Wooden Fence**: 25 LF, $88.00
- **Remove and Replace Tree**: 48 EA, $1,650.00
- **Remove and Replace 4" Thick Concrete Sidewalk**: 900 LF, $49.50
- **Milsap Sidewalk**: 28 SY, $60.50
- **Install New 6' Chain Link Fence**: 3600 LF, $17.60
- **10'X10' Steel Plate (Culvert Crossing at HWY 183)**: 3 EA, $5,500.00

### Paving Improvements
- **Unclassified Roadway Excavation**: 2640 CY, $18.70
- **Concrete Driveaway Approach**: 35 SY, $55.00
- **Traffic Rated Ornamental Fence**: 4000 LF, $154.00
- **Temp. Riding Surface**: 100 SY, $44.00

### Miscellaneous Site Work
- **general items**: $1,830,000
- **Mobilization**: 1 LS, $495,000.00
- **SWPPP Execution and Administration**: 1 LS, $5,500.00
- **Erosion and Sedimentation Control**: 1 LS, $22,000.00
- **Barricades**: 1 LS, $82,500.00
- **Arrow Display Boards**: 4 EA, $4,400.00
- **Staging Area**: 2 EA, $2,750.00
- **Project Sign**: 2 EA, $1,320.00
- **Permanent Shoring (Cantilevered)**: 8500 SF, $77.00
- **Permanent Shoring (With Tie-Backs)**: 3750 SF, $77.00
- **Care of Water**: 1 LS, $132,000.00

### General Item Costs
- **TOTAL**: $2,020,000
- **Mobilization**: 1 LS, $495,000.00
- **SWPPP Execution and Administration**: 1 LS, $5,500.00
- **Erosion and Sedimentation Control**: 1 LS, $22,000.00
- **Barricades**: 1 LS, $82,500.00
- **Arrow Display Boards**: 4 EA, $4,400.00
- **Staging Area**: 2 EA, $2,750.00
- **Project Sign**: 2 EA, $1,320.00
- **Permanent Shoring (Cantilevered)**: 8500 SF, $77.00
- **Permanent Shoring (With Tie-Backs)**: 3750 SF, $77.00
- **Care of Water**: 1 LS, $132,000.00

### Site Work Costs
- **TOTAL**: $420,000
- **Remove and Re-Install Pedestrian Bridge (56'X10')**: 2 EA, $25,000.00
- **Remove and Dispose Chain Link Fence**: 600 LF, $5,500.00
- **Remove and Replace Wooden Fence**: 25 LF, $88.00
- **Remove and Replace Tree**: 48 EA, $1,650.00
- **Remove and Replace 4" Thick Concrete Sidewalk**: 900 LF, $49.50
- **Milsap Sidewalk**: 28 SY, $60.50
- **Install New 6' Chain Link Fence**: 3600 LF, $17.60
- **10'X10' Steel Plate (Culvert Crossing at HWY 183)**: 3 EA, $5,500.00

### Paving Improvements Costs
- **TOTAL**: $1,181,000
- **Unclassified Roadway Excavation**: 2640 CY, $18.70
- **Concrete Driveaway Approach**: 35 SY, $55.00
- **Traffic Rated Ornamental Fence**: 4000 LF, $154.00
- **Temp. Riding Surface**: 100 SY, $44.00

### Miscellaneous Site Work Costs
- **TOTAL**: $550,000
- **Remove and Re-Install Pedestrian Bridge (56'X10')**: 2 EA, $25,000.00
- **Remove and Dispose Chain Link Fence**: 600 LF, $5,500.00
- **Remove and Replace Wooden Fence**: 25 LF, $88.00
- **Remove and Replace Tree**: 48 EA, $1,650.00
- **Remove and Replace 4" Thick Concrete Sidewalk**: 900 LF, $49.50
- **Milsap Sidewalk**: 28 SY, $60.50
- **Install New 6' Chain Link Fence**: 3600 LF, $17.60
- **10'X10' Steel Plate (Culvert Crossing at HWY 183)**: 3 EA, $5,500.00

### Channel Improvements Costs
- **TOTAL**: $4,811,000
- **Remove and Dispose Concrete Channel Lining and Slope Protection**: 19450 SY, $13.20
- **Remove and Dispose Box Culvert Headwall**: 16 EA, $1,650.00
- **Remove and Dispose Box Culvert**: 1241 LF, $85.00
- **Remove and Dispose Inlet**: 10 EA, $385.00
- **Unclassified Channel Excavation**: 20000 CY, $9.90
- **Subgrade Preparation**: 17940 SY, $6.60
- **Concrete Sloped Channel Wall**: 8200 CY, $70.40
- **Concrete Vertical Channel Wall**: 680 CY, $715.00
- **Concrete Channel Lining (Top)**: 18400 SY, $60.50
- **Stamped Concrete Channel Lining (Channel at Puritan to Brewster)**: 5500 SY, $88.00
- **10'X9' Concrete Box Culvert**: 180 LF, $550.00
- **10'X10' Concrete Box Culvert**: 450 LF, $600.00
- **10'X10' Concrete Box Culvert**: 400 LF, $660.00
- **Drilled Concrete Piers-Crown Span (8' C/C, 30VF; 18" DIA.)**: 21 EA, $2,200.00
- **Footings for Crown Span**: 28 LF, $275.00
- **Crown Span 28'X11.5'**: 100 LF, $4,235.00
- **Headwall for Box Culvert**: 12 EA, $16,500.00
- **Headwall for Crown Span**: 2 EA, $16,500.00
- **5" Hepe Pipe**: 12 LF, $26.40
- **24" Class III RCP**: 24 LF, $88.00
- **30" Class III RCP**: 12 LF, $132.00
- **9" Curb Inlet**: 12 EA, $2,200.00
- **10" Curb Inlet**: 6 EA, $2,750.00
- **Concrete Channel Drop Structure (2' Drop)**: 1 LS, $4,950.00
- **Concrete Channel Drop Structure (3' Drop)**: 2 LS, $8,250.00
- **Trench Safety**: 1313 LF, $2,889.00

### Paving Improvements Costs
- **TOTAL**: $1,181,000
- **Unclassified Roadway Excavation**: 2640 CY, $18.70
- **Concrete Driveaway Approach**: 35 SY, $55.00
- **Unclassified Roadway Excavation**: 2640 CY, $18.70
- **Saw Cut, Remove and Replace Existing 6" Integral Curb**: 960 LF, $8.80
- **9" Thick Concrete Pavement Repair (Full Depth)**: 2104 SY, $143.00
- **9" Thick Concrete Pavement Repair (Full Depth)**: 1210 SY, $165.00
- **Concrete Driveaway Approach**: 35 SY, $55.00
- **Traffic Rated Ornamental Fence**: 4000 LF, $154.00
- **Temp. Riding Surface**: 100 SY, $44.00
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APPENDIX D

CD ROM WITH ELECTRONIC DATA