US Army Corps Of Engineers®
Charleston District

amec foster wheeler

# PLANNING ASSISTANCE TO STATES

# KINLEY CREEK WATERSHED
# STORMWATER MANAGEMENT STUDY

# LEXINGTON COUNTY
# SOUTH CAROLINA

Lexington County — Good Friends and Great Communities

# AUGUST 2015

*"One of the most pressing problems facing Lexington County is storm drainage…the magnitude of the problem will multiply if corrective actions are not taken."*

Rodger Alderman, Lexington County Administrator, 1977

**Executive Summary**

Under the Planning Assistances to States (PAS) program, Lexington County and the United States Army Corps of Engineers, Charleston District, partnered to study the long term issues related to flooding along Kinley Creek and two of its tributaries, K-1 and K-2. Flooding within this area of Lexington County has been documented as early as 1974, and can be attributed to a myriad of causes, including a historical lack of stormwater management and development in the floodplain. Multiple houses have experienced repetitive flood damages.

This report analyzed current hydraulic and hydrologic conditions for Kinley Creek below Harbison Boulevard, and tributaries K-1 and K-2 respectively. Management measures addressing flooding were screened, combined into various alternatives, and modeled to determine potential drop in surface water elevation and effectiveness in removing existing structures out of the floodplain. Alternatives were also compared with respect to cost.

Due to the geographic variability and build out of the project area, no single alternative proved cost effective to both reduce flooding and remove structures out of the floodplain. It is recommended that implementation of the initial following measures will address the flooding within the project area:

- Focus on protecting structures in the 10-Yr. floodplain
- Acquire structures that have a history of repetitive loses
- Modify channel adjacent to Broken Hill Road and downstream of Piney Grove Road
- Construct pond offline of K-1

These initial steps would lower surface water elevations within portions of the floodplain and remove structures out of the floodplain. These measures also have the advantage of possessing a very positive cost to benefit ratio, ensuring a return on the capital invested.

Project/funding sources, in the form of federal programs and grants are also discussed in the report. After the initial measures are implemented, other management measures may also be implemented over time as these sources are identified.

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## 1. Introduction

In January 2013, Lexington County staff sent a letter to the U. S. Army Corps of Engineers (USACE) Charleston District requesting a study under the Planning Assistance to States (PAS) program to address the problem of persistent flooding in the Kinley Creek subwatershed near the Town of Irmo, Lexington County. Multiple studies (1983, 1987, and 1995) have been made to address this issue. However, no permanent solution has ever been implemented.

In August of 2013, the Lexington County Council authorized the Council Chairman to execute an agreement between Lexington County (referred to herein as "Sponsor") and the U. S. Department of Army for the Charleston District to analyze potential measures to address flood related impacts in the Kinley Creek subwatershed. In September of 2013, Lexington County and the Charleston District Commander executed an Agreement for the Study Cost of $322,000. Under the Agreement, Study Costs are shared 50%-50%, with Lexington County and Charleston District each responsible for $166,000. All related documents are available in Appendix A.

## 2. Study Authority

The Study Authority for this project is authorized by Section 22 of the Water Resources Development Act (WRDA) of 1974 (Public Law 93-251), as amended, otherwise known as the Planning Assistance to States (PAS) program. The PAS program authorizes the Secretary of the Army, acting through the Chief of Engineers, to assist the States in the preparation of comprehensive plans for the development, utilization and conservation of water and related resources of drainage basins, watersheds or ecosystems located within the boundaries of the state.

Section 319 of WRDA of 1990 (Public Law 101-640) authorizes the Secretary of the Army to collect fees from states and other non-federal government entities for the purpose of recovering 50 percent of the cost of the program established by the WRDA of 1974, Section 22.

## 3. Purpose and Scope

Through the PAS program, the Sponsor and USACE analyzed the engineering, environmental and economic feasibility of potential measures to address flood-related impacts to residential structures along Kinley Creek and two of its tributaries, known as K-1 and K-2. These measures were assessed and screened based on their engineering effectiveness, environmental impacts, and economic feasibility. Hydraulic and hydrologic modeling of ponds and channel capacity were performed as part of the analysis, although this study did not include a detailed analysis of the stormwater pipe network. The final work product provides the Sponsor with a conceptual level design and analysis of various alternatives to address flooding (management measures), and as such, engineering designs, plans and specifications were not developed. Additionally, potential impacts, benefits, costs and permitting requirements associated with each alternative were identified.

The Scope of Work and Cost Estimate for the Study are available in Appendix A. The list of Project Delivery Team (PDT) members for this Study is provided in Appendix B.

## 4. Project Location

The Kinley Creek watershed is a highly developed watershed approximately 7 square miles in size. Kinley Creek starts north of SC Highway 60, and ends in the Saluda River Figure 1). Elevations in watershed vary from 410 feet to 180 feet NGVD 29. Kinley Creek and its tributaries are typical of small Piedmont streams, exhibiting deeply incised channels with widely varying widths. Due to extensive residential and commercial development, the floodplain also varies greatly. The 14 acre Lake Quail Valley was created by impounding Kinley Creek above Harbison Boulevard (and outside of the project area). With the exception of a few isolated reaches, most of the floodplain within the project area has little or no unaltered floodplain remaining. It is not until Kinley Creek is below the CSX Railroad Bridge that the floodplain expands to natural conditions.

## 5. Problem

The area has experienced significant changes and flood frequency over the last 60 years. The majority of this growth has been prior to the implementation of State (1992) and County (2006) stormwater management regulations. Much of the area below Piney Grove road was built out prior to 1974. The area above Piney Grove proximate to Harbison Boulevard experienced rapid build out through the 1980s. As a result, much of the current infrastructure is not properly sized to handle current rainfall/runoff events.

Compounding the problem is that the development along Kinley Creek and its tributaries has resulted in little or no undeveloped floodplain remaining along most reaches. Flooding and subsequent property damage was identified as a problem as early as 1974, and has worsened as the watershed continued to be developed. Lexington County has seven repetitive loss p6roperties in the entire county. Five of those properties are within the study area.

In addition to encroachment into the floodplain, the development in the watershed has also impacted the hydrodynamic cycle of Kinley Creek, K-1, and K-2. The increase in hard or impervious surfaces reduces infiltration and increases overland runoff. Therefore, more water is discharged in a given period of time during precipitation events, and less water enters the streams through shallow groundwater recharge. The net result is that there is higher than normal runoff during rain events and lower than normal discharge during dry periods. Table 1 shows how storm flows through Kinley Creek increased over a 25 year period.

**Table 1. Historic and Current Flows at Piney Grove Road**

| Year Storm Event | 1987 Flow (cfs) | 2012 Flow (cfs) |
|---|---|---|
| 2 | 362 | 949 |
| 5 | Unknown | 1376 |
| 10 | 1000 | 1737 |
| 25 | 1411 | 2254 |
| 50 | 1766 | 2685 |
| 100 | 2056 | 3156 |

Due to the increase in storm-related runoff and accompanying discharge velocity, the stream increased in cross sectional area; eroding either deeper or wider (or both). Kinley Creek is deeply incised with steep, unstable banks. In multiple areas, attempts have been made to stabilize slopes in the past but no permanent solution has been implemented to protect properties from damage.

## 6. Previous Studies

The following reports are earlier attempts to address the flooding problems related to Kinley Creek and associated tributaries:

**Reconnaissance Report for Kinley Creek Lexington County, SC. 1987. USACE.** A reconnaissance report for a Section 205 of the 1948 Flood Control Act (As Amended) study initiated in 1983. This report evaluated flooding on Kinley Creek, assessed preliminary alternative solutions and determined that there was a positive net benefit to going further with the study, which is summed up in the next listing.

**Final Detailed Project Report, Kinley Creek Lexington County, SC- Section 205 of the 1948 Flood Control Act As Amended June 1991. USACE.** The final report of the Section 205 of the 1948 Flood Control Act (As Amended) study initiated in 1983 to reduce flood damages on Kinley Creek. The study recommended the excavation of a 600 foot flood control channel upstream of Piney Grove Road.

**Flood of September 7-9, 1987 in Lexington and Richland Counties in the Vicinity of Saint Andrews Road and Irmo, South Carolina. U.S. Geological Survey Water Resources Investigations Report 89-4077. 1989.** This study detailed the impacts of a large storm event on Rawls Creek, Koon Branch, and Kinley Creek, respectively. Study reported on high water marks and peak discharges as the result of receiving 5.5 inches of rain in three hours.

**An Analysis of Construction Activities in the Piney Grove Area and the Impact on the Kinley Creek Watershed. Alberghini and Newton, University of South Carolina, 1995.** – This was a University of South Carolina Study attempted to analyze why sediments found in Kinley Creek had changed from sandy to a more clay like material. This study attributed the source of the clay to a SCDOT operated borrow pit northeast of the Grove Park Subdivision. The study also noted that many of the stormwater structures in place (such as the Grove Park pond) and many of the road culverts were inadequate to handle the runoff that resulted from changes in the watershed.

Other documents and studies have been produced to address overall stormwater development, best management practices (BMP) effectiveness, and watershed management associated with Lexington County's Stormwater Management regulations. However, they are either repetitive with the documents listed above, or not germane to this project.

## 7. Project Description

The primary components of the study include hydrologic modeling, hydraulic modeling, and a survey of homeowners within the project area. The hydraulic and hydrologic modeling was used to determine the effectiveness of various combinations of management measures in reducing flooding and the survey was used to obtain details on items such as flood history, damage history, and type of structures that exist within the project area. The modeling efforts were undertaken by USACE and Amec Foster Wheeler. The surveys were developed by USACE and Lexington County and distributed and compiled by the County.

## 8. Hydraulic Modeling

Hydraulic modeling was performed in HEC-RAS (US Army Corps of Engineers, Hydrologic Engineering Center, River Analysis System, Version 4.1.0), a backwater hydraulic model for studying open channel flow. The initial HEC-RAS modeling for Kinley Creek and the K-1 and K-2 tributaries was conducted by FEMA and served as the starting point for establishing the Existing and Without Project conditions for this Study. Site visits resulted in model updates including revisions of roughness coefficients, bank stations, and structures. Additional details to the model were also added using GIS-created cross-sections. These details filled in a model gap that existed on Kinley Creek, proximate to Columbia Centre Mall. Initial model runs were output from HEC-RAS to ESRI ArcMap ™, analyzed using HEC-GeoRAS toolbar to view the extent of flooding for the 2-YR, 10-YR and 100-YR return intervals. This identified the extent of problem areas and obtained a baseline for alternative comparisons.

Channel, culvert, and bridge modifications were tested through the model to identify potential management measures to reduce flooding impacts for reaches of Kinley Creek, K-1, and K-2. Due to the extent of flooding in the watershed and the multiple causes, the various management measures could be combined and applied to specific sites to achieve localized reduction of flood impacts.

A detailed hydraulic modeling analysis is found in Appendix C.

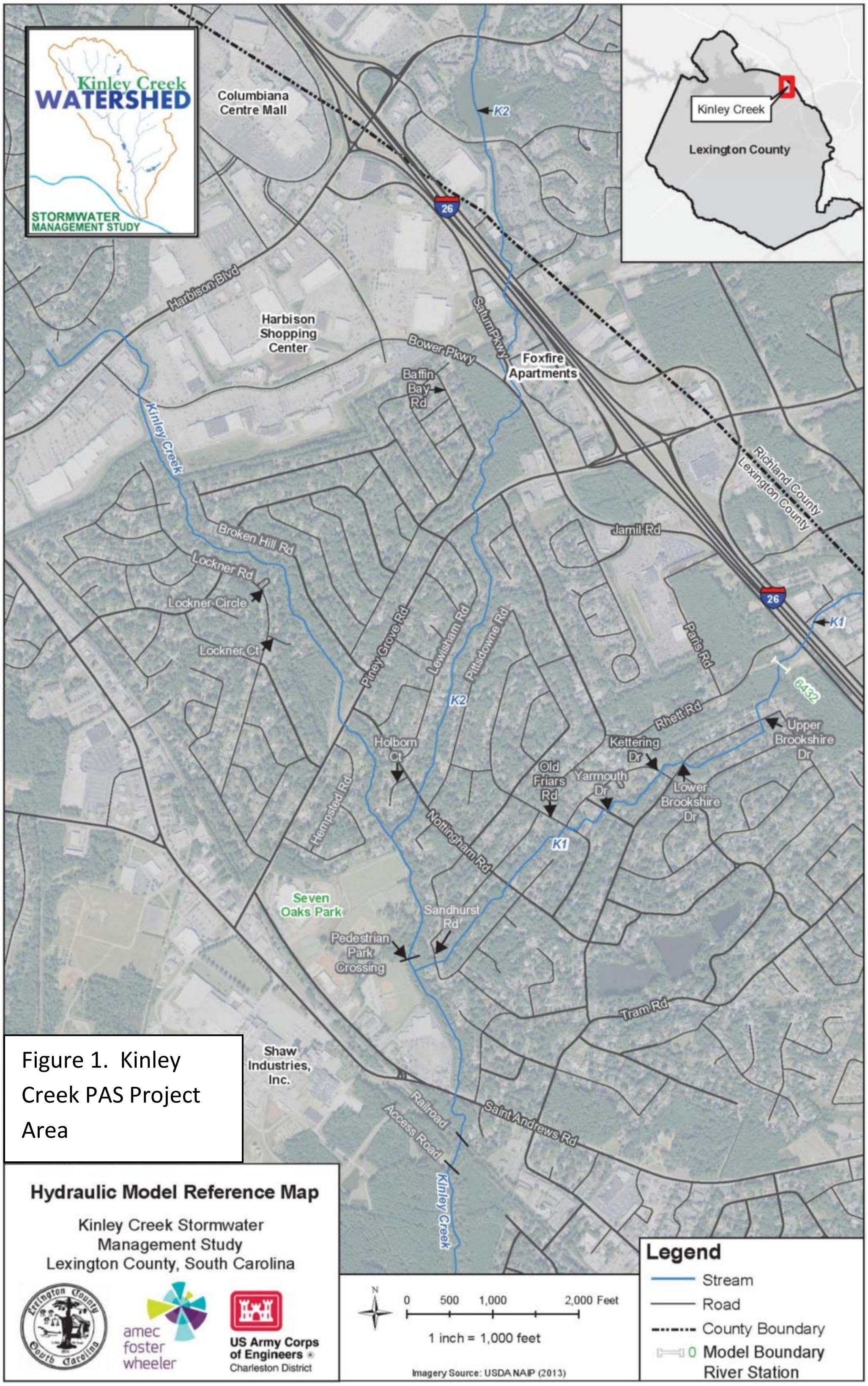



Figure 1. Kinley Creek PAS Project Area

## 9. Hydrologic Modeling

As part of this project, Lexington County retained Amec Foster Wheeler to model potential hydrologic solutions to address frequent flooding problems for the project area. This activity was combined with the USACE hydraulic modeling to test management measures to address flooding. In essence, Amec Foster Wheeler studied the stormwater contribution to the flooding and developed relevant management measures; USACE addressed issues within the channels.

The original Kinley Creek hydrologic model was developed by AECOM using USACE's Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS version 3.5.0.) for the purposes of updating Digital Flood Insurance Rate Maps (DFIRMs) and Flood Insurance Studies (FIS). AECOM used the HEC-HMS model to determine the peak flood discharges into Kinley Creek, K-1 and K-2 for the 2-, 5-, 10-, 25-, 50-, 100-YR, and 500-YR return intervals (Table 2). (For the remainder of this report, AECOM's model will be referred to as the original HEC-HMS model.)

This original HEC-HMS model was used as a starting point to subsequently develop and analyze potential solutions. The model delineates the project area into 14-sub basins elements, 9 junction elements, 8 Modified Puls routing elements, and 2 reservoir elements. Precipitation depth inputs were obtained from "NOAA Atlas 14, Volume 2, Version 3" at station Columbia WSFO AP (ID: 381939):

**Table 2. Precipitation Depths as a Function of Storms**

| Storm Return Interval | Precipitation Depth (Inches) |
|---|---|
| 2-Year | 3.62 |
| 5-Year | 4.52 |
| 10-Year | 5.28 |
| 25-Year | 6.39 |
| 50-Year | 7.33 |
| 100-Year | 8.36 |
| 500-Year | 11.10 |

Curve number (CN) inputs were calculated by intersecting land use, soils, and basin shape files. Basins were delineated using a digital elevation model (DEM) which was derived from Light

Detection and Ranging (LiDAR). Soil Survey Geographic (SSURGO) data is publicly available from the United States Department of Agriculture (USDA), and land use data was based on National Land Cover Dataset (NLCD) 2006. AECOM grouped the NLCD land cover classes into 6 general land-use types to calculate curve numbers. Technical Release 55 (TR-55) land use and soils relationships were then used to calculate composite CNs at each of the basins. A summary of CNs developed to support the original hydrologic model can be found in Appendix D.

Times of concentration (TC) values were calculated according to methods defined in TR-55. For each basin, longest flow paths were determined using a hydro-corrected terrain dataset and break lines.

The Modified Puls method was used to calculate reach routing in the original HEC-HMS model. Manning's equation was used to calculate initial storage-discharge curves for each routing element. The curves were incorporated into the HEC-HMS model to compute initial flows for the 2-, 5-, 10-, 25-, 50- and 100-YR events. The initial flows were then entered into detailed HEC-RAS models of the streams to obtain more accurate storage-discharge curves. The new storage-discharge curves were then input back into the HEC-HMS models and new discharges were calculated. This process was done for 3 iterations or until the discharges differed by no more that 10%. Prior to current modeling efforts, Amec Foster Wheeler updated the original HEC-HMS model to meet the study needs. This included adding site-level details such as stormwater control facilities and pipe networks to incorporate the existing conditions into the hydrologic model necessary to quantify impacts of evaluated management measures and alternatives.

The subbasins in the original HEC-HMS model were subdivided to account for stormwater facilities and to determine the effects of sheet runoff on the peak flows in the streams. They were also subdivided to accommodate stormwater infrastructure in the both the Harbison shopping area and along both K-1 and K-2. (A stormwater GIS layer was provided by the City of Columbia for the Kinley Creek reach proximate to the Harbison shopping area.) The data provided by the City of Columbia was used to delineate the drainage areas of the stormwater ponds. The remaining portion of the project area (where stormwater pipe information could not be obtained) the basins were delineated using a DEM generated from LiDAR data. Basins were subdivided at existing structures that could be identified using available orthoimagery such as bridges, culverts, and stormwater pipe outlets.

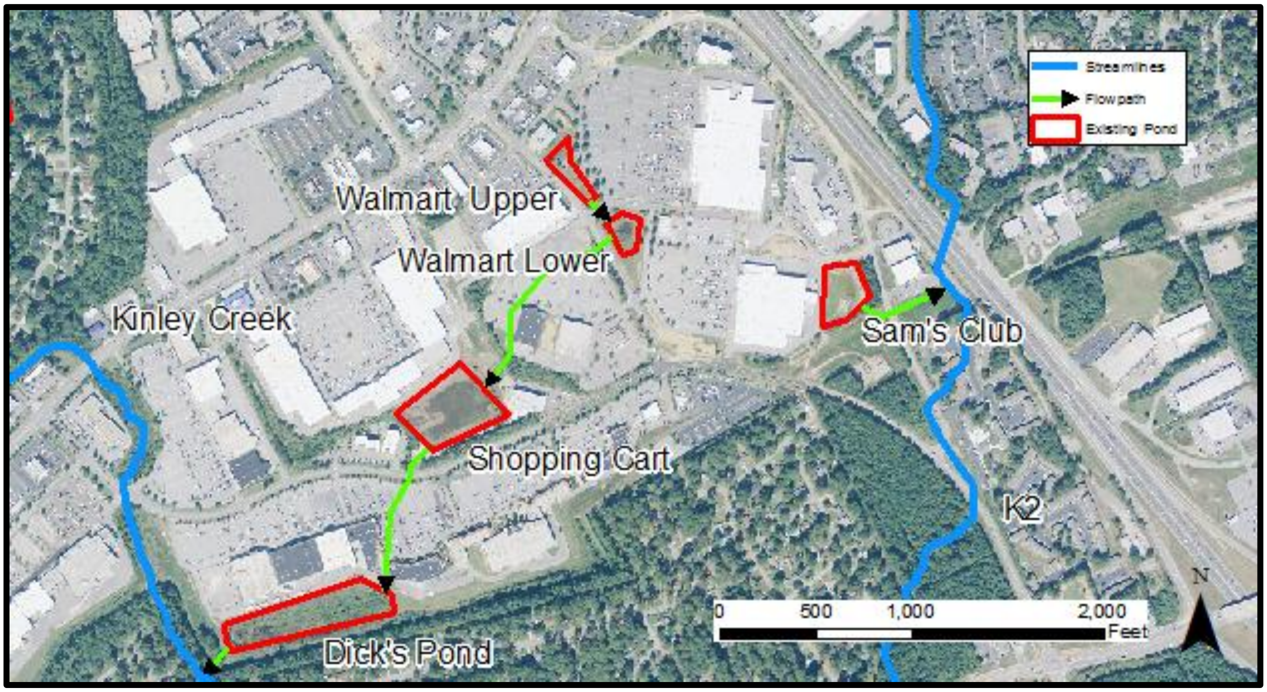



**Figure 2: Harbison Shopping Area Stormwater Ponds**

HydroCAD was used to develop stage-discharge curves for each of the existing ponds (Figure 2). Storage data developed in ArcGIS was transferred into HydroCAD to produce stage-area curves. The outlet for the Car Max pond (not pictured) was modeled based on as-built plans provided by Lexington County. For all other ponds, Lexington County officials surveyed the outlet structures and provided that information to Amec Foster Wheeler. Once the stage-area and outlet structure information was incorporated into HydroCAD, stage-discharge curves for each of the ponds could be calculated. The stage-discharge curves and stage- area curves were then added to the HEC-HMS model.

To remain consistent with the methodology used to create the original HEC-HMS model, Amec Foster Wheeler used the land use descriptions and CN relationships created by AECOM which were outlined in Appendix D. NLCD 2011 was used to more accurately reflect current land use.

Times of concentration were calculated according to the methods outlined in TR-55. Since pipe and hydraulic structure information was unavailable for most of the watershed, longest flow paths were primarily determined based on LiDAR-derived terrain datasets and observations in the orthoimagery.

The addition of new junctions, stormwater ponds, and subbasins in the HEC-HMS necessitated the development of new routing curves for Kinley Creek, K-1, and K-2, were entered into the models to produce storage-discharge curves each of the stream segments. Using the Modified Puls routing method, these storage-discharge curves were then inserted into the HMS model. A detailed hydrologic analysis is found in Appendix D.

## 10. Survey

Homeowners adjacent to Kinley Creek, K-1 and K-2 were sent surveys designed by the USACE and Lexington County to assess flooding and related damage history and to serve as a secondary back check for the modeling results. Lexington County mailed out 327 questionnaires and received 68 replies (response rate approximately 20%). Forty respondents reported flooding with 26 of these respondents reporting multiple flood events with property damage. While most of the flood impacts were yard or crawl space, 11 of the houses that reported multiple flooding events indicated damage inside structures (first floor, basement, garage, and den). Overall, the questionnaire confirmed that multiple properties within the study area have experienced multiple flood damage episodes.

The questionnaire can be found in Appendix E.

## 11. Management Measures

As previously stated, the extent of flooding in the watershed and the various causes of the flooding have allowed for the development of a suite of management measures that could be combined to form various alternatives, applied to specific stream reaches, and modeled to determine reduction of flood impacts. Table 3 shows management measures that were modeled and combined to form the various evaluated alternatives that will be discussed.

**Table 3. Hydraulic Management Measures Modeled with HEC-RAS**

| Reach | Measure |
|---|---|
| K-1 | Sandhurst Road Bridge Modifications |
| K-1 | Nottingham Road Culvert Modification |
| K-1 | Old Friars Road Culvert Modification |
| K-1 | Reduce Minor Losses at Old Friars Road |
| K-1 | Yarmouth Drive Culvert Modification |
| K-1 | Kettering Drive Culvert Modification |
| K-1 | Lower Brookshire Road Culvert Modification |
| K-1 | Upper Brookshire Road Culvert Modification |
| K-1 | Channel Modifications |
| K-1 | 1.6 Acre Off-Line Pond |
| K-2 | Nottingham Road Bridge Modification |
| K-2 | Piney Grove Road Bridge Modification |
| K-2 | Lower Channel Modifications |
| K-2 | Upper Channel Modifications |
| K-2 | Full Reach Channel Modifications |
| K-2 | Relocate Upper Channel |
| K-2 | Add Fill or Wall at Upper K-2 Bend |
| K-2 | 7.9 Acre On-Line Pond on K-2 |
| Kinley | Railroad Bridge Modification |
| Kinley | St. Andrews Road Bridge Modification |
| Kinley | Sandhurst Road Bridge Modification |
| Kinley | Piney Grove Road Bridge Modification |
| Kinley | Channel Modification Starting at Harbison Shopping Area and Heading Downstream |
| Kinley | Channel Modifications along Broken Hill Road |
| Kinley | Channel Modifications at Confluence with K-2 |
| Kinley | Clearing and Grubbing |

Initially, the proposed measures were modeled individually to optimize the desired dimensions. The Without Project HEC-RAS model was copied as the starting point for each measure and modifications were entered based on quick hand calculations of required capacity for the 10-YR and 100-YR return intervals. Due to the proximity of structures and utilities, and the low slope along many reaches, the ideal capacity was not always feasible and, as such, the measures were modified to maximize the available space. Additionally, all channel modifications are limited by rocky terrain in the channels which will make modifications to the channel bottom very difficult and costly. For this reason, and due to the large difference between the base flow and storm flows in the Kinley watershed, all channel modifications proposed have limited revisions to the bottom of the channel. It is assumed that the rocky and highly vegetated side slopes will allow for slightly steeper slopes to be recommended than are typically used in Lexington County and thus proposed alternatives include side slopes ranging from 1.5:1 to 3:1. Note that the modifications proposed in this study were assessed at a preliminary screening level and full plans and specifications have not been prepared. Any measures identified as desirable for future projects will need to be re-assessed at a higher level of detail.

**K-1: Nottingham Road Culvert Modification**

Nottingham Road is owned by the South Carolina Department of Transportation (DOT) and K-1 crosses below the road through a 7 ft pipe culvert. The pipe culvert location does not coincide with the low point in the road, and thus water overtops the road prior to filling the culvert. The culvert is the optimal size already for the existing channel, and thus modifications are only proposed in conjunction with modifications to the inlet and outlet channel dimensions. It was determined that addition of a 6 ft pipe culvert would provide enough increased capacity to accommodate more frequent storms, while fitting beneath the existing road deck with proper cover depth (Figure 3). It may be possible to raise the road elevations or shift the culverts to provide further benefits, although that was not assessed in detail as part of this study.

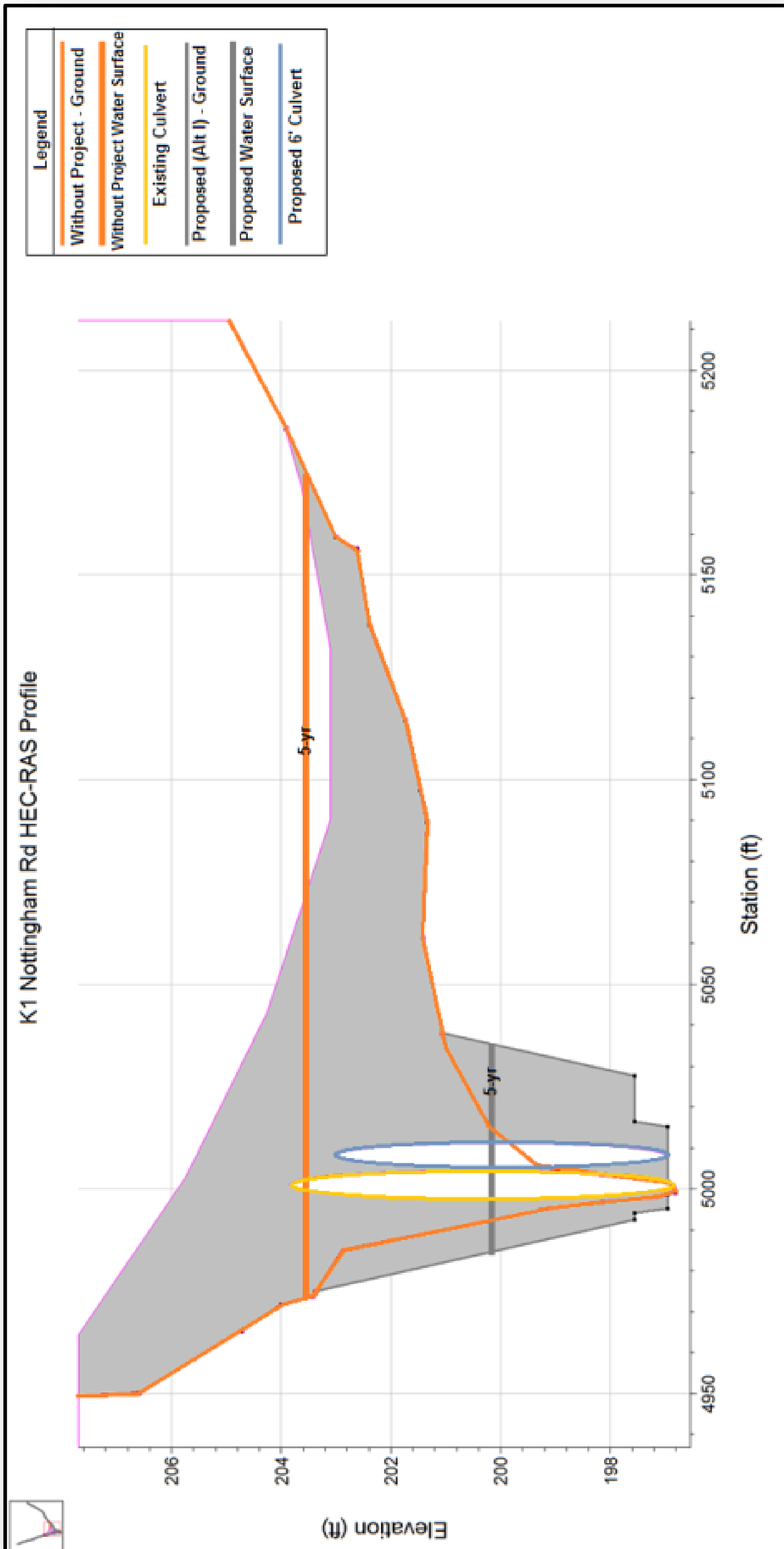



**Figure 3. Proposed Nottingham Road Culvert Addition and Associated Reduction in Water Surface Elevation**

### K-1: Old Friars Road Culvert Modification

Old Friars Road is owned by Lexington County and K-1 crosses below the road through a single 4 ft concrete pipe, and brick culvert. The culvert path zigzags across the road at an angle, including six 90-degree bends, and passes underground through yards on the upstream and downstream side of the road, for a total length of 339 ft. This culvert is severely undersized, only providing 13 $ft^2$ whereas a 10-YR storm in K-1 would require a minimum cross-sectional area of 60 $ft^2$. The proposed modifications are limited by the location of nearby structures and depth under the road. Two 6 ft-by-6 ft box culverts are proposed which would extend the culvert opening to the low point of the road and maximize the available space to accommodate the more frequent storms and reduce flooding in larger, less-frequent storms. Additionally, minor benefits would be gained by reducing the zigzag pattern down to two 45-degree bends and by the reduced friction provided by the proposed culverts compared to the existing culvert.

### K-1: Yarmouth Drive Culvert Modification

Yarmouth Drive is owned by SC DOT and K-1 crosses below the road through a single 4 ft corrugated metal pipe. The culvert path zigzags across the road at an angle, including three 45-degree bends, and passes underground through yards on the upstream and downstream side of the road, for a total length of 339 ft. Significant flooding has occurred at the structures adjacent to K-1 at Yarmouth Dr. and the force of floodwaters over yards and the road were enough to detach an exterior AC unit from a house on the upstream side of Yarmouth Drive and carry it to the garage door of the home on the downstream side. The proposed modifications are limited by the location of nearby structures and depth under the road. Despite the limited access, it is imperative that the culvert at this location be as large as possible in order to improve the flooding and thus, two 6 ft by 5 ft box culverts are proposed (Figure 6).

**Figure 4 Inlet to Yarmouth Dr Crossing**

**Figure 5 Outlet of Yarmouth Dr Culvert**

**Figures 4 and 5 represent Without Project Conditions**

**(USACE)**

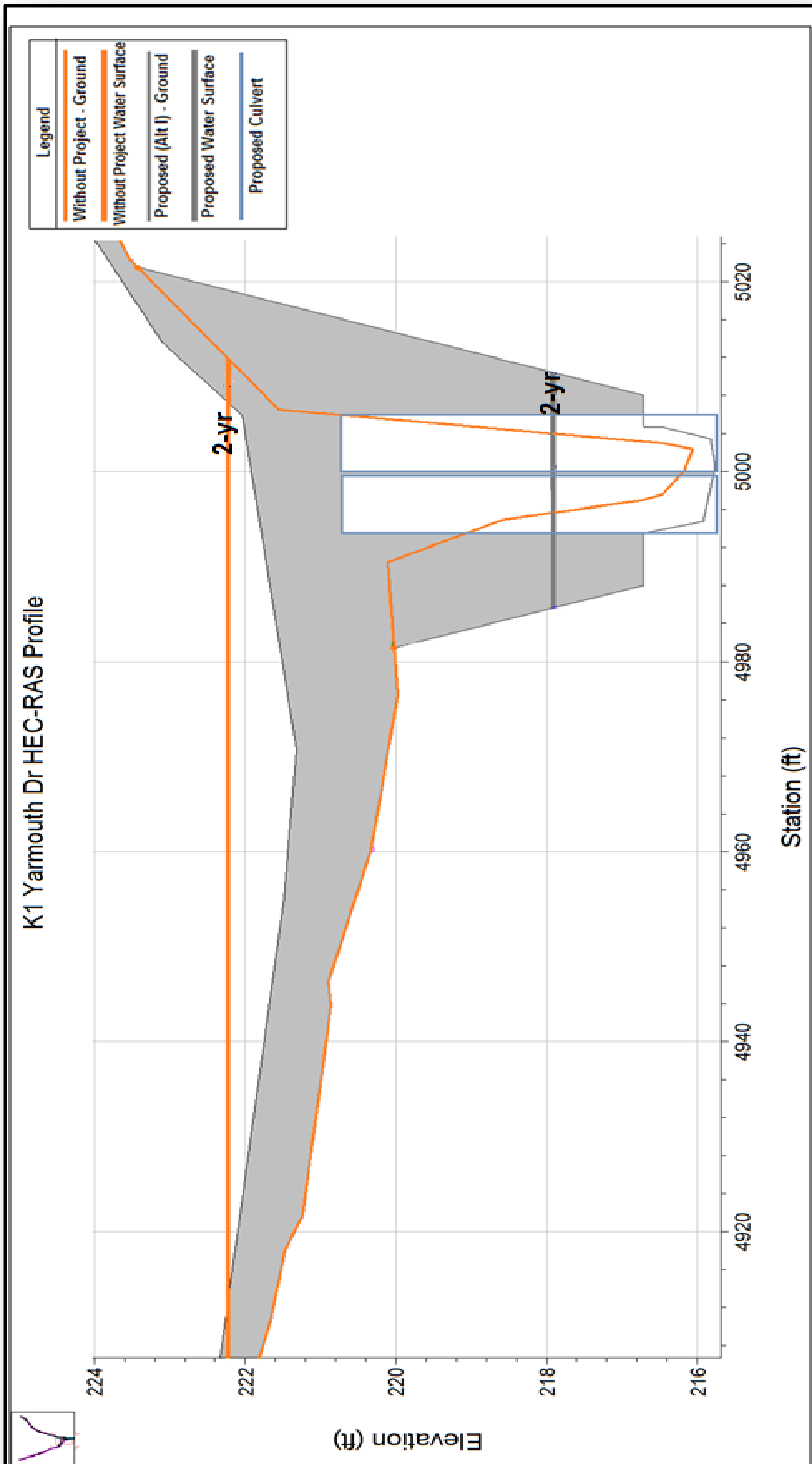



**Figure 6. Proposed Yarmouth Dr Culvert and Associated Reduction in Water Surface Elevation (At Inlet)**

Kettering Drive is owned by Lexington County and K-1 crosses below the road through a single 4 ft concrete pipe. Flooding has been documented at the home on the upstream side of Kettering Dr. Two concrete 6 ft-by-4 ft box culverts are proposed.

**Figure 7. Flooding at home between Kettering and Lower Brookshire Drive**

**(Photo Courtesy of Mr. Dru Kennedy)**

**K-1: Lower and Upper Brookshire Drive Culvert Modifications**

Brookshire Drive is owned by Lexington County and K-1 crosses Brookshire Drive at the upstream end and again just before it meets with Kettering Drive. At the lower Brookshire Drive crossing, addition of a 5 ft diameter and a 4 ft diameter concrete pipe parallel to the existing 4 ft corrugated metal pipe culvert are proposed and were modeled in HEC-RAS. At the upper Brookshire Drive crossing, there is not sufficient space or slope to modify the 3 ft diameter corrugated metal culvert in the existing alignment. The existing 3 ft diameter pipe culvert meets with two pipes with larger total capacity but the increased dimensions are not modeled due to the upstream limitation of the 3 ft diameter pipe. In combination with acquisition or modification of structures, it could be feasible to re-route the upper crossing to the lowest path and to increase the culvert capacity. There is a gas line easement that crosses K-1 upstream of Brookshire Drive, further limiting options for improvement. Flood waters have been reported to flow down Brookshire Drive during storms, temporarily blocking access to structures.

**K-1: Channel Modifications**

Channel modification options on K-1 are very limited due to space available between structures. The alignment alternates between open channel and pipe flow, with over 1400 ft of K-1 being piped through yards and under roads. Benefits gained from increased channel capacity are only realized in close proximity to the modified area and, thus, only alternatives that modify the full length of K-1 have been assessed (Figure 8). Channel modifications were made in HEC-RAS with locations of structures guiding the boundary locations, and then again ignoring the location of structures in order to contain the 10-YR storm peak flows where ever possible, which is only possible when combined with property acquisitions. Additionally, base flows in K-1 are very low and thus a low flow channel was maintained in proposed modifications. The low flow channel proposed does not exceed a foot of depth since K-1 is only a few feet in some areas and wide floodplain benches are proposed.

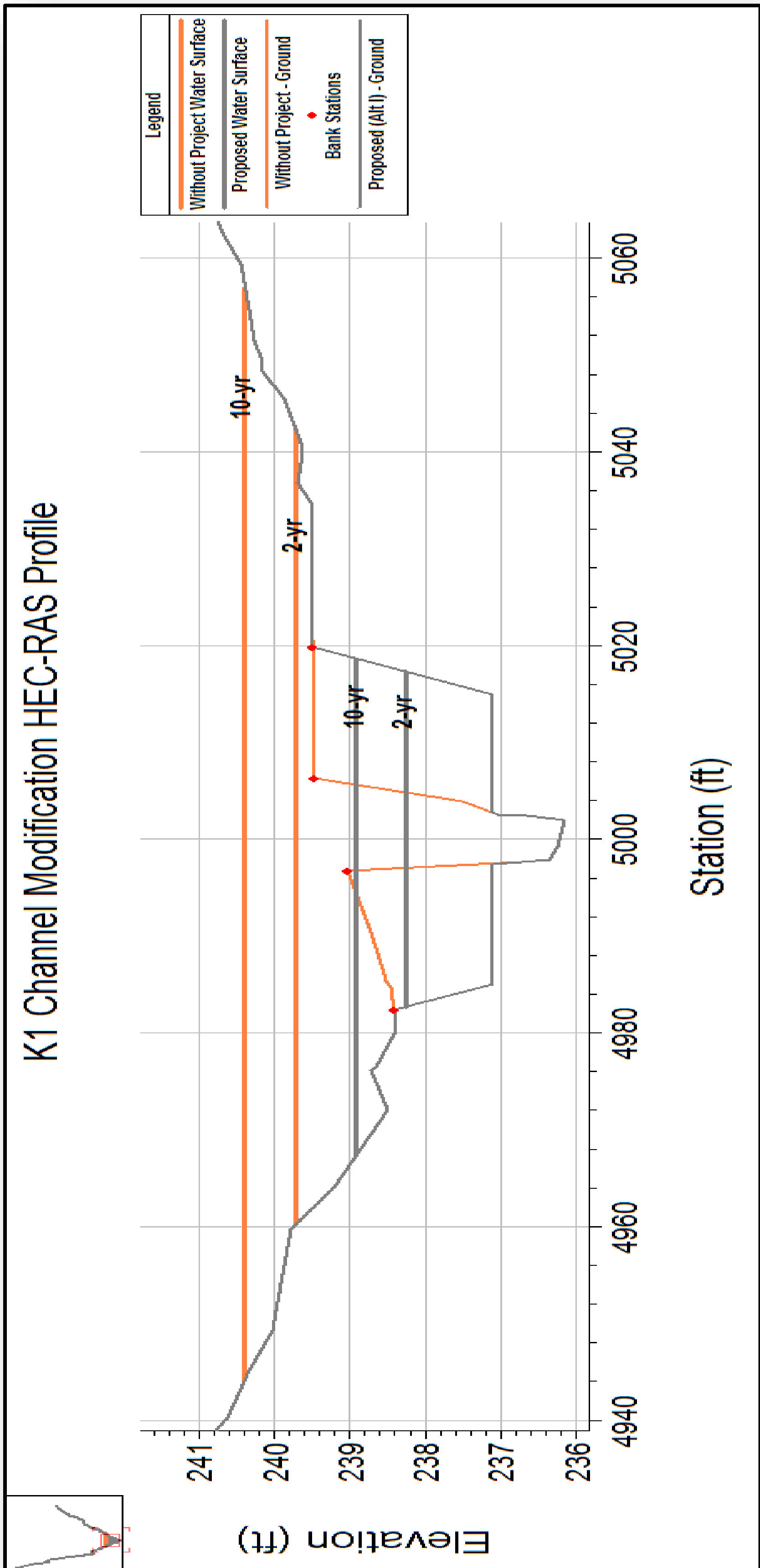



**Figure 8. Proposed Channel Modification Cross-Section**

**K-1: Nottingham Road Bridge Modification**

Nottingham Road is owned by SC DOT and K-2 crosses under it through a bridge. In conjunction with channel modifications, the bridge was modified in HEC-RAS to have a 20 ft wider span which accommodated 2-YR storm peak flows and eliminated road overtopping past the 10-YR flood, as shown in Figure 9. This modification lowered peak flood water surface elevations in all modeled floods.

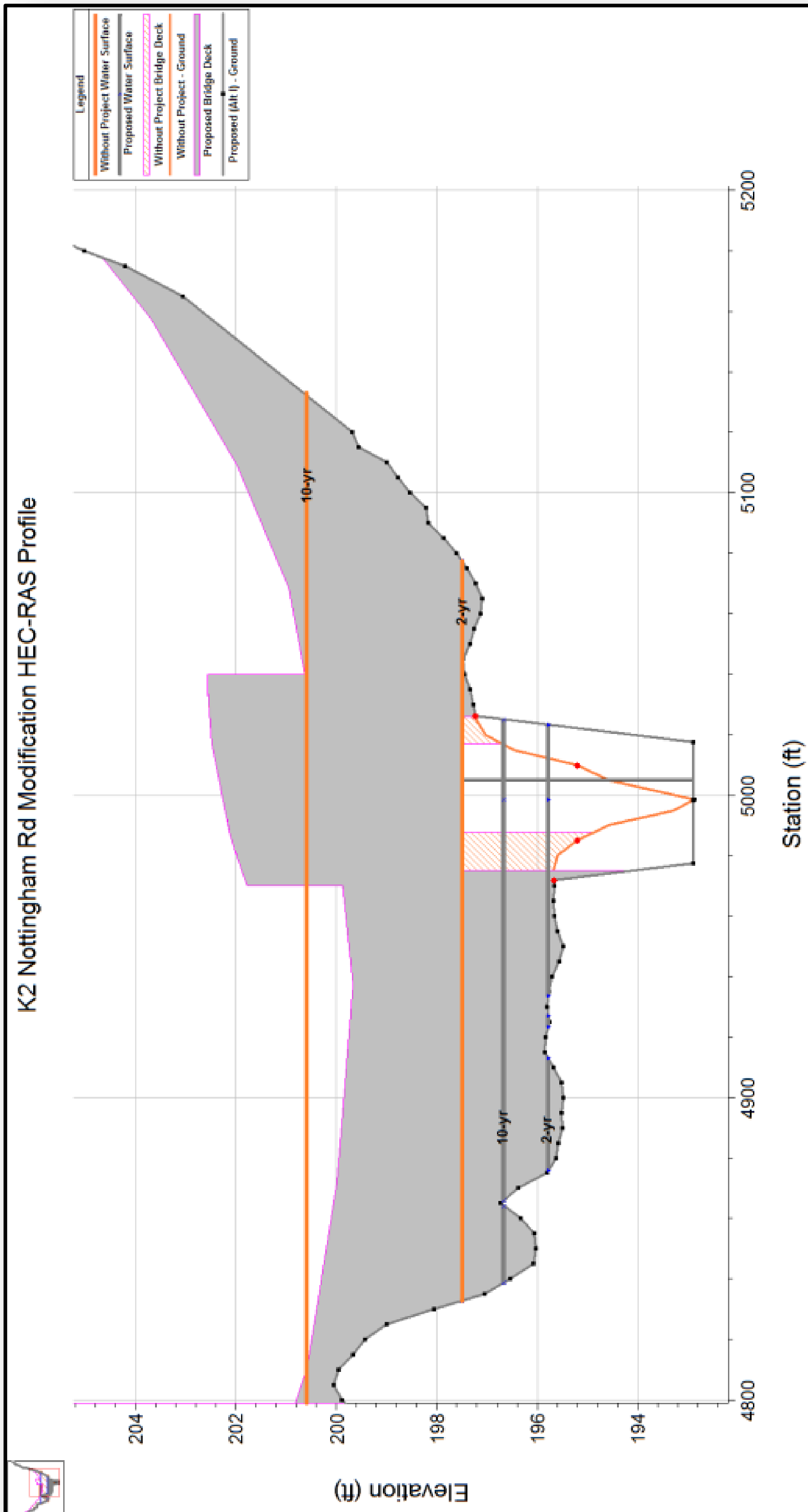



**Figure 9. Proposed Channel Modification Cross-Section**

## K-2: Piney Grove Road Bridge Modification

Piney Grove Road is owned by SC DOT and K-2 crosses under it through a bridge. Piney Grove Road Bridge has low-slope abutments of rip-rap that extend into the channel and rip-rap that extends upstream and downstream of the bridge. The rip-rap reduces the capacity of undersized channel. Abutments were modified in conjunction with the channel in HEC-RAS in order to provide additional capacity. Water surface elevations were lowered, as shown in Figure 10.

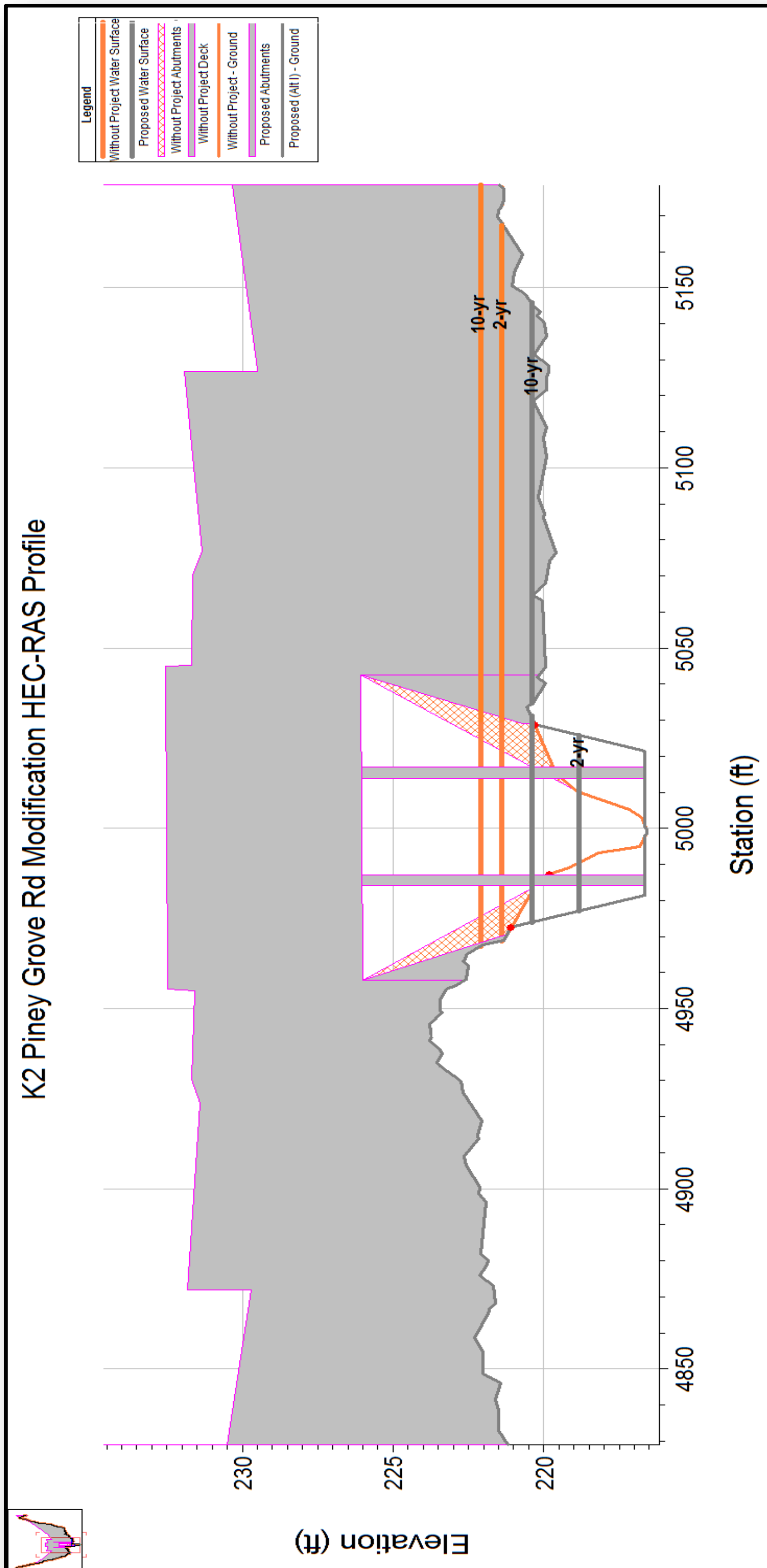



**Figure 10. Piney Grove Road Abutment Modifications for 2-yr and 10-yr Peak Floods**

**K-1: Full Reach Channel Modifications**

Similar to the K-1 channel modifications, K-2 was modified to increase the capacity while maintaining a low-flow channel. Utilities and proximity of structures to K-2 is limiting, and large flows enter K-2. Channel modifications were made with locations of structures guiding the boundary locations, and then again ignoring the location of structures in order to contain the 10-YR storm peak flows where ever possible, which is only possible when combined with property acquisitions.

In order to allow for flexibility in upgrading infrastructure as funding permits, the K-2 channel modification model was also separated to identify benefits gained through modified shorter reaches.

**K-1: Off-Line Pond**

This measure calls for the construction of a 1.6 acre pond adjacent to K-1 West of Jamil Road. Flow from K-1 would enter the pond through a lateral weir. Peak flow reductions are therefore dependent on the water elevation within the channel. The pond dimensions are as follows:
K-1 Offline Pond Design:

- Bottom elevation = 256 ft.
- Top elevation = 26 ft.
- Inlet is a 100ft lateral weir at elevation 260 ft.
- Outlet is a 1ft diameter orifice at elevation 257.5 ft.
- The emergency spillway is 75ft long at elevation 260 ft.

**K-2 Lower Channel Modifications**

Due to reported flooding in the Holborn Court neighborhood, the lower reach of K-2 was modified to provide increased flood capacity. A 60 ft wide channel, with a small low flow channel, was modeled in HEC-RAS for the first 600 ft of K-2 from Kinley Creek.

**K-2 Relocate Upper Channel/Increase Capacity**

Due to reported flooding along Baffin Bay Road, and open space to the east of K-2, a large floodplain bench was modeled. This alternative reduced flooding in the Baffin Bay neighborhood but the neighborhood is at lower elevations than most of the open space and thus, flooding could not be fully prevented.

### K-2 Add Fill or Wall at Upper K-2 Bend

This measure consisted of the addition of bank material at a low point along K-2 where the tributary bends around structures and water flows out of the banks and into the street. The measure has been eliminated upon review of the maps due to the limited space available behind structures and because the slightly raised banks will not add enough capacity to remedy flood risk.


**Figure 11. Flooding from K-2 adjacent to Lewisham Court.**
**(Unattributed Photo)**

### K-2 Construct a 7.9 Acre Pond on K-2

This measure calls for the construction of a 7.9 acre pond on K-2 South of Bower Parkway. The pond dimensions are as follows:

- Bottom elevation = 226 ft.
- Top elevation = 234 ft.
- The lower outlet consists of two 6 in. diameter orifices at elevation 226.5 ft.

- The upper outlet consists of two 6 in. diameter orifices at elevation 228.5 ft.
- The emergency spillway is 100 ft long at elevation = 230.5 ft.

**Kinley Creek: Railroad Bridge Modification**

The railroad bridge over Kinley Creek is small, with only a 22 ft span. Water backs up behind the crossing but backwater from the Saluda River extends further upstream than this crossing, which may control the water levels according to the FEMA Flood Insurance Study Flood Profiles. If localized flooding occurs from Kinley Creek when the Saluda River is not at flood stage, then the railroad bridge effects will be apparent since the water surface in Kinley Creek is the starting elevation for the water surface on the tributaries. More coordination efforts for this measure would be required since the railroad company owns this bridge. The backwater impacts of the bridge upstream extend for more than 2500 ft but are downstream of the majority of reported flooding locations. Modification of this bridge was modeled to include a 57 ft span and a high point in the channel upstream of the bridge was removed. Figure 12 shows the railroad bridge over Kinley Creek. Figure 13 shows the water surface elevations surrounding the bridge and the modified bridge, without modification to the high point in the stream.

**Figure 12. Railroad Bridge over Kinley Creek looking D/S (USACE)**

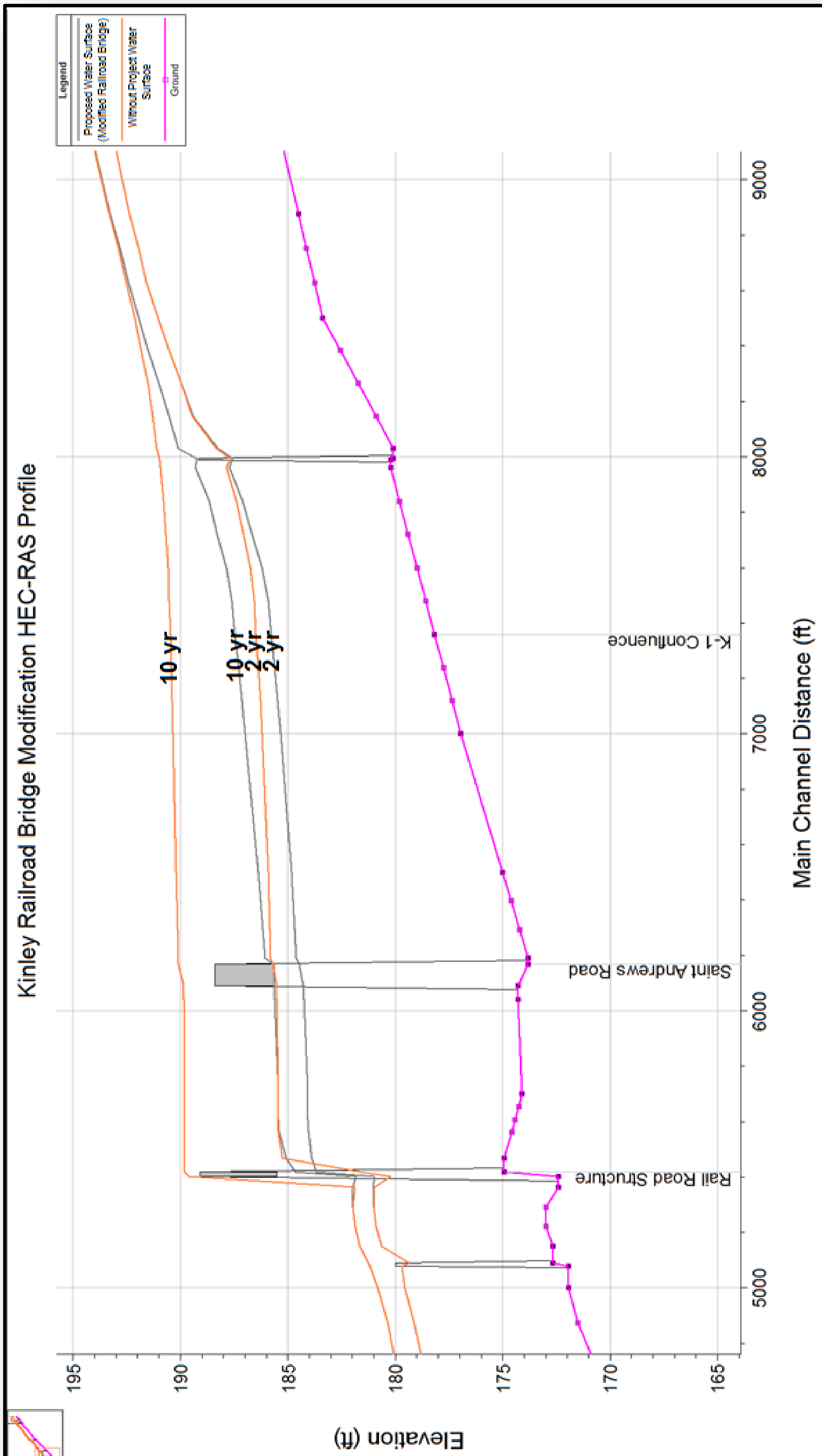



**Figure 13. Modification of CSX Crossing at Kinley Creek**

**Kinley Creek: St. Andrews Road Bridge Modification**

The St. Andrews Road Bridge is owned by SC DOT. A modification was proposed to expand the span from 86 ft to 112 ft. Since the downstream Railroad Bridge is not likely to be expanded as wide as this bridge, this measure was only carried forward in conjunction with modifications to the Railroad Bridge. Reductions in water surface were achieved by modifying this bridge in the Kinley model but the impacts of this bridge are small compared to those caused by the railroad bridge. St. Andrews Road is an unlikely cause of flooding upstream.

**Kinley Creek: Piney Grove Road Bridge Modification**

Similar to the Piney Grove Road Bridge proposed modifications along K-2, revisions to the bridge abutments were proposed to add additional capacity. The Piney Grove Road Bridge was recently expanded but this measure would match the bridge with proposed channel modifications and prevent the likelihood of overtopping.

**Kinley Creek: Channel Modification from Harbison Shopping Area to Saluda River**

The channel of Kinley Creek was modified to increase the capacity while maintaining a low-flow channel. Utilities, sewer lines in particular, run along and cross over Kinley Creek. Just as with the K-2 channel modifications, this measure was first designed to accommodate more flow between the existing neighborhoods, and later was modified again to contain the 10-YR flood, which required that some structures were removed in conjunction with the channel modifications (Figure 14). The width of the modified upper channel was 40 ft, and if structures were removed the width was expanded to 85 ft. Channel modifications around Piney Grove Rd were designed to smoothly transition through the bridge. Without acquiring any structures, the proposed channel could be modified to 60 ft wide.

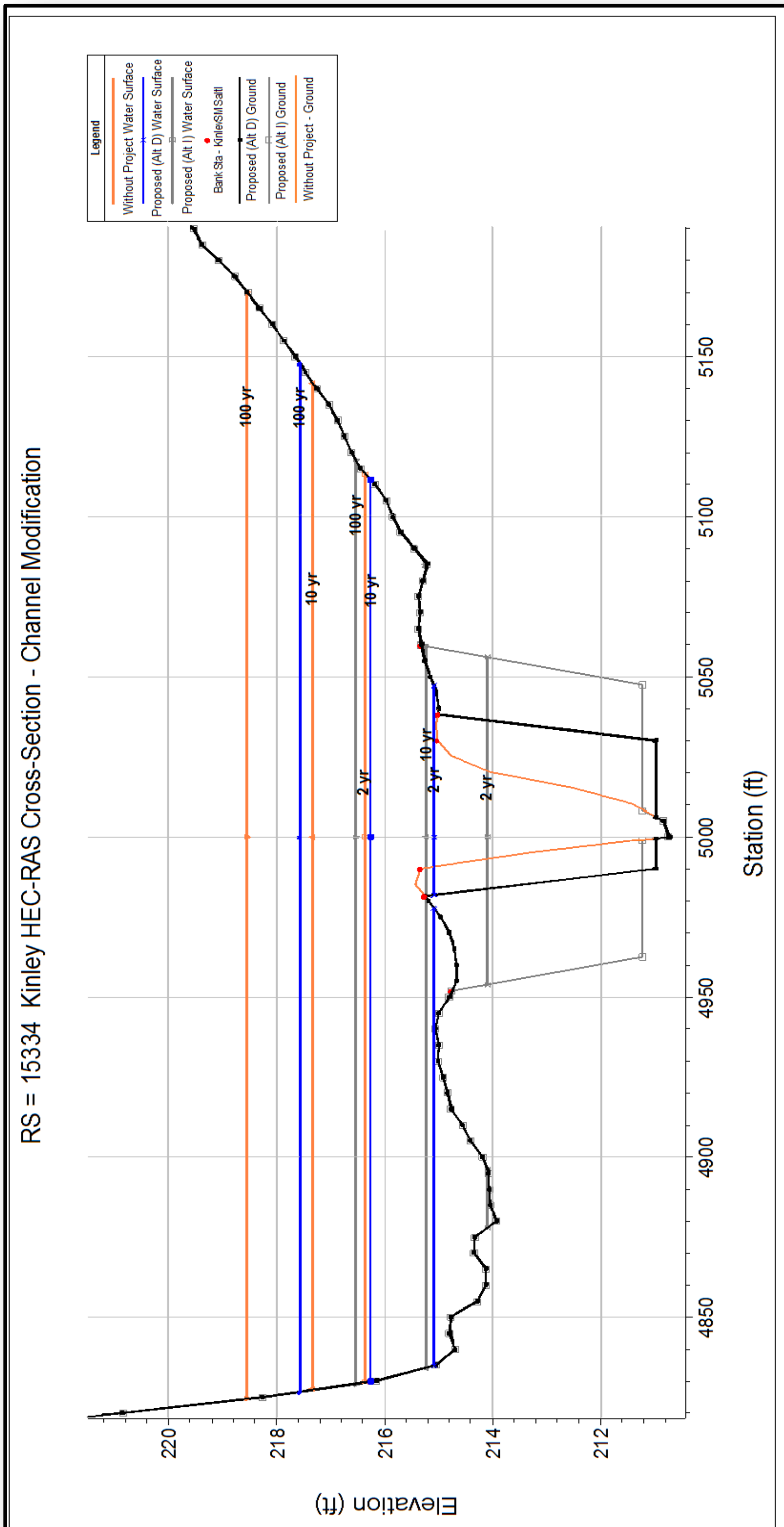



**Figure 14. Kinley Channel Modification Measures: Harbison Shopping Area to Saluda River**

**Kinley Creek: Channel Modifications along Broken Hill Road**

Channel modifications were made to Kinley Creek for the portion of channel between Broken Hill Road and Lockner Court where significant flooding has been reported. This measure was assessed as a less intensive alternative that might be more easily accomplished than some of the more expansive modifications.

**Kinley Creek: Channel Modifications at Confluence with K-2**

This measure was another less intensive alternative modeled to determine the potential for localized reductions in flooding between Piney Grove Road and where K-2 enters Kinley Creek. Repeated flooding has been reported along this portion of the creek (See photograph of flooding in Figure 16). As discussed in previous measures, the utilities in close proximity to Kinley Creek complicate any modifications (Figure 15).

**Figure 15. Pipe crossing Kinley Creek with collected debris, immediately upstream of K-2 confluence. (USACE)**


**Figure 16. Flooding at Home on Holborn Ct.**

**(Photo courtesy of Mr. Alan Ray)**

**Kinley Creek: Clearing and Grubbing**

In order to model the effect of clearing and grubbing alone, roughness coefficients were reduced. This measure provided additional channel capacity and increased velocities, which reduced the water surface elevations (Figure 17). This measure should occur when channel modifications are made and was not analyzed extensively as an independent measure. If construction is unlikely to occur in the near future, this measure should be performed for short-term benefits.

**Figure 17. Fallen Tree in Kinley Creek and multiple trees with exposed roots along Kinley Creek. (USACE)**

### Management Measures Screened and Rejected

Due to the geographic spread and the various causes of flooding within the project area, multiple management measures were considered and not considered for various reasons. These dropped management measures include the following:

**Table 4. Management Measures Initially Considered But Not Analyzed**

| Management Measure | Measure Description | Reason for Not Carrying Forward |
|---|---|---|
| In-Line Pond on K-2 Tributary | Pond constructed upstream of the Shadow Brook Pond and would receive runoff from I-26 and nearby areas | Modeling showed minimal benefits |
| Off-Line K-2 Pond | Us an old wastewater pond north of Pine Grove Road to receive runoff | Modeling showed minimal benefits |
| Modification of Beaverdam Road Dam | Modify pond to extend storage capacity | Potential impacts to other properties, shifting problems upstream |
| Modification of BAS605 | Modify pond to extend storage capacity | Potential impacts to other properties, shifting problems upstream |
| Stormwater Retrofit | Retrofitting impervious areas with new/improved stormwater controls | Modeling showed little impact for the amount of available land |

### Transforming Measures into Alternatives

After modeling all of the proposed measures, the effective measures were combined into eight alternatives for a more manageable dataset. Measures were grouped based on whether they could be realistically implemented together. A Kinley, a K-1, and a K-2 model were created for each alternative, although some models were duplicated between alternatives to isolate modifications to a smaller area. Boundary conditions were adjusted in K-1 and K-2 HEC-RAS models to incorporate the combined modification impacts obtained from the results of the Kinley HEC-RAS models through the use of a known water surface elevation. Additional alternatives were not modeled but were included for cost-benefit analysis, which included elevating structures and acquisition of structures. The final list of alternatives is provided in Table 5. Individual measures could be implemented independently if funding, timing, or other constraints do not allow for a watershed-wide solution to be implemented.

## 12. Alternatives

As previously stated, due to the size and variance of problems in the Project Area, the management measures could be combined to form various Alternatives that could be applied to specific stream reaches to determine flood reduction. Table 5 lists the Alternatives and describes the management measures. A discussion of each Alternative follows. Alternatives B (1), B (2), J (1), and J (2) were not modeled due to the model's inapplicability (these alternatives do not change the extension of inundation), but were still evaluated for their effectiveness.

**Table 5. Alternatives Evaluated**

| Alt # | Alternative Short Name | Summary Description | Modeled? |
|---|---|---|---|
| A | Without Project | Without project (existing conditions) | Y |
| B(1) | Acquisition - 10 YR | Acquisition of impacted properties within 10-YR floodplain | N |
| B(2) | Acquisition - 100 YR | Acquisition of impacted properties within 100-YR floodplain | N |
| C | Partially Modified Channel – Kinley/K-2 | Increased channel dimensions around Holborn Ct (lower K-2 and mid-Kinley), no K-1 modifications, and modified Piney Grove Rd. Bridge at Kinley | Y |
| D | Modified Channel, Bridges, Culverts, and New Ponds | Increased channel dimensions along most of Kinley, K-1 and K-2, modified all bridges/culverts downstream of Bower Parkway on Kinley/K-2 and downstream of the lower Brookshire Drive K-1 crossing, and K-1 offline and K-2 inline pond | Y |
| E | K-1 and K-2 New Ponds | K-2 inline pond and K-1 offline pond | Y |
| F | Modified Channels, Bridges, and Culverts | Increased channel dimensions along most of Kinley, K-1 and K-2, modified all bridges/culverts downstream of Bower Parkway on Kinley/K-2 and downstream of the lower Brookshire Drive crossing on K-1 | Y |
| G | Modified Channels, Limited Bridges, and Culverts | Increased channel dimensions along most of Kinley, K-1 and K-2, modified Piney Grove Rd Bridge on Kinley, modified all bridges/culverts downstream of Bower Parkway on K-2 and downstream of the lower Brookshire Drive crossing on K-1 | Y |
| H | Upper K-2 Floodplain Bench | Create large floodplain bench along Upper K-2 | Y |
| I | Selective Acquisition with Modified Channel, Limited Bridges, and Culverts | Selective acquisition with increased channel dimensions along most of Kinley, K-1 and K-2, modified Piney Grove Rd Bridge on Kinley, modified all bridges/culverts downstream of Bower Parkway on K-2 and modified all on K-1 | Y |
| J(1) | Elevate Structures- 10 YR | Modify eligible structures to above 10-YR water surface elevation | N |
| J(2) | Elevate Structures- 100 YR | Modify eligible structures to above 100-YR water surface elevation | N |

## 13. Alternative Evaluations

The following is a discussion of each alternative. This discussion includes what management measures were combined to form the alternative, a graphical description of the modeling results, and estimated costs. The discussion also includes a list of all noticed constraints and applicable environmental regulations that must be addressed to implement each alternative.

### 13.1 Alternative A: Without Project (Existing Conditions)

**Management Measure(s): None**

**Constraints**

If nothing is done, the situation will not improve. Kinley Creek, K-1 and K-2 will continue to incise and banks will continue to fail. This will lead to continued loss of private property and the continued endangering of structures and utilities. The structures such as those shown in Figures 15, 16, and 17 will continue to experience flood damage during storm events. Flows will remain as shown in Figures 19, 20, and 21. Estimated annual damages are approximately $386,507.

**Estimated Cost- N/A**

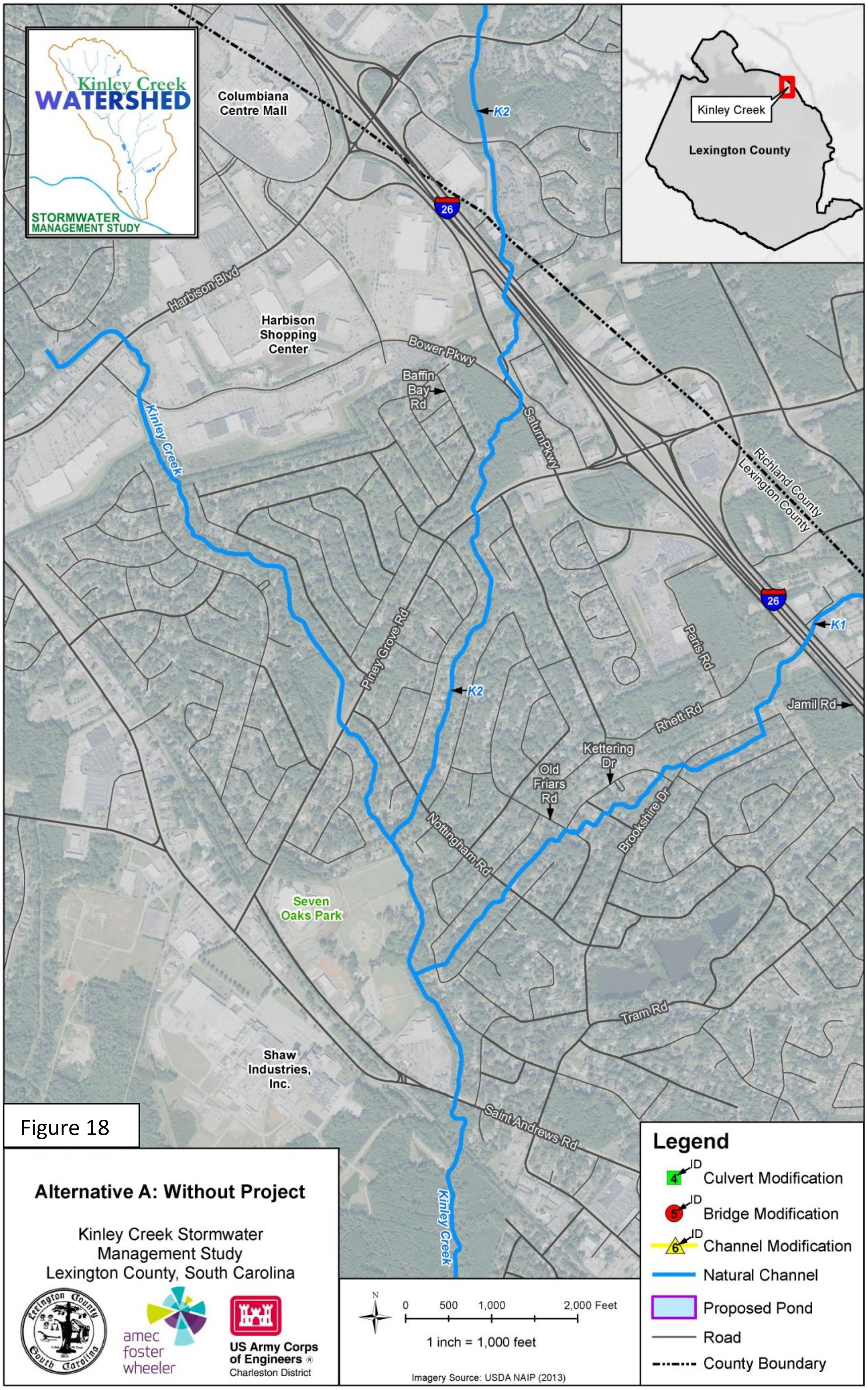



Figure 18

**Alternative A: Without Project**

Kinley Creek Stormwater
Management Study
Lexington County, South Carolina

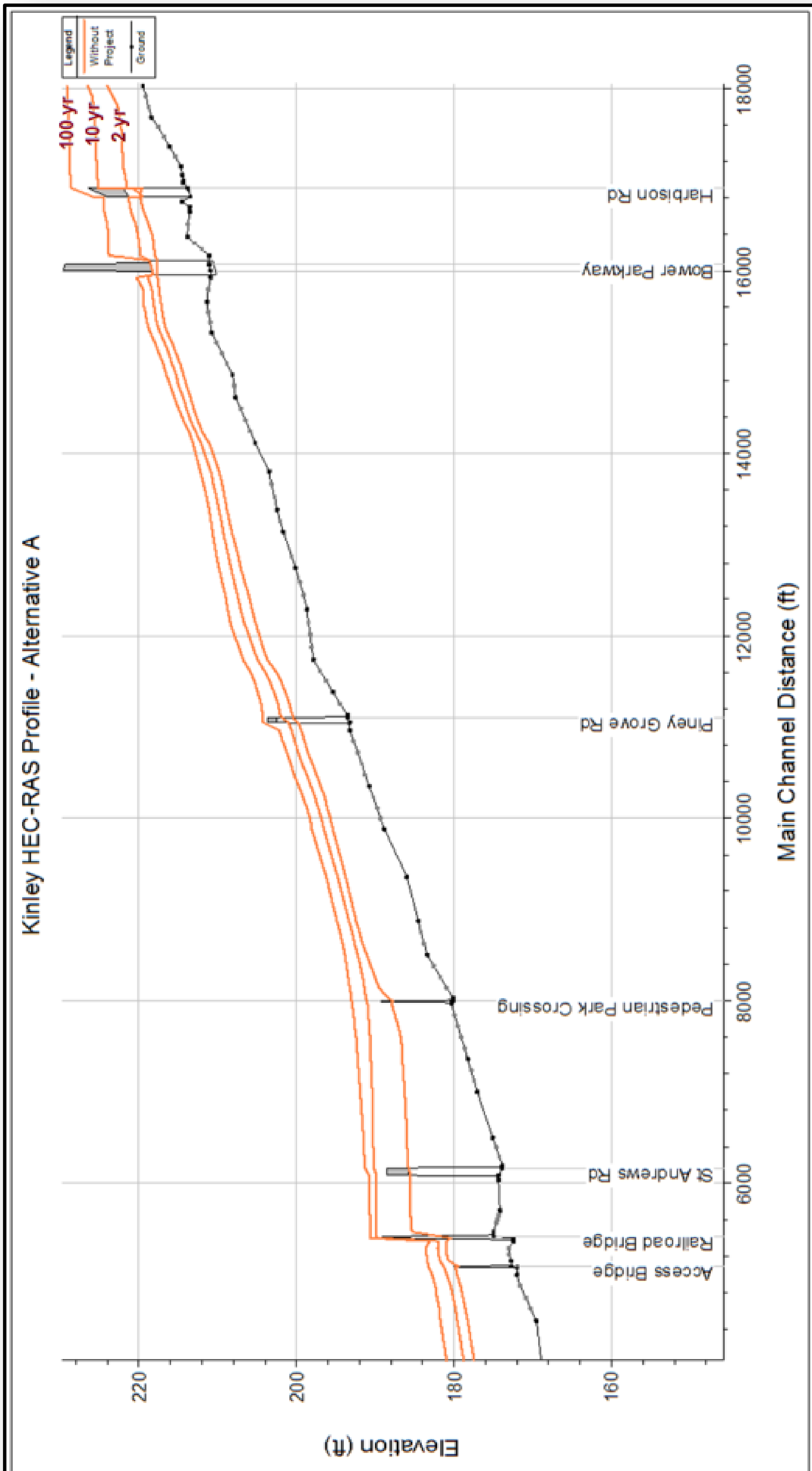



**Figure 19. Water Surface Profile Kinley Creek : Alternative A**

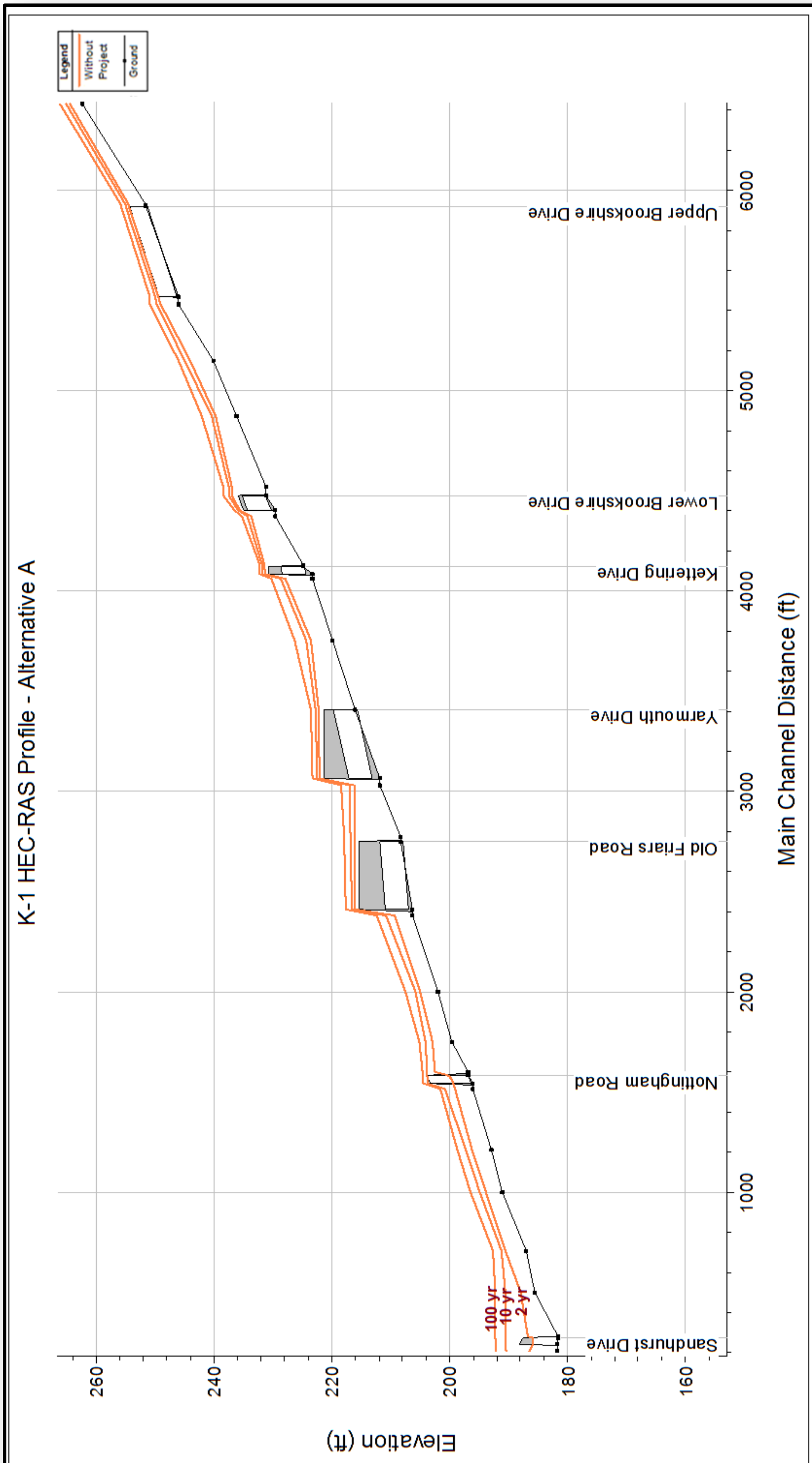



**Figure 20. Water Surface Profile K-1 : Alternative A**

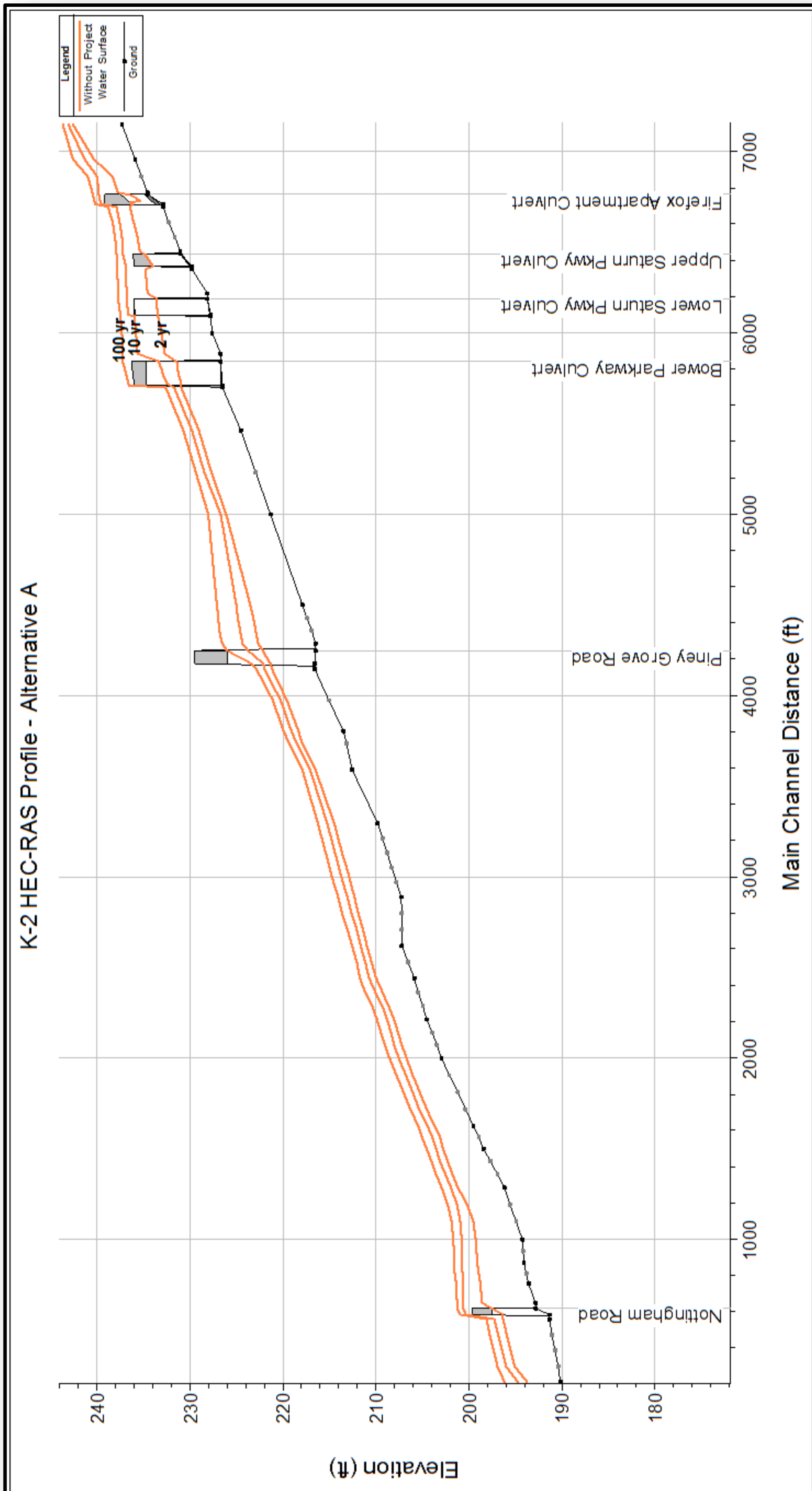



**Figure 21. Water Surface Profile K-2 : Alternative A**

## 13.2 Alternative B (1) and B (2) Acquisition of All Impacted Properties within the 10 Year or 100 Year Floodplain

**Management Measure(s):** This alternative involves purchasing all properties within the 10 year or 100 year Floodplain.

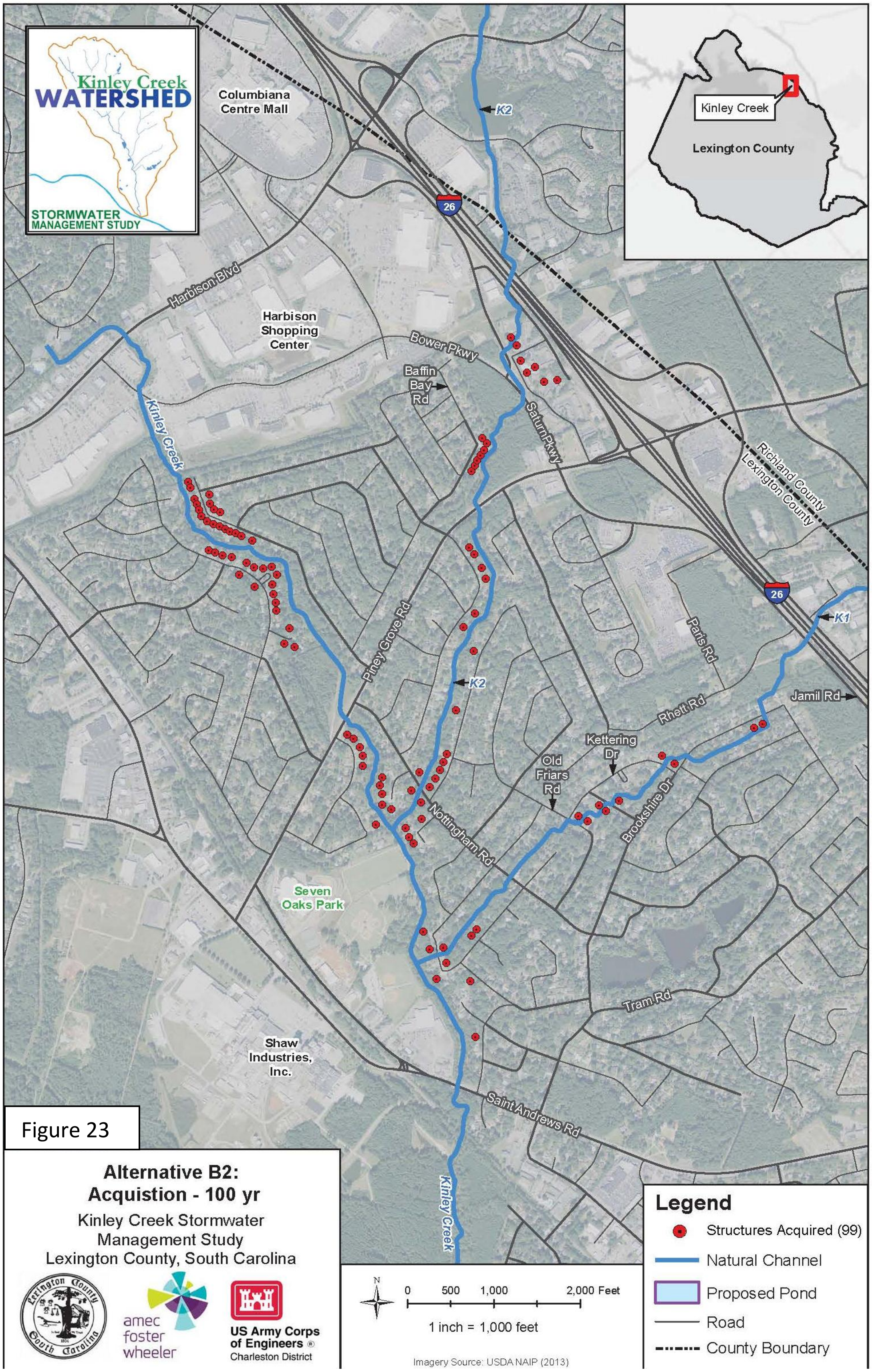
**Benefits:** Will remove structures from the floodplain, allow for unimpeded flow during overbank events, and restore floodplain.

**Constraints:** Property owners may be reluctant to sell. Properties may have to be condemned. Relocating property owners may be difficult.

**Estimated Cost:** Estimated cost of purchasing all the houses within the 10 year floodplain is $9,000,000. The estimated cost of purchasing all the structures within the 100 year flood plain is $24,750,000.


Kinley Creek
WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
K2
26
Richland County
Lexington County
K1
Paris Rd
Piney Grove Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Alternative B1:
Acquistion - 10 yr
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Structures Acquired (36)
Natural Channel
Proposed Pond
Road
County Boundary

Figure 22


Kinley Creek
WATERSHED
STORMWATER
MANAGEMENT STUDY
Columbiana Centre Mall
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
K2
26
Richland County
Lexington County
K1
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 23
Alternative B2:
Acquistion - 100 yr
Kinley Creek Stormwater
Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Structures Acquired (99)
Natural Channel
Proposed Pond
Road
County Boundary

## 13.3 Alternative C - Partially Modified Channel – Kinley/K-2

**Management Measure(s)** This alternative combines the following measures: Modify the Piney Grove Bridge to have an 83 foot span and an 4 foot abutment, reconfigure a 3000 linear foot reach of Kinley Creek between Piney Grove and it's junction with K-2 to have a 60 foot bench with 2:1 side slopes, reconfigure a 600 linear foot reach of K-2 downstream of Nottingham Drive to have a 60 foot bench with 2:1 side slopes (Figure 24).

**Benefits:** This alternative will remove thirteen structures out of the floodplain, but some structures will remain vulnerable to a 2, 10, and 100-Year storm events (Figures 25, 26, and 27). Table 6 shows the average drop in water depth during storm events**.**

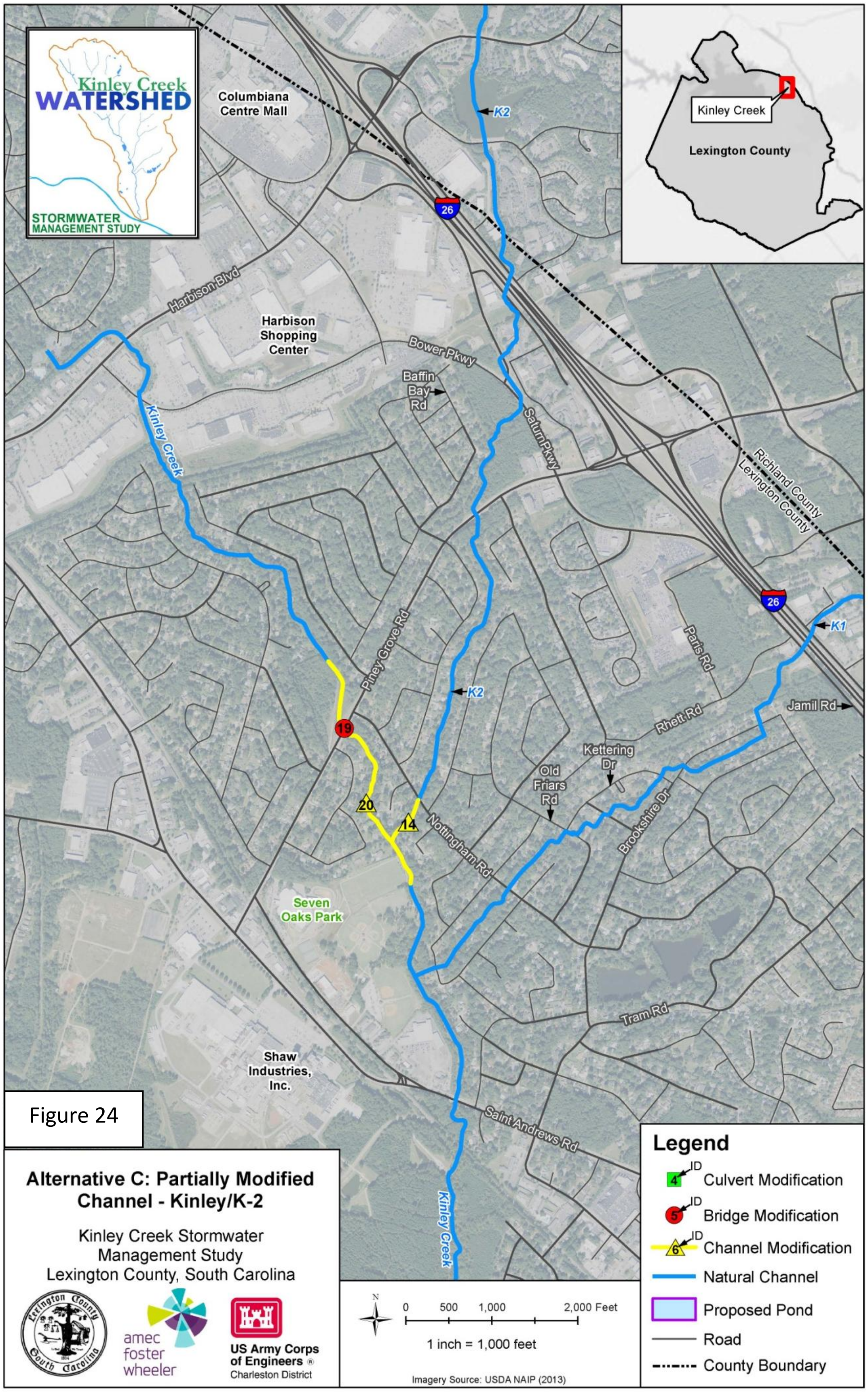
**Table 6. Average Drop in Water Depth as a Function of Storm Events if Alternative C is Implemented**

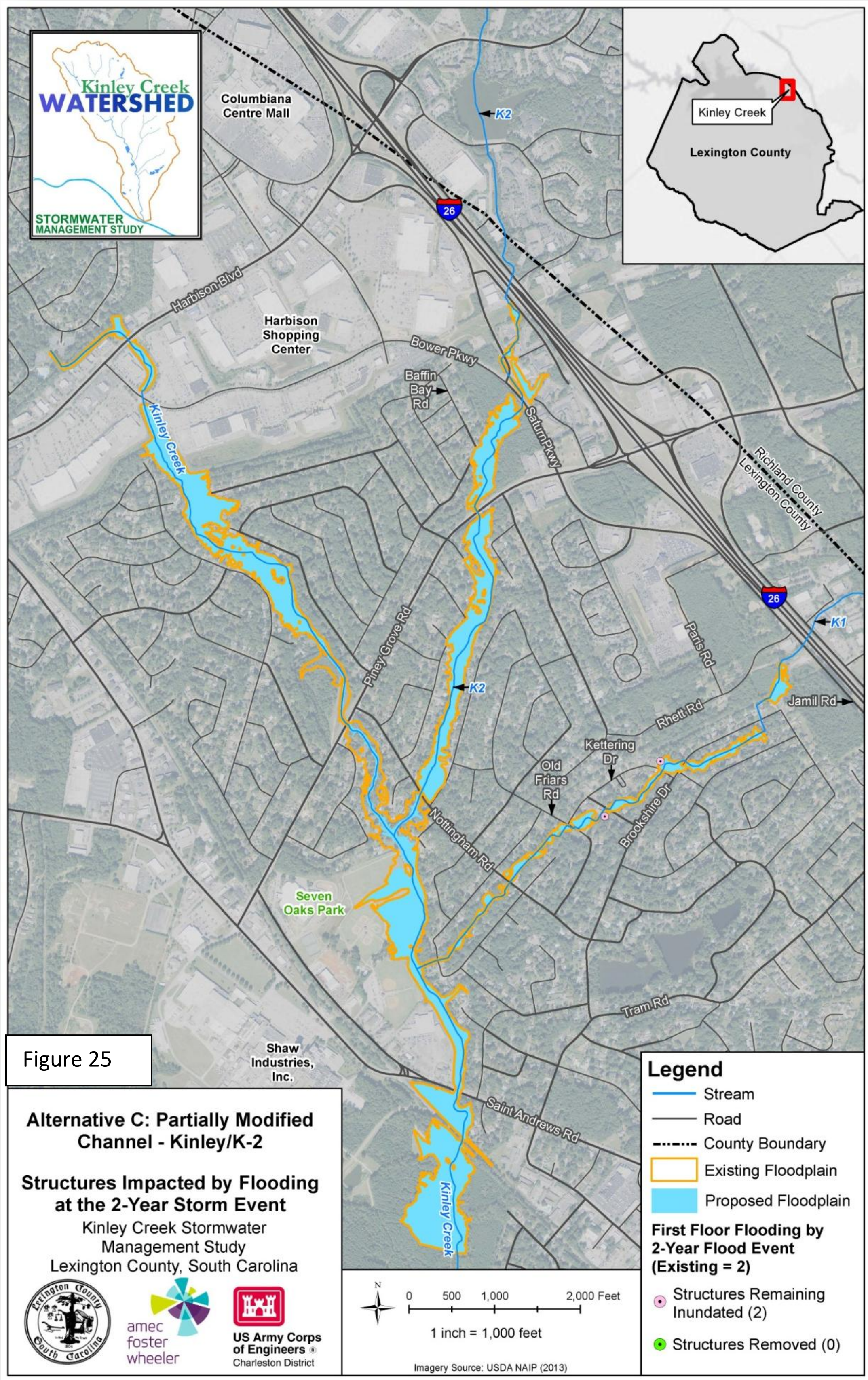
| Storm Event | Average Drop in Water Depth (ft) |
|---|---|
| 2-YR | 1.66 |
| 5-YR | 1.56 |
| 10-YR | 1.43 |
| 25-YR | 1.49 |
| 50-YR | 1.38 |
| 100-YR | 1.30 |

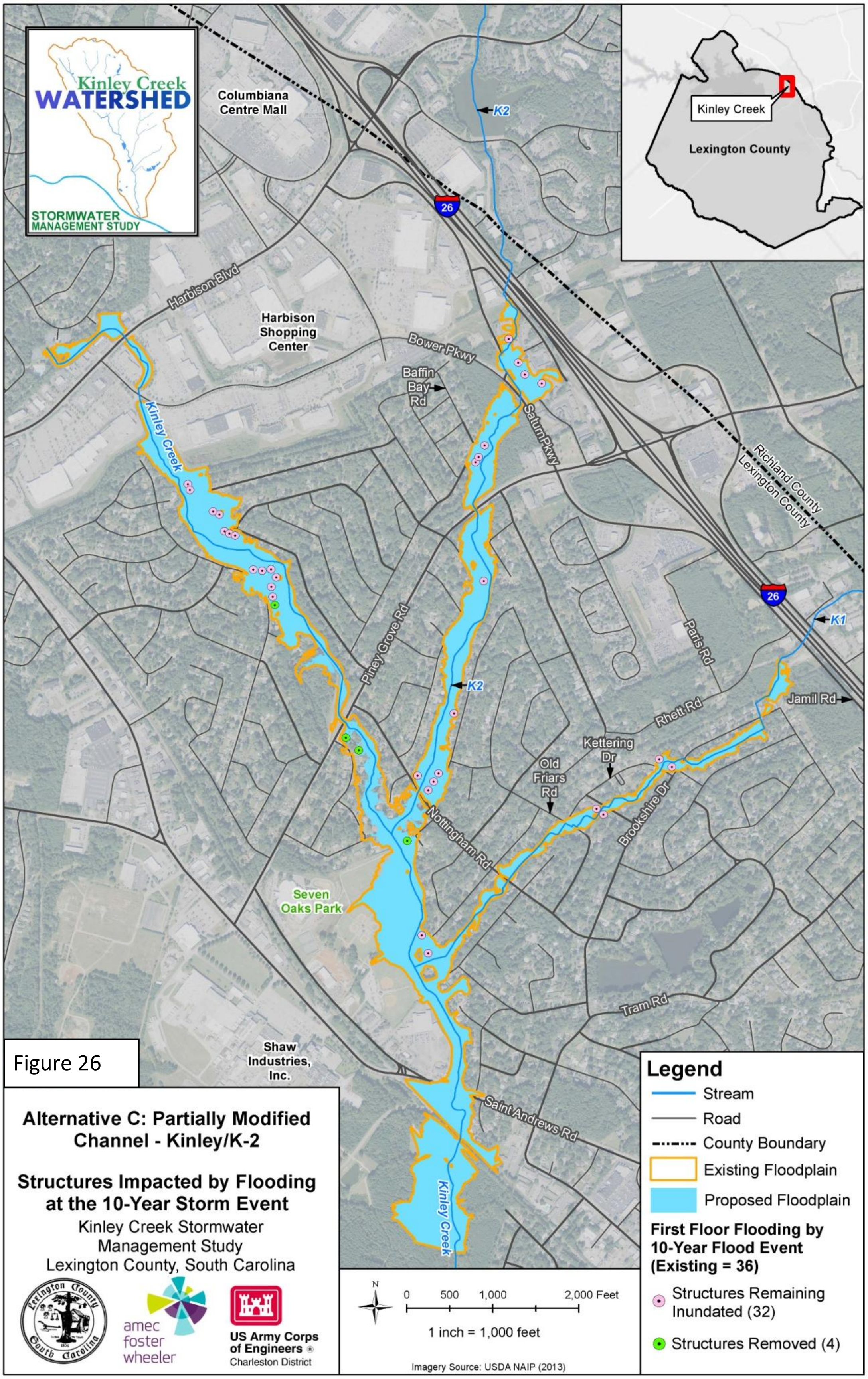
Most of the reduction will be along the lower reaches of K-2 and the middle reaches of Kinley Creek (Figure 28).

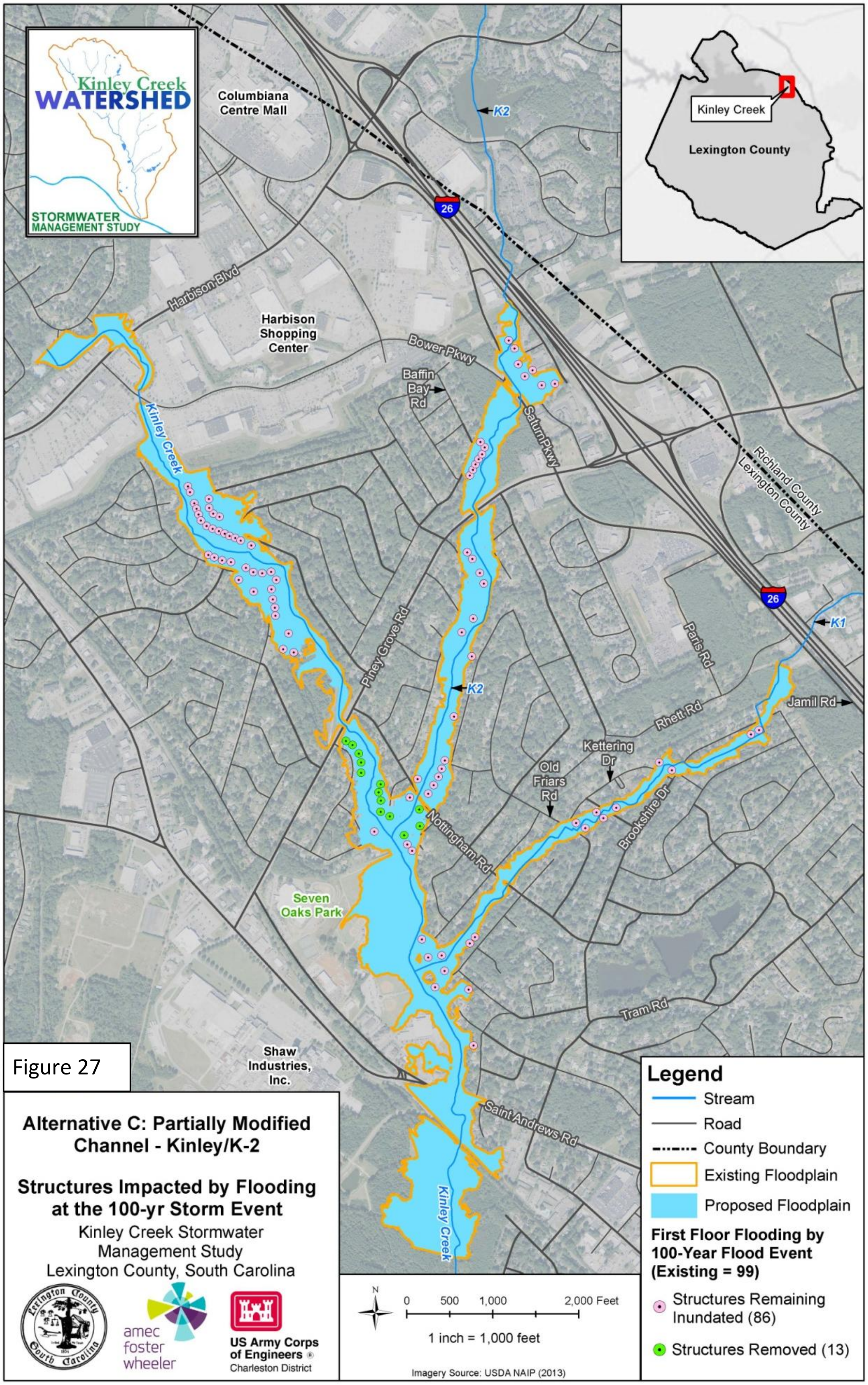
**Constraints:** The Kinley Creek Bridge is a SCDOT bridge, which necessitates their involvement. In addition, this is a permitted structure and any approval for modifications must be obtained from SCDHEC and USACE-Regulatory. Both Kinley Creek and the K-2 Tributary have multiple utility line crossings that will have to be either relocated or worked around. Both streams have bedrock at or near the surface that will make construction difficult. Mature tree removal and replacement, in addition to private property easements for construction and maintenance will be necessary.

**Estimated Cost:** Estimated cost is $2,996,000.


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Kinley Creek
Lexington County
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Richland County
Lexington County
K2
K1
26
Kinley Creek
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
19
20
14
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 24
Alternative C: Partially Modified Channel - Kinley/K-2
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Culvert Modification
Bridge Modification
Channel Modification
Natural Channel
Proposed Pond
Road
County Boundary


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Kinley Creek
Lexington County
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Richland County
Lexington County
K2
K1
26
Kinley Creek
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 25
Alternative C: Partially Modified Channel - Kinley/K-2
Structures Impacted by Flooding at the 2-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers ®
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 2-Year Flood Event (Existing = 2)
Structures Remaining Inundated (2)
Structures Removed (0)


Kinley Creek
WATERSHED
STORMWATER MANAGEMENT STUDY
Kinley Creek
Lexington County
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Richland County
Lexington County
K2
K1
26
Kinley Creek
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 26
Alternative C: Partially Modified Channel - Kinley/K-2
Structures Impacted by Flooding at the 10-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0
500
1,000
2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 10-Year Flood Event (Existing = 36)
Structures Remaining Inundated (32)
Structures Removed (4)


Kinley Creek
WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Kinley Creek
Lexington County
K2
26
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Richland County
Lexington County
Kinley Creek
Piney Grove Rd
K2
K1
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 27
Alternative C: Partially Modified Channel - Kinley/K-2
Structures Impacted by Flooding at the 100-yr Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 100-Year Flood Event (Existing = 99)
Structures Remaining Inundated (86)
Structures Removed (13)

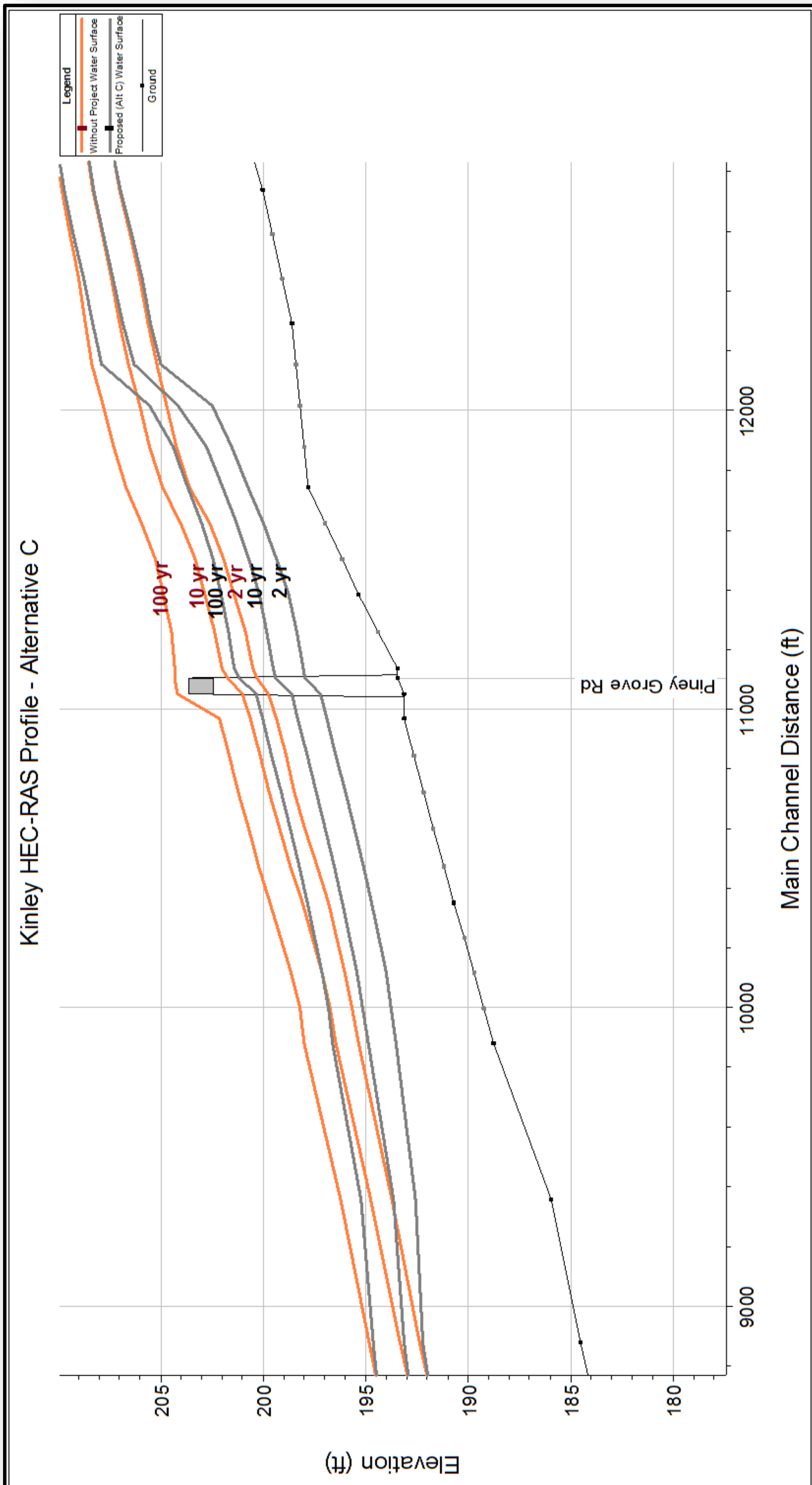



**Figure 28. Water Surface Profile Kinley Creek : Alternative C**

## 13.4 Alternative D - Modified Channel, Bridges, Culverts, and New Ponds, Kinley/ K-1/K-2

**Management Measures:** The following management measures for Kinley Creek, K-1 and K-1 were combined to form this alternative:

**K-1:** Add a 6 foot diameter, 42 foot long culvert parallel to existing culvert and extend headwall. Replace the existing 4 foot culvert pipe at Old Friars Road Culvert with two 6 foot by 6 foot box culverts. Replace existing pipe at Yarmouth Road with two 6 foot by 5 foot, 339 foot long, concrete box, including 45 degree wing walls. Replace the pipe at Kettering with two 6 foot by 4 foot parallel box culverts. Add 5 foot and 4 foot, 71 foot long culverts next to the existing culvert at Lower Brookshire. Construct a 1.6 acre pond offline of K-1 west of Jamil Temple Road. Channelize a 4000 foot reach of K-1 with a 20 foot wide bench and 2:1 slopes; channelize an additional 2500 foot reach with a 15 foot wide bench and 1.5:1 slopes.

**K-2:** Modify the channel at Nottingham Road and increase the bridge span by 20 feet, remove approximately 130 CY of material. Construct a 7.9 acre pond on K-2 south of Bower Parkway. Reshape a reach of the channel to include a 600 linear foot reach with a 60 foot bottom width; 3,757 foot reach to have a 40 foot bottom width, and a 2,790 foot reach to have a 35 foot bottom width.

**Kinley Creek**: Reshape entire length channel to include a 3400 linear foot reach with a 40 foot bench and a 7400 linear foot reach with a 60 foot bench. Modify railroad crossing to a 57 foot span. Modify St, Andrews Bridge to a 112 foot span. Modify Piney Grove Road Bridge to an 83 foot span with abutments not to exceed four foot.

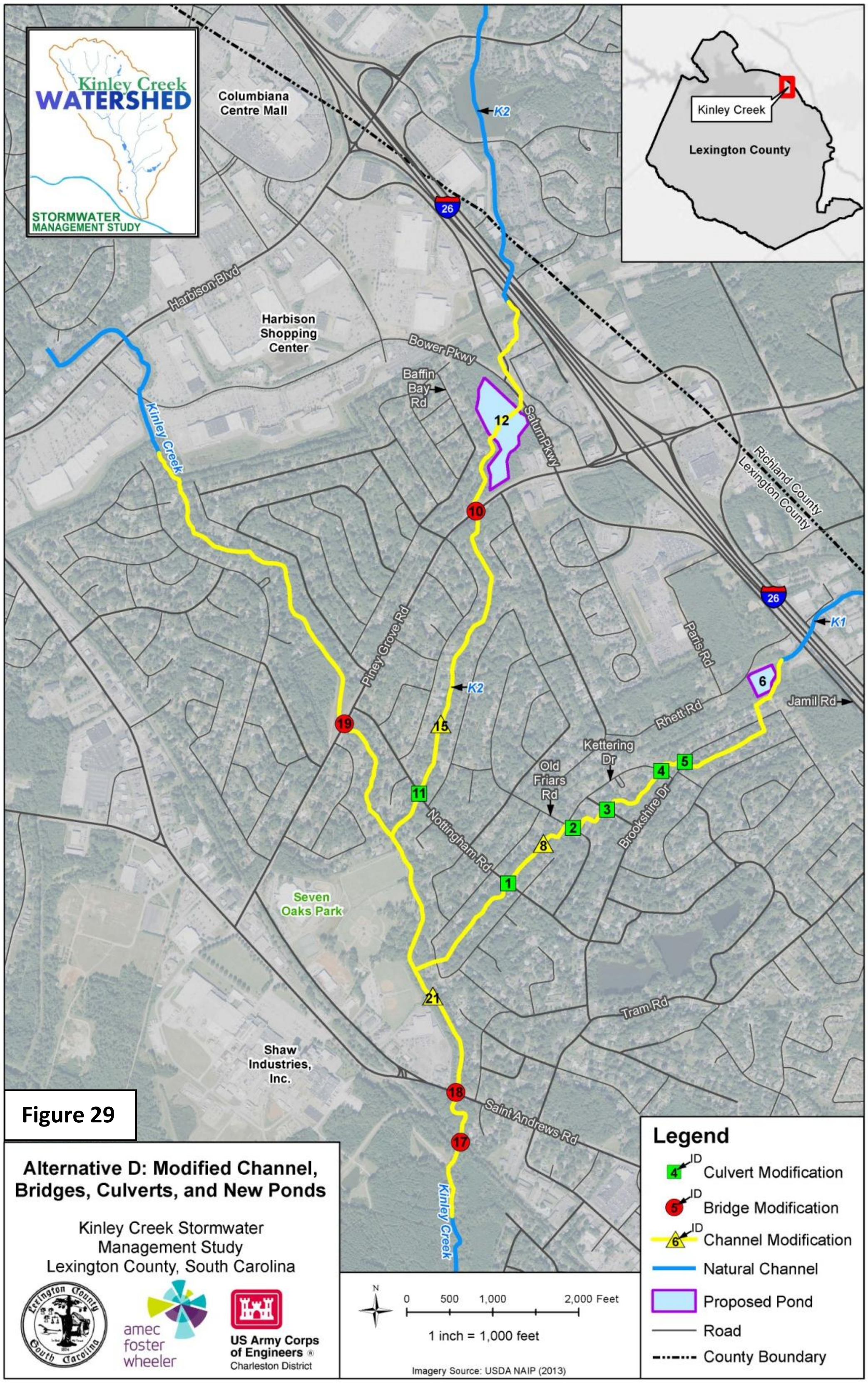
**Benefits:** This alternative will remove 60 structures out of the floodplain. No structures will be left in the 2 Year event, but a few structures will remain be vulnearble to a 5 Year storm event (Figures 31-32). Table 7 shows the average drop in water depth during storm events.

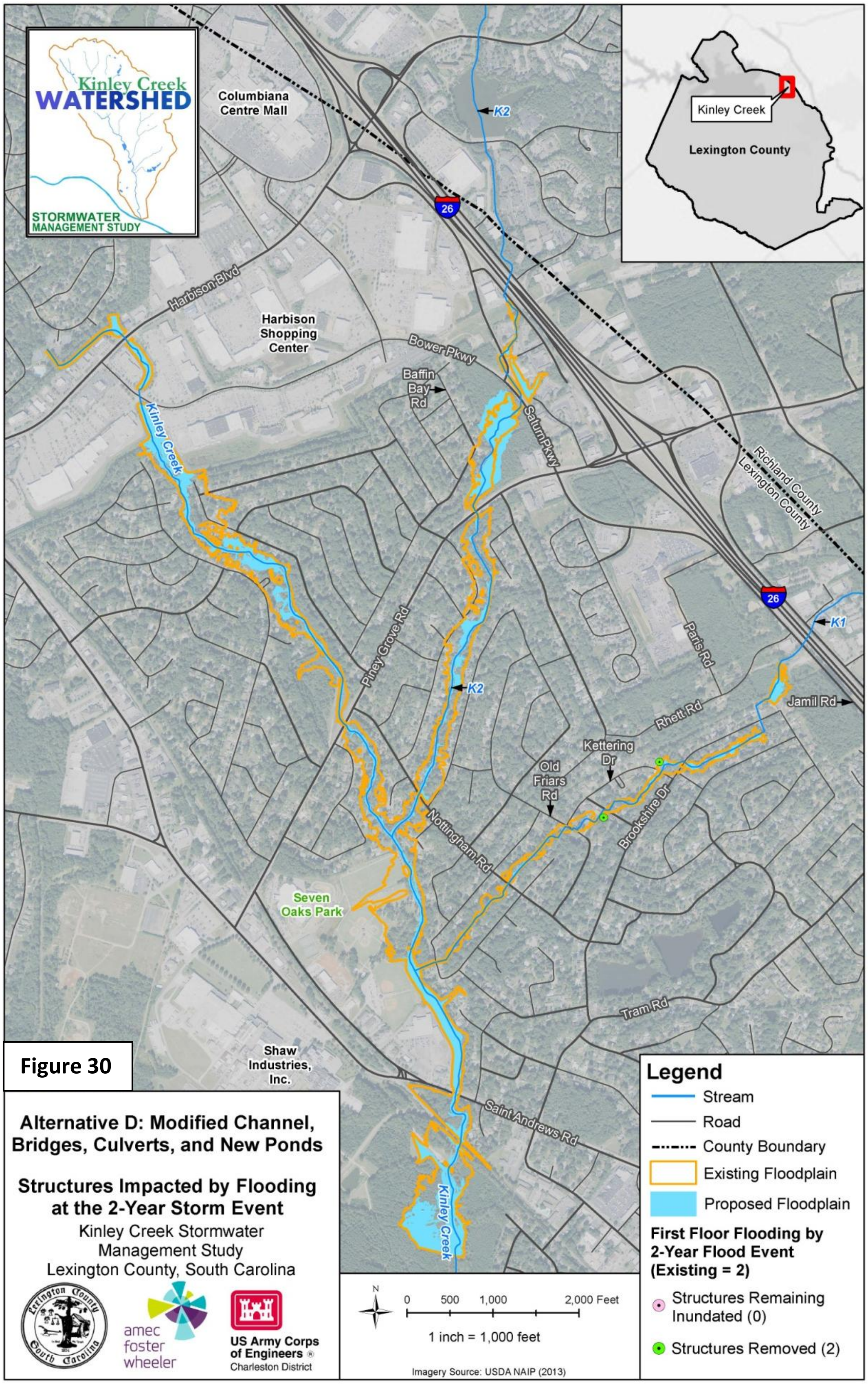
**Table 7. Average Drop in Water Depth as a Function of Storm Events if Alternative D is Implemented**

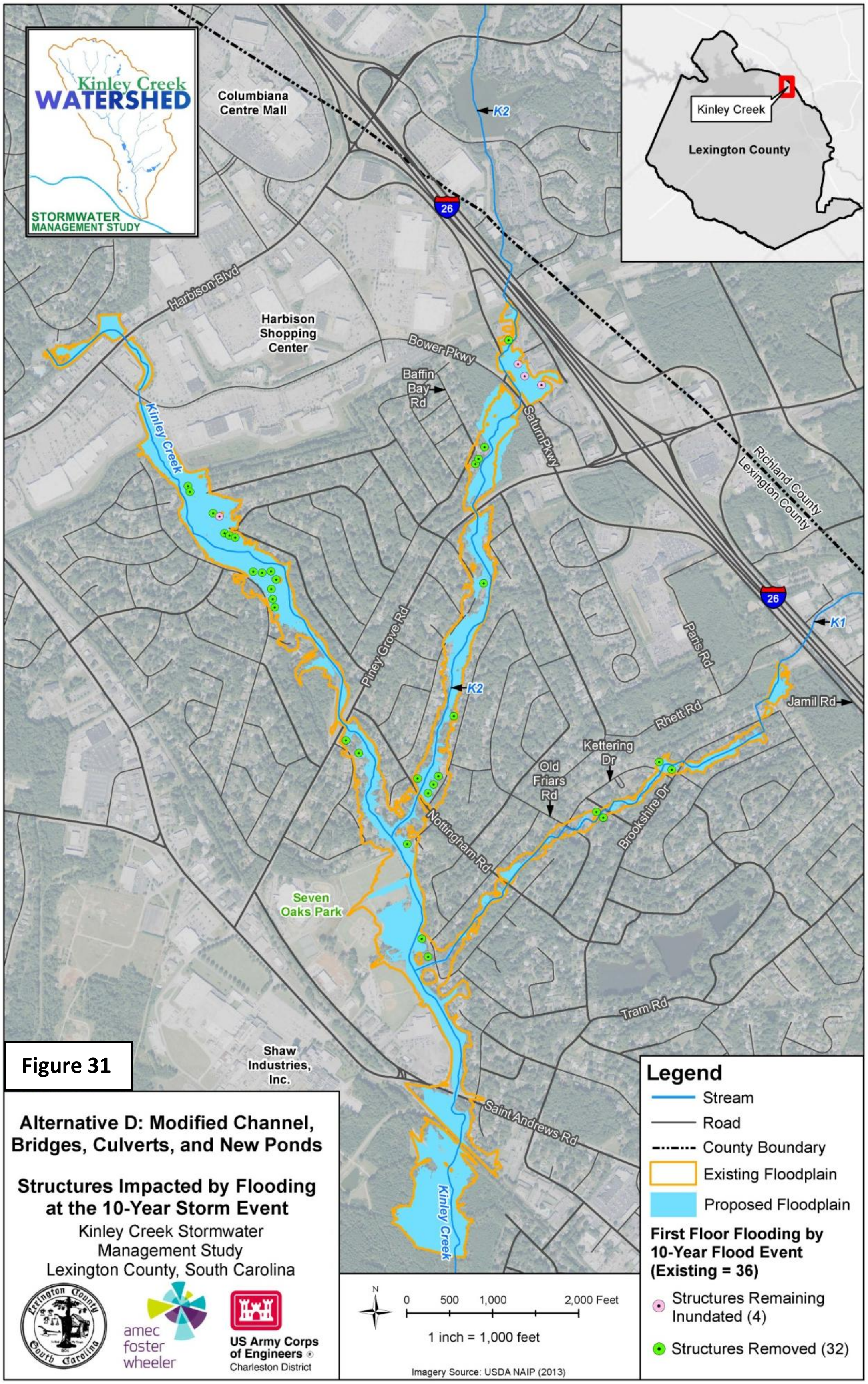
| Storm Event | Average Drop in Water Depth (ft) |
|---|---|
| 2-YR | 1.88 |
| 5-YR | 2.01 |
| 10-YR | 1.91 |
| 25-YR | 1.62 |
| 50-YR | 1.59 |
| 100-YR | 1.28 |

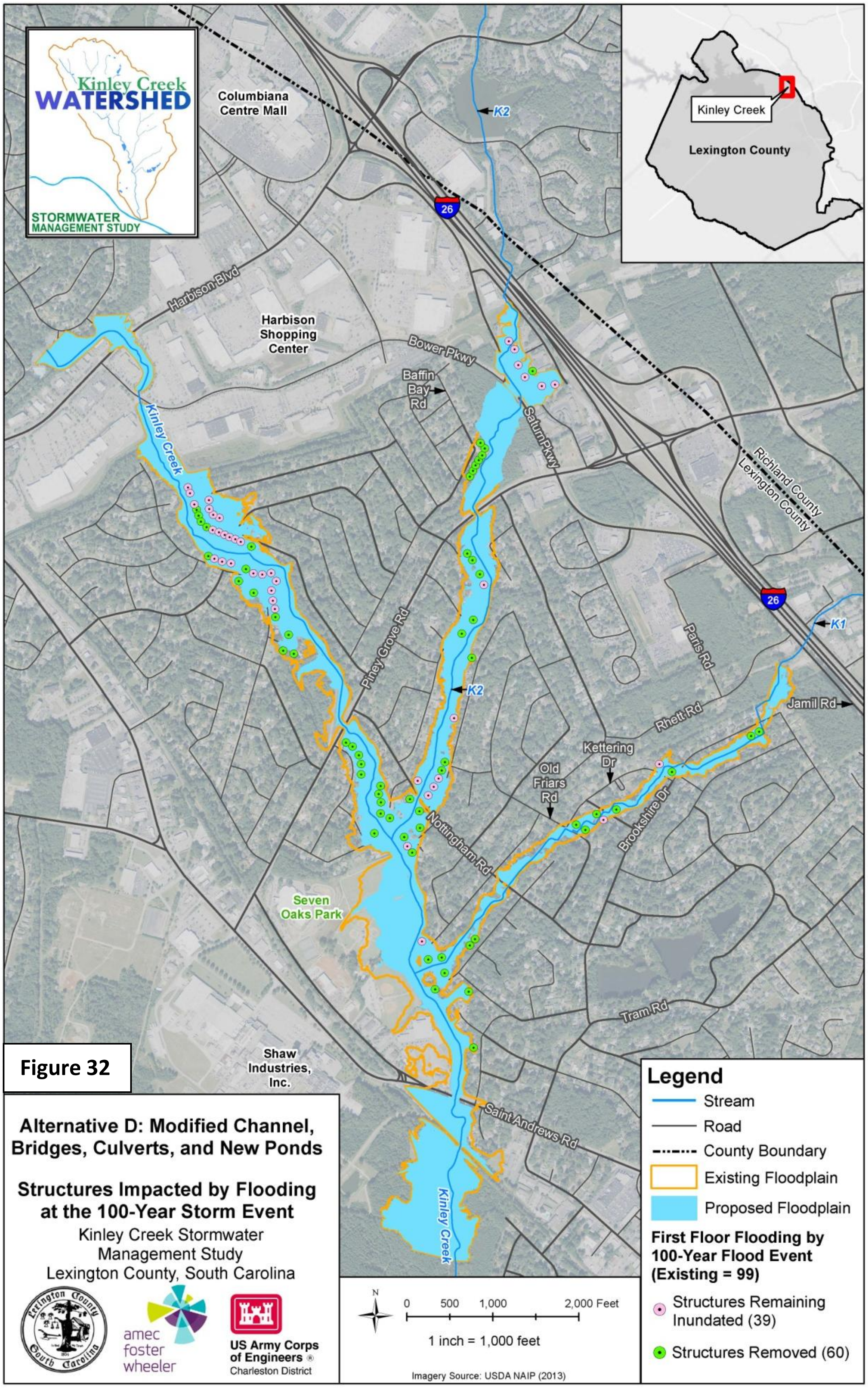
Water levels will be reduced through all three reaches if this Alternative is Implemented. **Constraints:** Bedrock in channels may complicate construction. Multiple utility lines along work area will have to be either relocated or worked around. Mature tree removal and replacement, in addition to private property easements for construction and maintenance will be necessary. The Kinley Creek Bridge is a SCDOT bridge, which necessitates their involvement. Other bridges may require coordination with DOT. In addition, this is a permitted structure and any approval for modifications must be obtained from SCDHEC and USACE-Regulatory. Modifying RR Crossing will require coordination with the Rail Road Company.

**Estimated:** The estimated cost to implement Alternative D is $ 22,785,000.


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
K2
K1
26
Richland County
Lexington County
Kinley Creek
Lexington County
Piney Grove Rd
Nottingham Rd
Old Friars Rd
Kettering Dr
Rhett Rd
Paris Rd
Jamil Rd
Brookshire Dr
Tram Rd
Seven Oaks Park
Shaw Industries, Inc.
Saint Andrews Rd
Figure 29
Alternative D: Modified Channel, Bridges, Culverts, and New Ponds
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Culvert Modification
Bridge Modification
Channel Modification
Natural Channel
Proposed Pond
Road
County Boundary


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
K2
26
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
Richland County
Lexington County
Piney Grove Rd
K2
K1
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 30
Alternative D: Modified Channel, Bridges, Culverts, and New Ponds
Structures Impacted by Flooding at the 2-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 2-Year Flood Event (Existing = 2)
Structures Remaining Inundated (0)
Structures Removed (2)


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
K2
26
Kinley Creek
Lexington County
Richland County
Lexington County
K1
Paris Rd
Jamil Rd
Rhett Rd
Piney Grove Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 31
Alternative D: Modified Channel, Bridges, Culverts, and New Ponds
Structures Impacted by Flooding at the 10-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 10-Year Flood Event (Existing = 36)
Structures Remaining Inundated (4)
Structures Removed (32)



Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
K2
26
Richland County
Lexington County
K1
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Piney Grove Rd
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 32
Alternative D: Modified Channel, Bridges, Culverts, and New Ponds
Structures Impacted by Flooding at the 100-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 100-Year Flood Event (Existing = 99)
Structures Remaining Inundated (39)
Structures Removed (60)

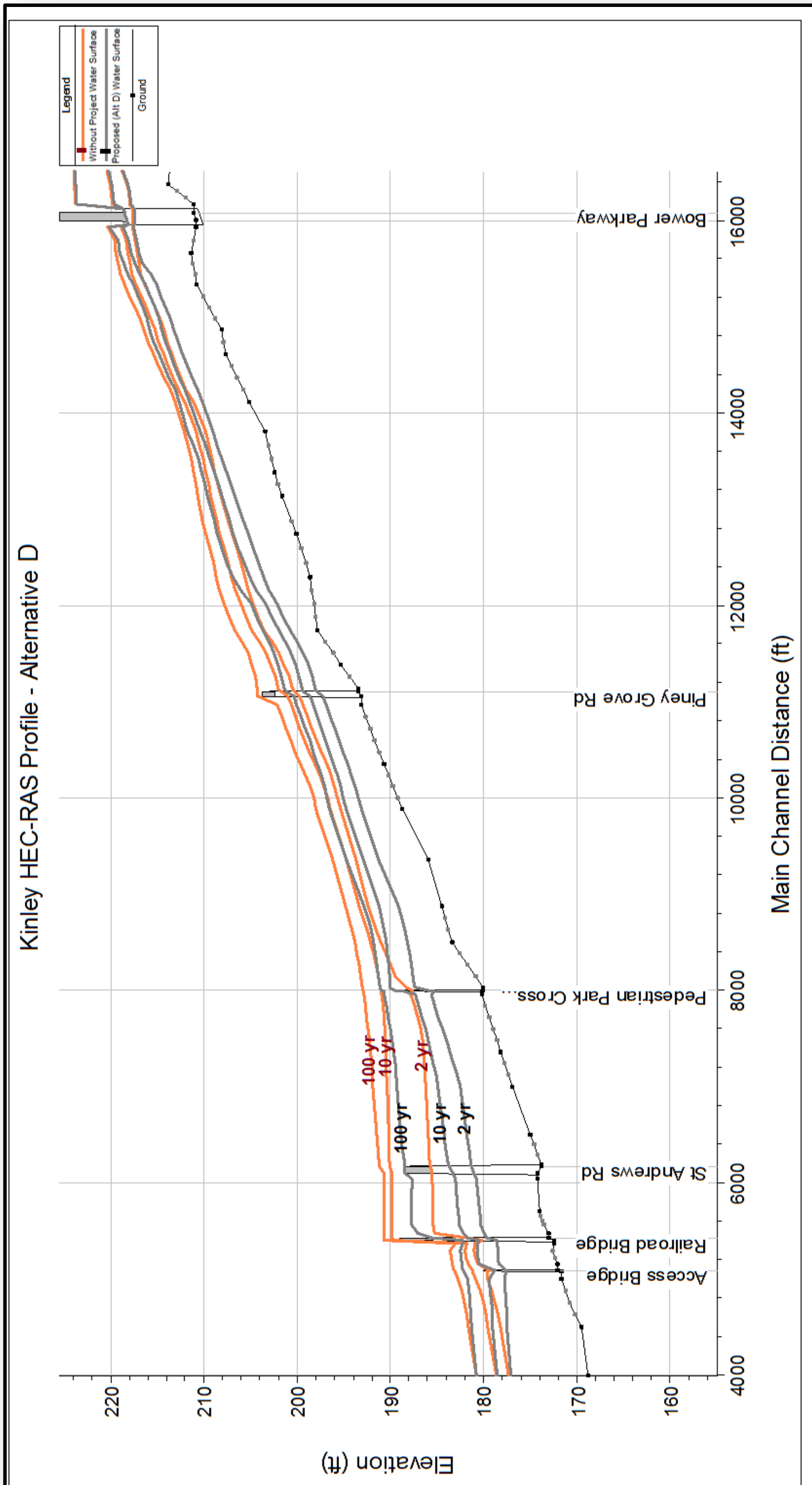



**Figure 33. Water Surface Profile Kinley Creek : Alternative D**

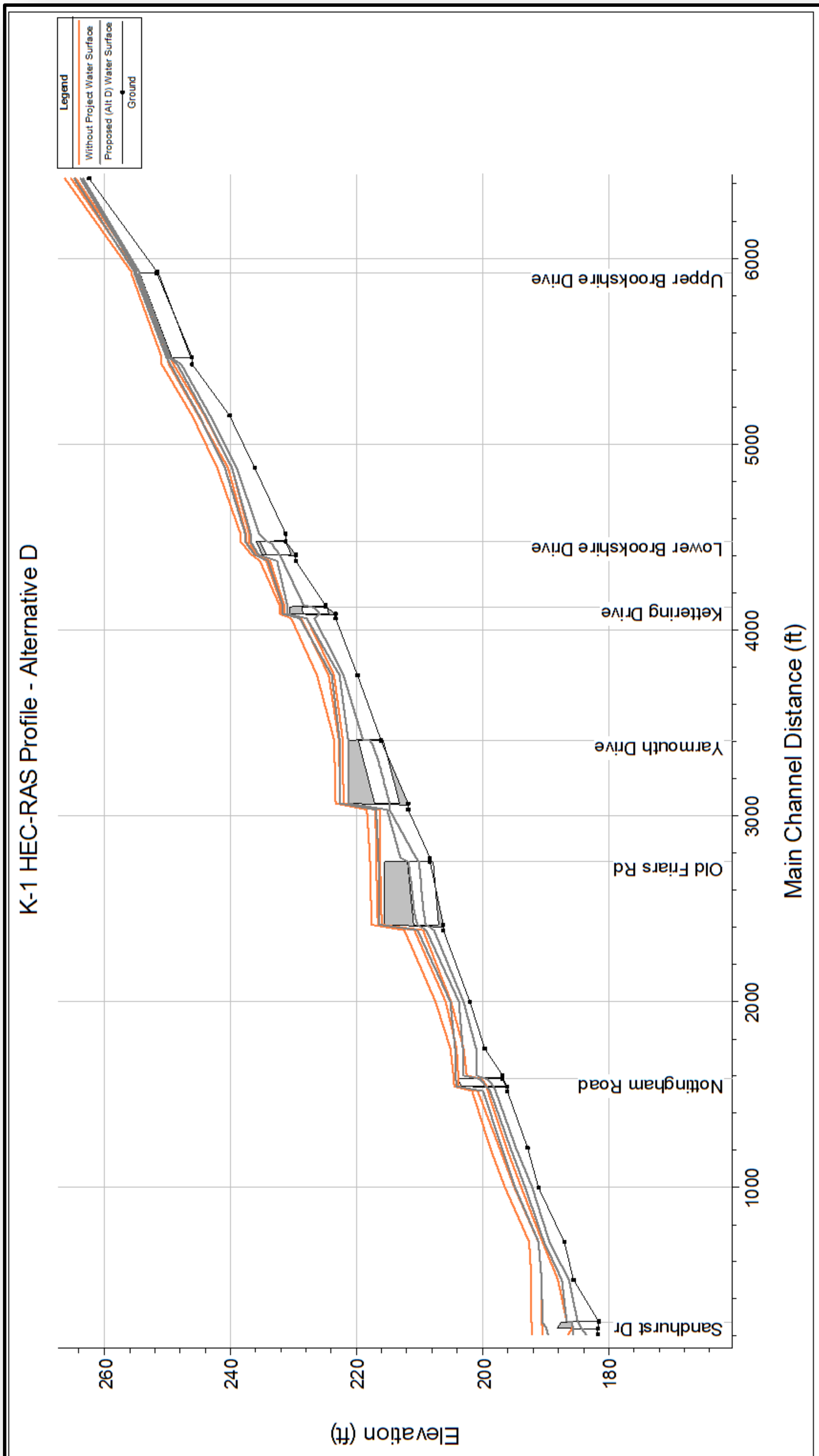



**Figure 34. Water Surface Profile K-1: Alternative D**

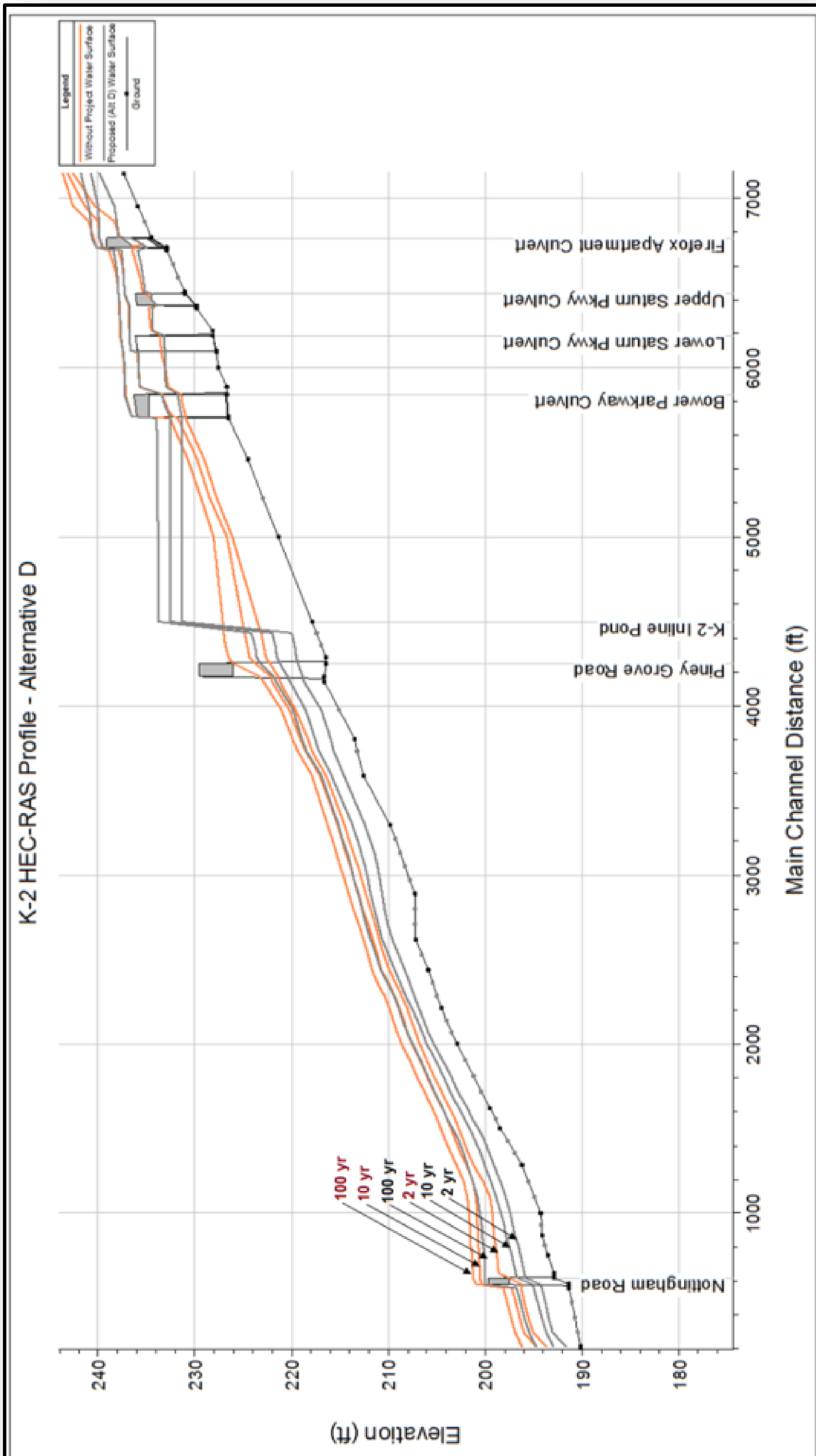



**Figure 35. Water Surface Profile K-2 : Alternative D**

## 13.5 Alternative E - K-1 and K-2 New Ponds

**Management Measure(s):** This alternative combines the construction of two ponds: a 1.6 acre pond constructed offline of K-1 West of Jamil Road (Figure 43) and a 7.9 acre pond on K-2 south of Bower Parkway (Figure 44).

**Benefits:** The benefits of both ponds are discussed below:

**K-1 Pond:** The K-1 pond reduced discharges immediately downstream of the proposed pond site (Table 8), however, the reduction decreased further downstream as runoff is continuously introduced into the channel. The K-1 offline pond is located receives drainage from 76.2 acres: the drainage area downstream of the K-1 offline pond is 206.3 acres. Thus the majority of the K-1 discharge will not enter the pond and areas further downstream are still subject to flooding.

**Table 8. K-1 Offline Pond Peak Flows**

| Storm Return Interval | Peak Inflow (cfs) | Peak Outflow (cfs) | Reduction (%) |
|---|---|---|---|
| 2-year | 66.6 | 0 | 100 |
| 5-year | 115.2 | 2.7 | 98 |
| 10-year | 158.6 | 4.4 | 97 |
| 25-year | 219.9 | 15.7 | 93 |
| 50-year | 273 | 93.5 | 66 |
| 100-year | 332.3 | 184.4 | 45 |

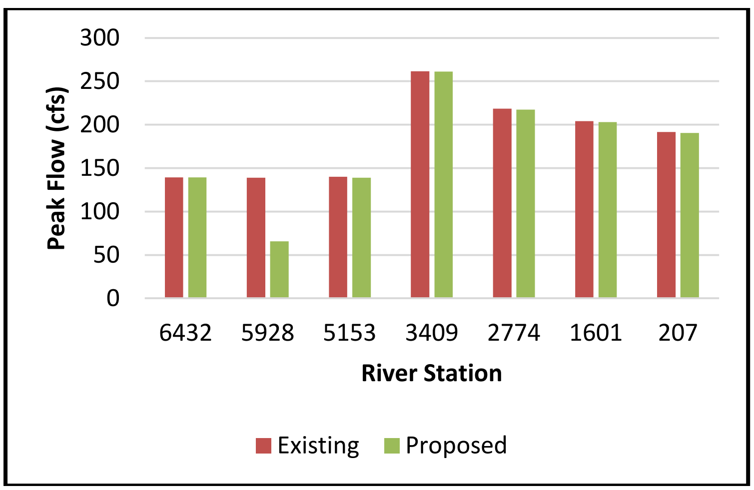



**Figure 36. 2-Year Peak Flows on K-1**

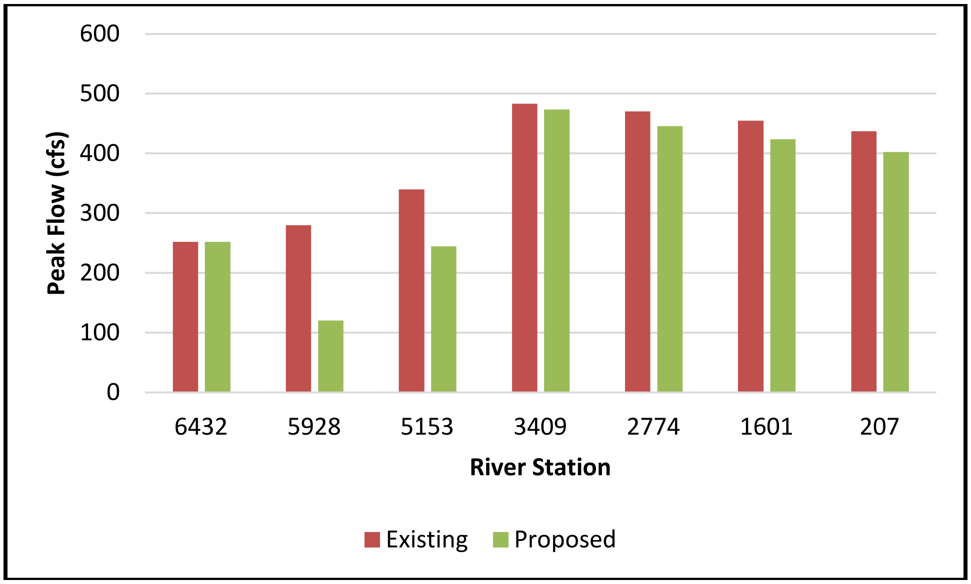



**Figure 37. 10-year Peak Flows on K-1**

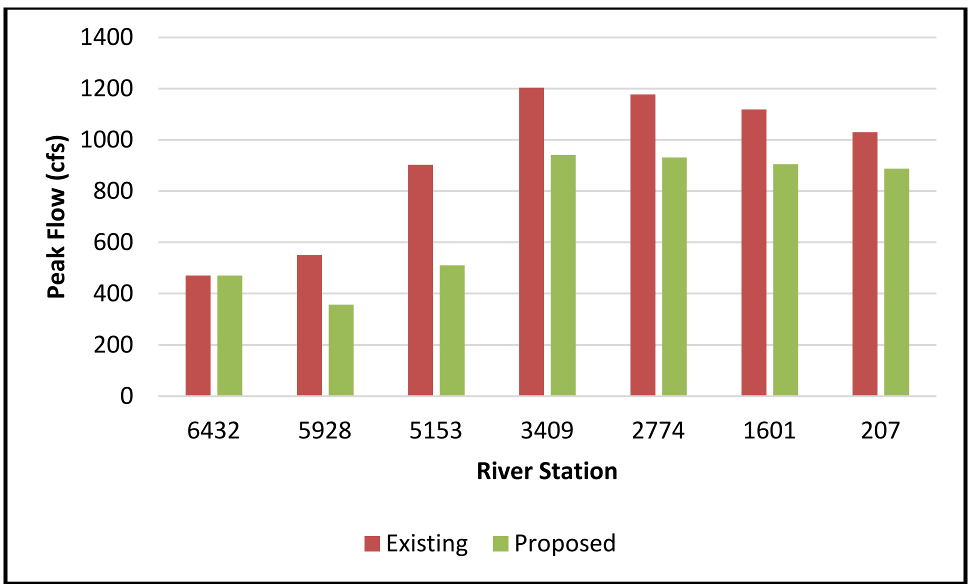



**Figure 38. 100-year Peak Flows on K-1**

The revised peak flows for each event were added to the HEC-RAS existing condition model to determine whether the reductions would result in a lowering of the water surface along K-1 (Figures 36 and 37). Reductions were not achieved in more frequent storm events, but were up to 1ft on the 100-YR return interval storm as shown in Figure 38. This measure was carried forward for thorough cost-benefit analysis due to the potential reduction in water surface elevations for large storms.

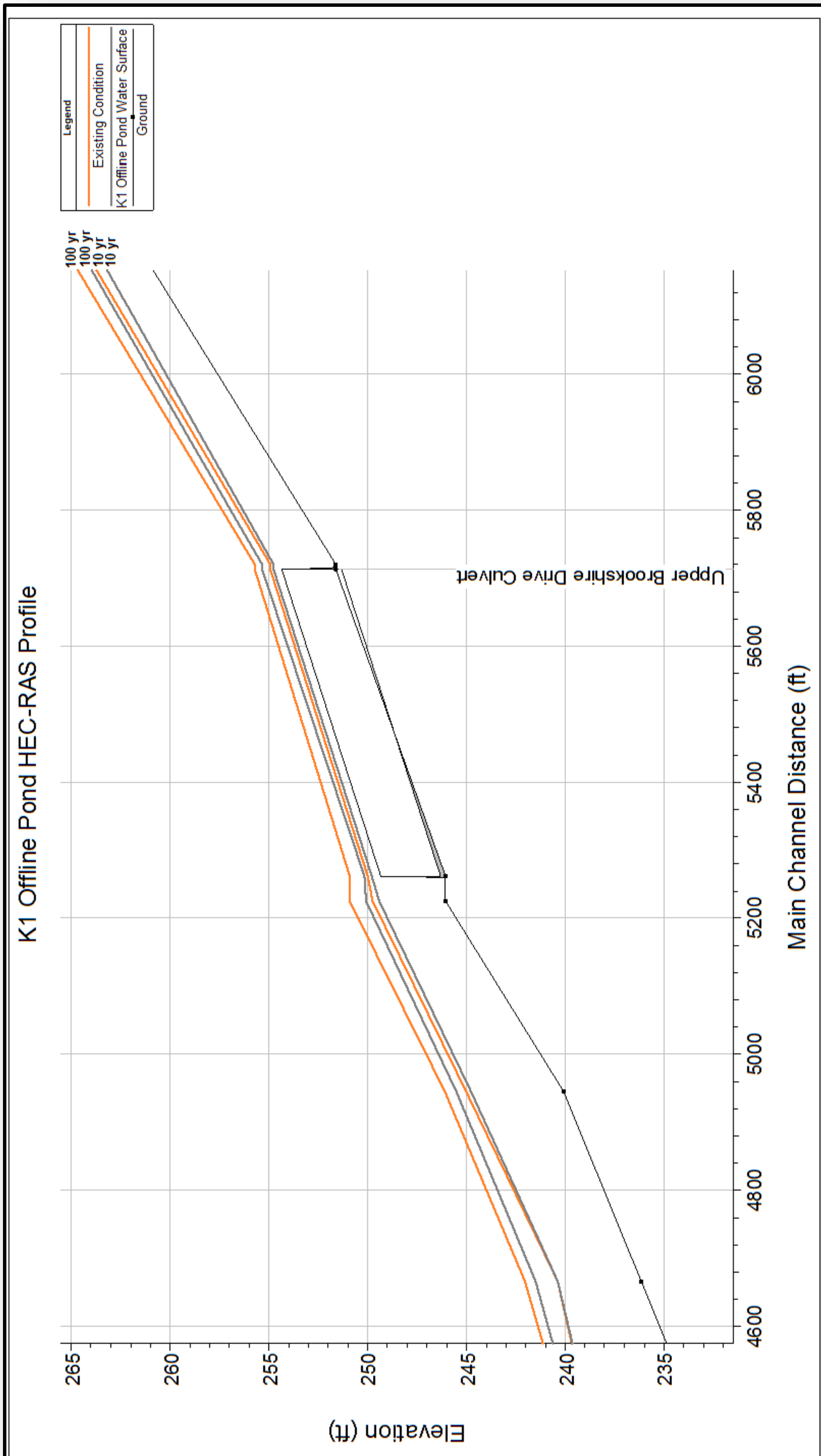



**Figure 39. 10-yr and 100-yr Water Surface Profile on Upper K-1 with Offline Pond**

**K-2 Online Pond:** The alternative adequately addresses smaller flooding events (Table 9) and may be helpful in reducing flooding to structures immediately downstream of the pond however, these benefits are limited. Beyond 1,500 feet downstream of the K-2 Pond, reductions in flow rates become negligible as more stormwater enters the system.

**Table 9: K-2 Inline Pond Peak Flow**

| Storm Return Interval | Peak Inflow (cfs) | Peak Outflow (cfs) | Reduction (%) |
|---|---|---|---|
| 2-year | 590.9 | 306.9 | 48 |
| 5-year | 837.1 | 626.7 | 25 |
| 10-year | 1050.3 | 891.6 | 15 |
| 25-year | 1366.9 | 1254.2 | 8 |
| 50-year | 1637.5 | 1541.7 | 6 |
| 100-year | 1934.5 | 1844.2 | 5 |

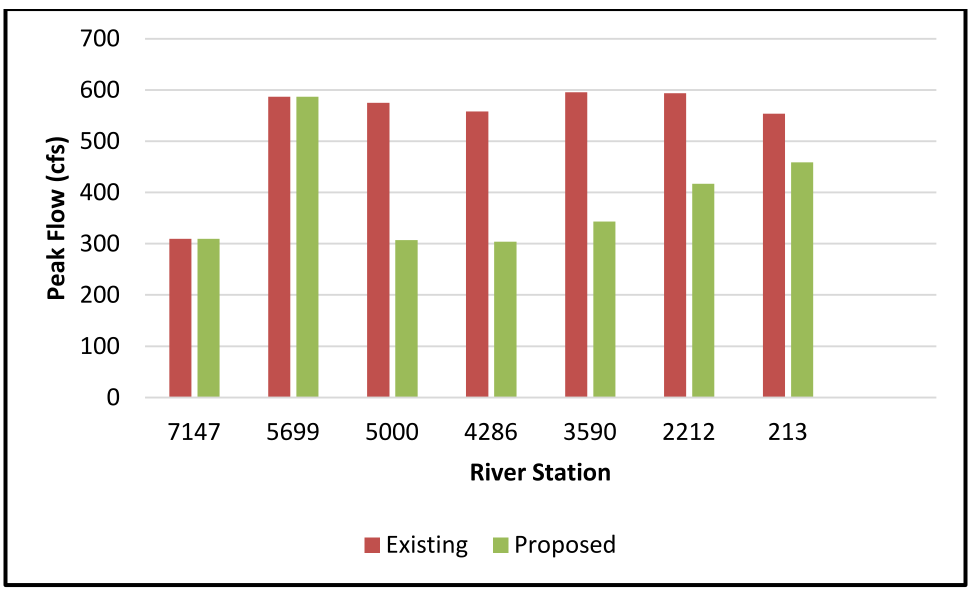



**Figure 40. 2-year Peak Flows on K-2**

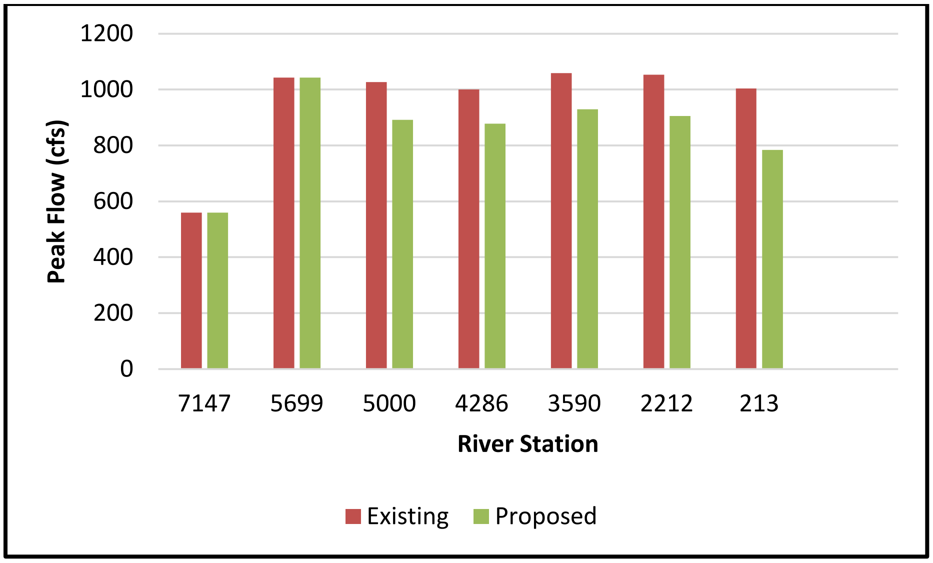



**Figure 41. 10-year Peak Flows on K-2**

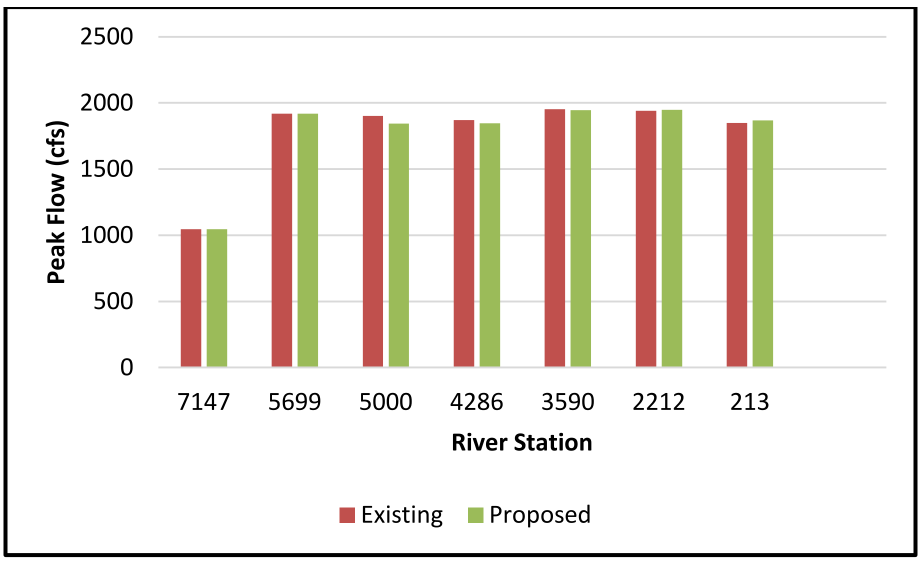



**Figure 42. 100-year Peak Flows on K-2**

The net effect of both ponds is that their benefits will be limited to the downstream vicinity of the ponds (Figures 40-42). Stormwater entering below the ponds will continue to cause flooding.
**Cost:** The cost for the two ponds is $ 4,256,000.

**Constraints:** Long term maintenance of ponds will be necessary to maintain volume. Utility lines must be relocated or worked around. K-2 Pond will require individual permits from USACE-Regulatory and DHEC, complete with mitigation for stream impacts.


Kinley Creek
WATERSHED
STORMWATER
MANAGEMENT STUDY
K1 Offline Pond
Lexington County
STEWARD DR
26
JAMIL RD
STONEMARK LN
FERNANDINA RD
PARIS RD
K1
K1 Offline Pond
RHETT RD
BROOKSHIRE DR
SULGRAVE DR
LYDGATE DR
WINSTAIRE DR
WILKSHIRE DR
K1 Offline Pond
Kinley Creek Stormwater
Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 100 200 400 Feet
1 inch = 200 feet
Imagery Source: USDA NAIP (2013)
Legend
K1
K1 Offline Pond
Road
County Boundary

Figure 43

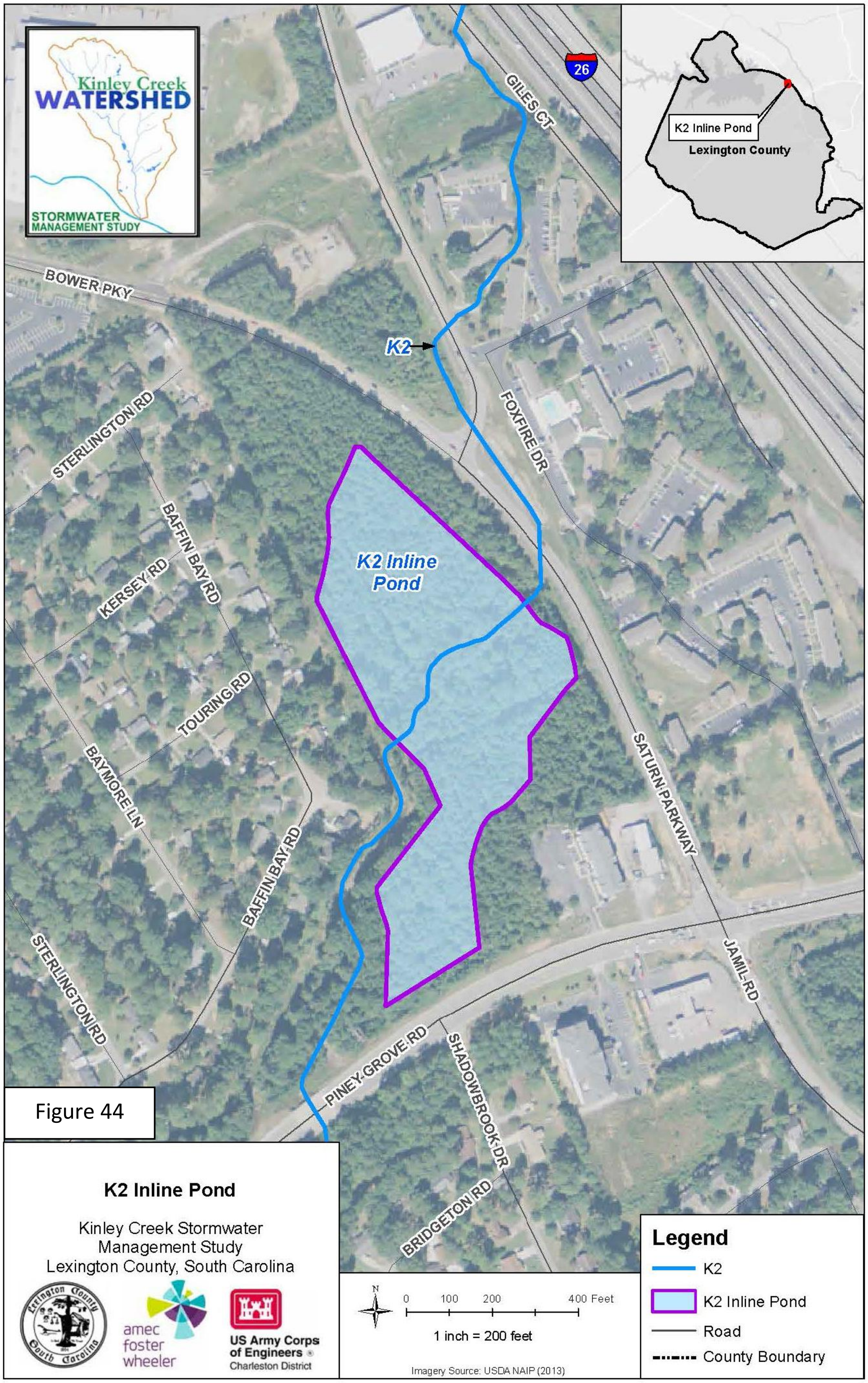
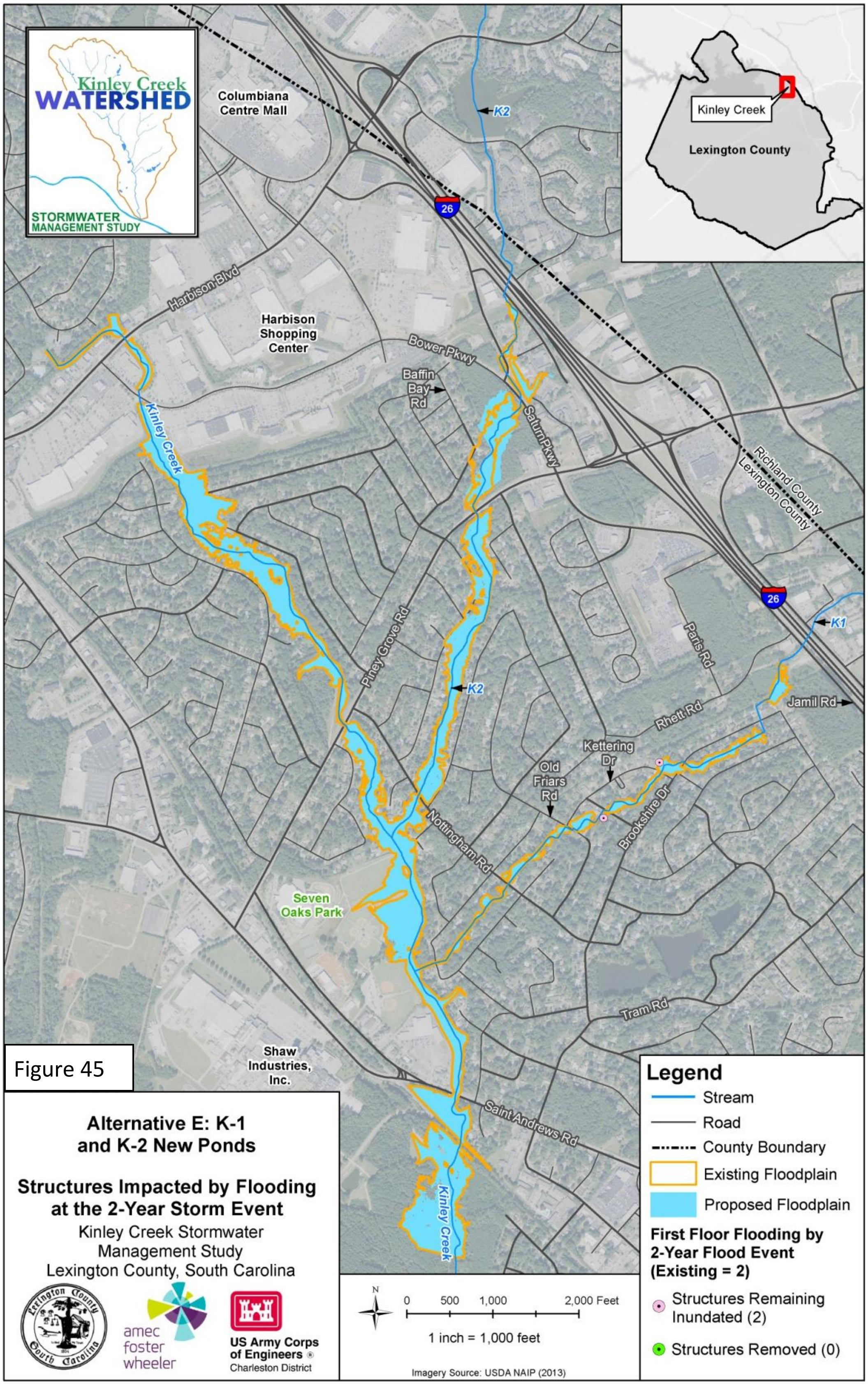

Kinley Creek
WATERSHED
STORMWATER MANAGEMENT STUDY
26
GILES CT
K2 Inline Pond
Lexington County
BOWER PKY
K2
STERLINGTON RD
FOXFIRE DR
BAFFIN BAY RD
K2 Inline Pond
KERSEY RD
TOURING RD
BAYMORE LN
SATURN PARKWAY
BAFFIN BAY RD
STERLINGTON RD
JAMIL RD
PINEY GROVE RD
SHADOWBROOK DR
BRIDGETON RD
K2 Inline Pond
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 100 200 400 Feet
1 inch = 200 feet
Imagery Source: USDA NAIP (2013)
Legend
K2
K2 Inline Pond
Road
County Boundary

Figure 44


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
K2
K1
26
Richland County
Lexington County
Kinley Creek
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 45
Alternative E: K-1 and K-2 New Ponds
Structures Impacted by Flooding at the 2-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 2-Year Flood Event (Existing = 2)
Structures Remaining Inundated (2)
Structures Removed (0)

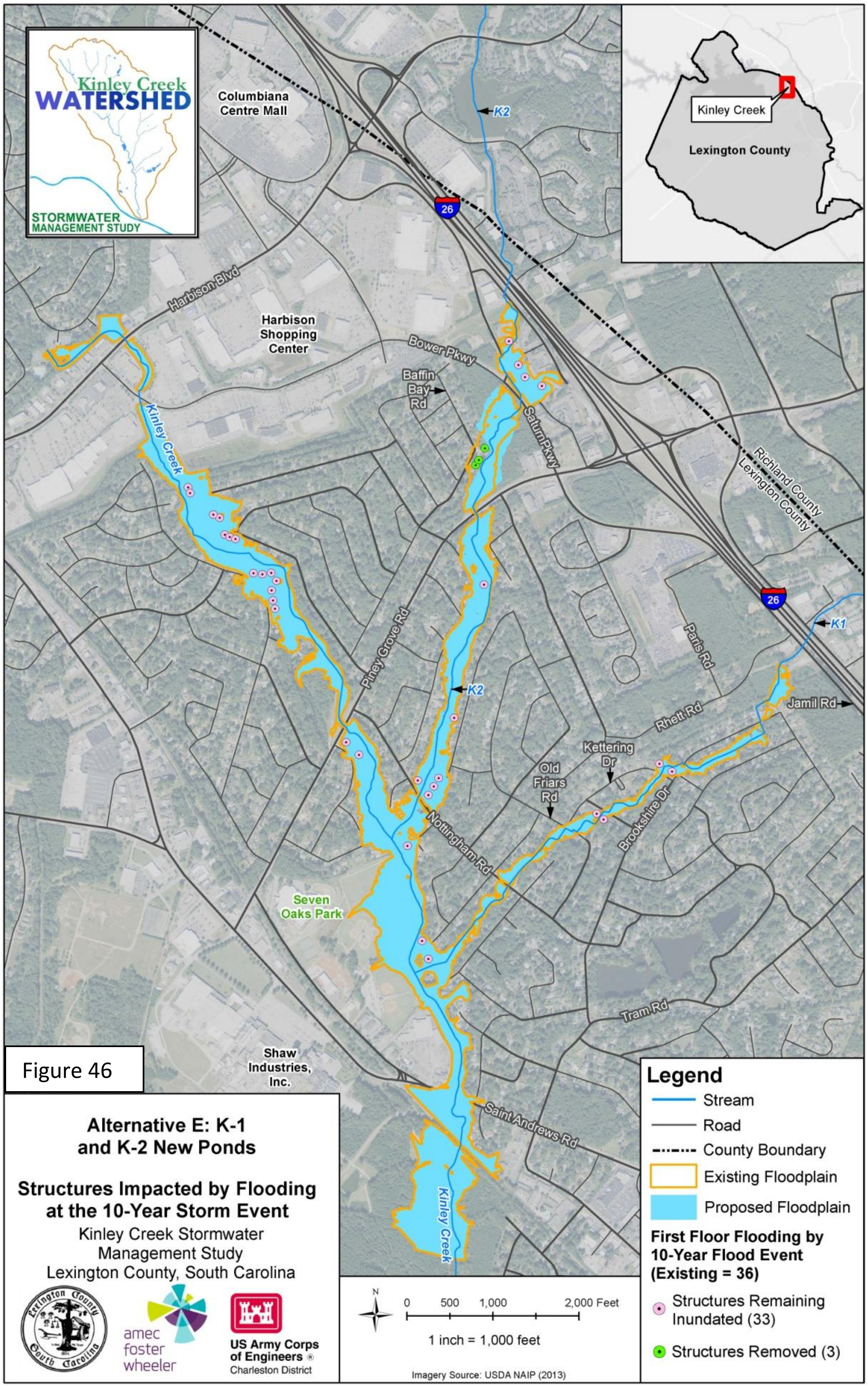
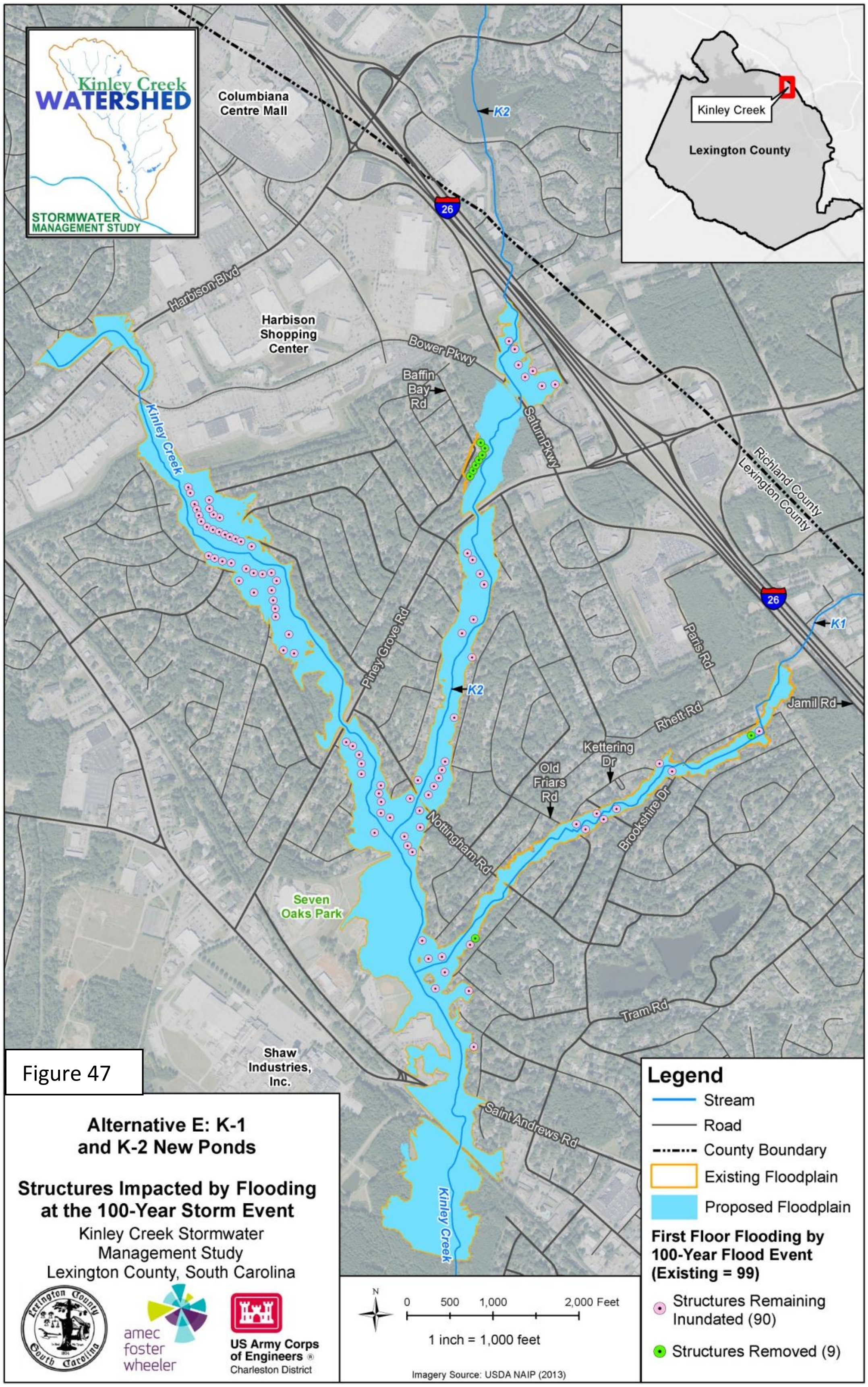



Figure 46

**Alternative E: K-1 and K-2 New Ponds**

**Structures Impacted by Flooding at the 10-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
K2
26
Kinley Creek
Lexington County
Richland County
Lexington County
Piney Grove Rd
Paris Rd
K1
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 47
Alternative E: K-1 and K-2 New Ponds
Structures Impacted by Flooding at the 100-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 100-Year Flood Event (Existing = 99)
Structures Remaining Inundated (90)
Structures Removed (9)

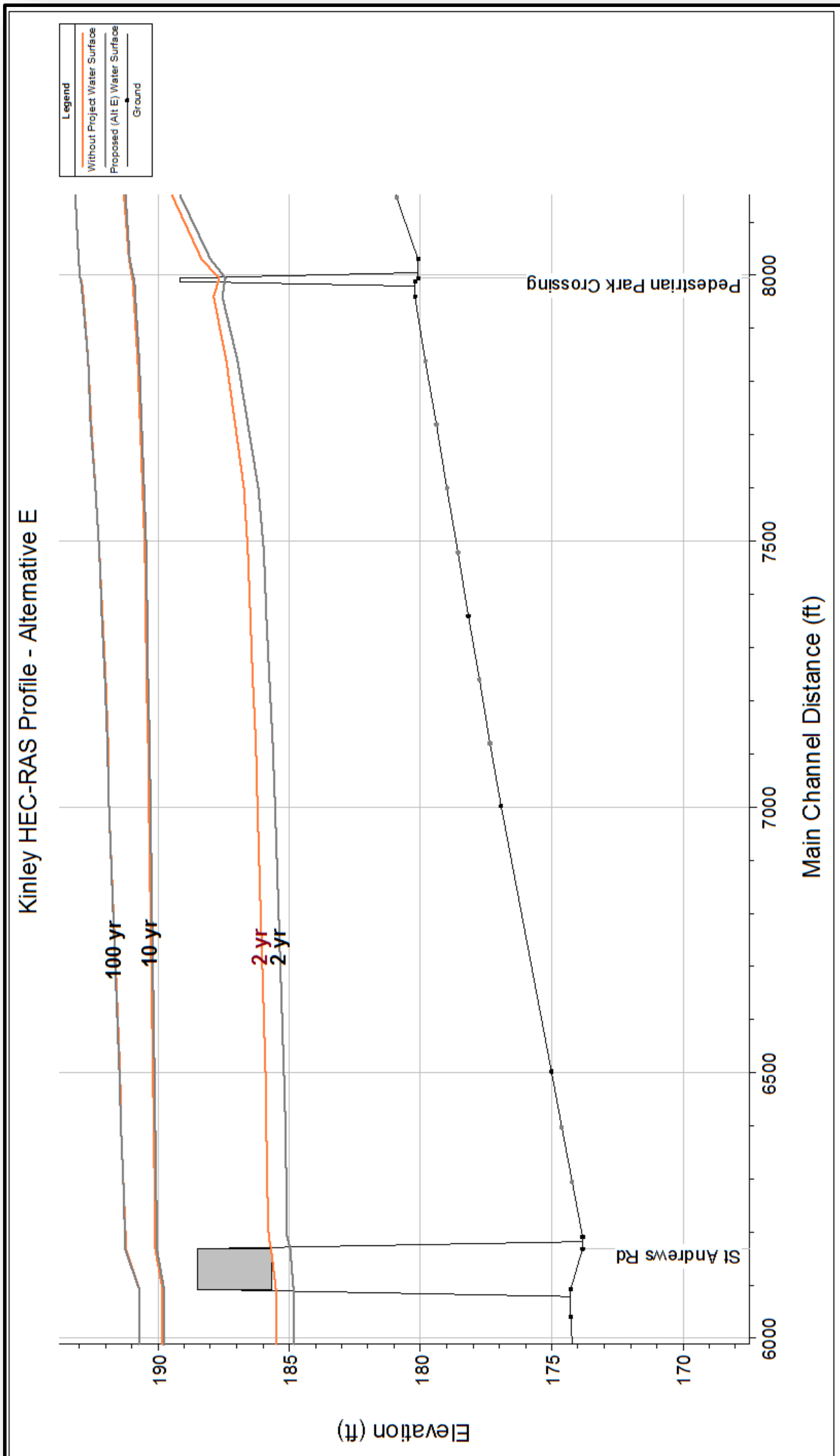



**Figure 48. Water Surface Profile Kinley Creek : Alternative E**

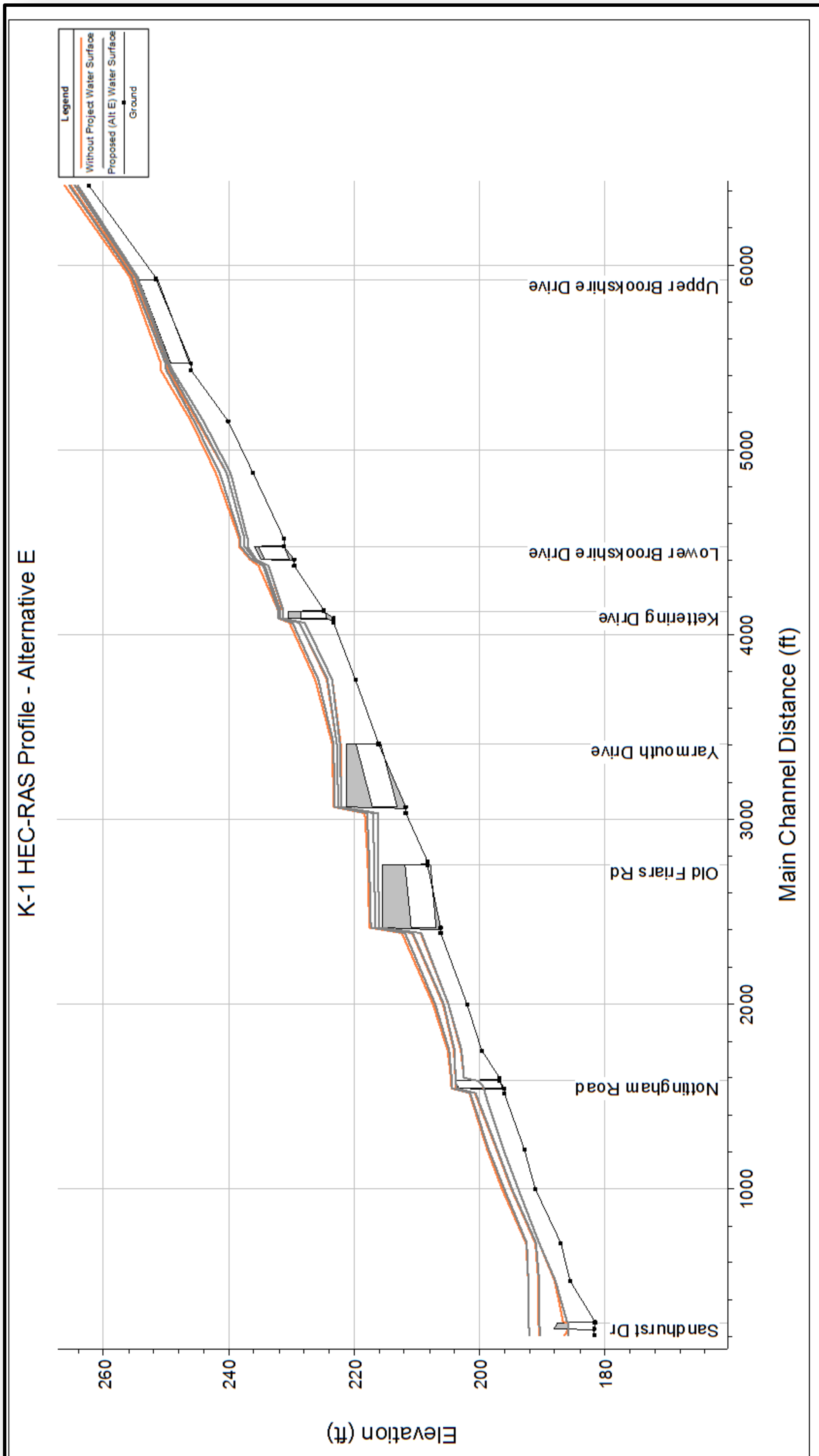



**Figure 49. Water Surface Profile K-1 : Alternative E**

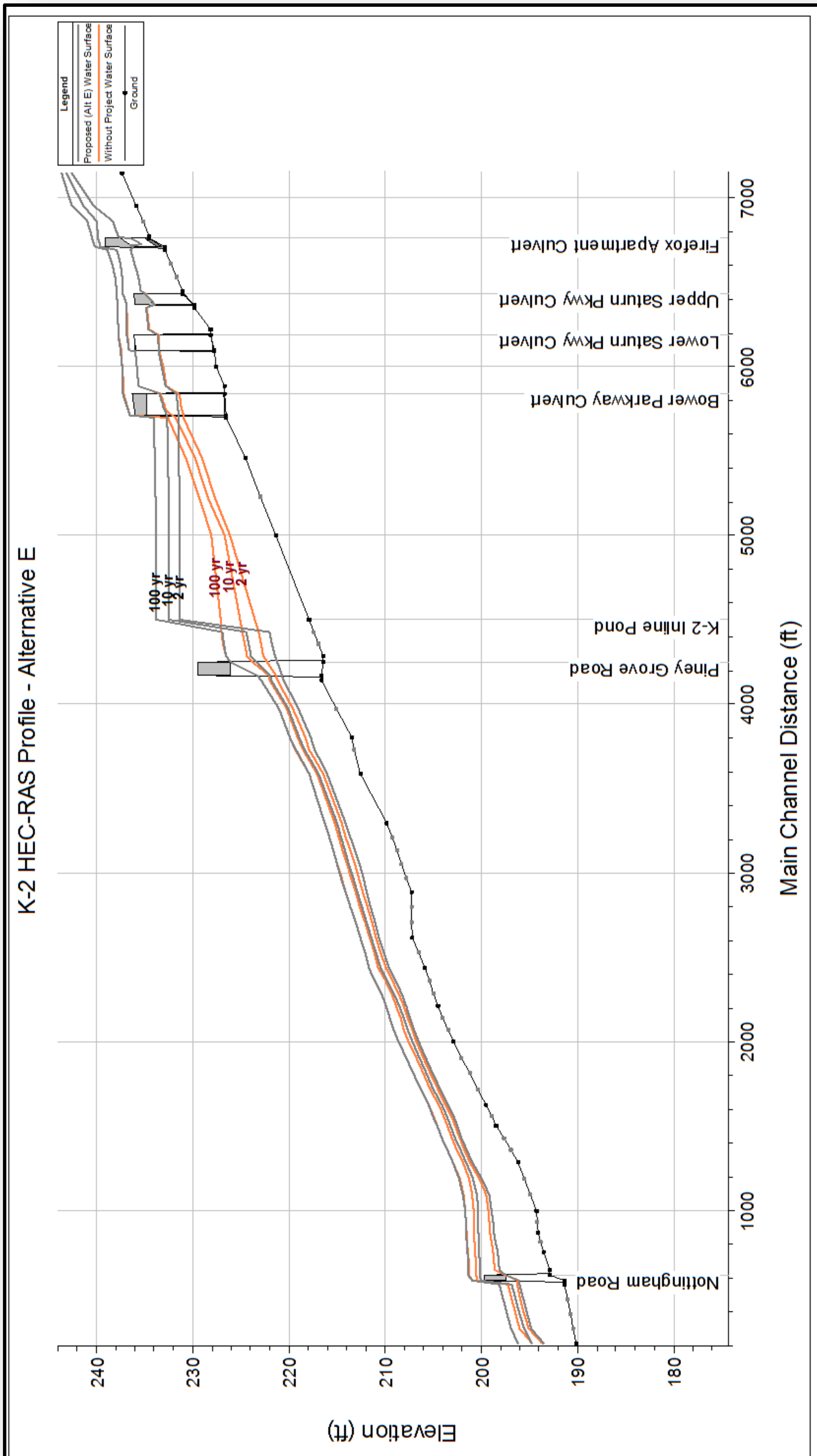



**Figure 50. Water Surface Profile K-2 : Alternative E**

## 13.6 Alternative F - Modified Channels, Bridges, and Culverts

**Management Measures:** The following management measures for Kinley Creek, K-1 and K-1 were combined to form this alternative (Figure 51):

**K-1**: Add a 6 foot diameter, 42 foot long culvert to the existing culvert at Nottingham Road and extend the existing headwall. Replace the 4 foot pipe and headwall at Olds Friars Road with two 6 foot by 6 foot, 39 foot long box culverts and 45 degree wing walls. Replace the headwall and pipe at Yarmouth Culvert with two 6 foot by 5 foot, 339 foot long box culverts and 45 degree wing walls. Add 5 foot and 4 foot, 71 foot long culverts next to the existing culvert at Lower Brookshire. Replace the Kettering culvert with two 38 foot long, 6 foot by 4 foot box culverts. Channelize a 4000 foot reach of K-1 with a 20 foot wide bench and 2:1 slopes; and 510 yards of rip rap. Channelize an additional 2500 foot reach with a 15 foot wide bench and 1.5:1 slopes.

**K-2:** Modify channel at Piney Grove Bridge by removing 400 cubic yards from side slopes, modify channel at Nottingham Road and increase the bridge span by 20 feet, remove approximately 130 CY of material. Construct a 60 foot shelf for 600 linear feet of channel, a 40 foot wide shelf for 3757 linear feet and then a 60 foot wide channel for 2790 linear feet.

**Kinley Creek:** Reshape entire length channel to include a 3400 linear foot reach with a 40 foot bench and a 7400 linear foot reach with a 60 foot bench. Modify RR Crossing to a 57 foot span. Modify St, Andrews Bridge to a 112 foot span. Modify Piney Grove Road Bridge to an 83 foot span with abutments not to exceed 4 foot.

**Benefits:** This alternative will remove 54 structures out of the floodplain. No structures will be left in the 2 year event, amd only 2 structures will remain be vulnearble to a 5 storm event (Figures 52-54). Table 10 shows the average drop in water depth during storm events**.**

**Table 10. Average Drop in Water Depth as a Function of Storm Events if Alternative F is Implemented**

| Storm Event | Average Drop in Water Depth (ft) |
|---|---|
| 2-YR | 1.71 |
| 5-YR | 1.88 |
| 10-YR | 1.80 |
| 25-YR | 1.57 |
| 50-YR | 1.52 |
| 100-YR | 1.25 |

Water levels will be reduced through all three reaches if this Alternative is implemented.

**Costs:** Construction costs for Alternative F is $18,529,000.

**Constraints:** Bedrock in channels may complicate construction. Multiple utility lines along work area will have to be either relocated or worked around. Mature tree removal and replacement, in addition to private property easements for construction and maintenance will be necessary. The Kinley Creek Bridge is a SCDOT bridge, which necessitates their involvement. Other bridges may require coordination with DOT. In addition, this is a permitted structure and any approval for modifications must be obtained from SCDHEC and USACE-Regulatory. Modifying RR Crossing will require coordination with the CSX Railroad Company.

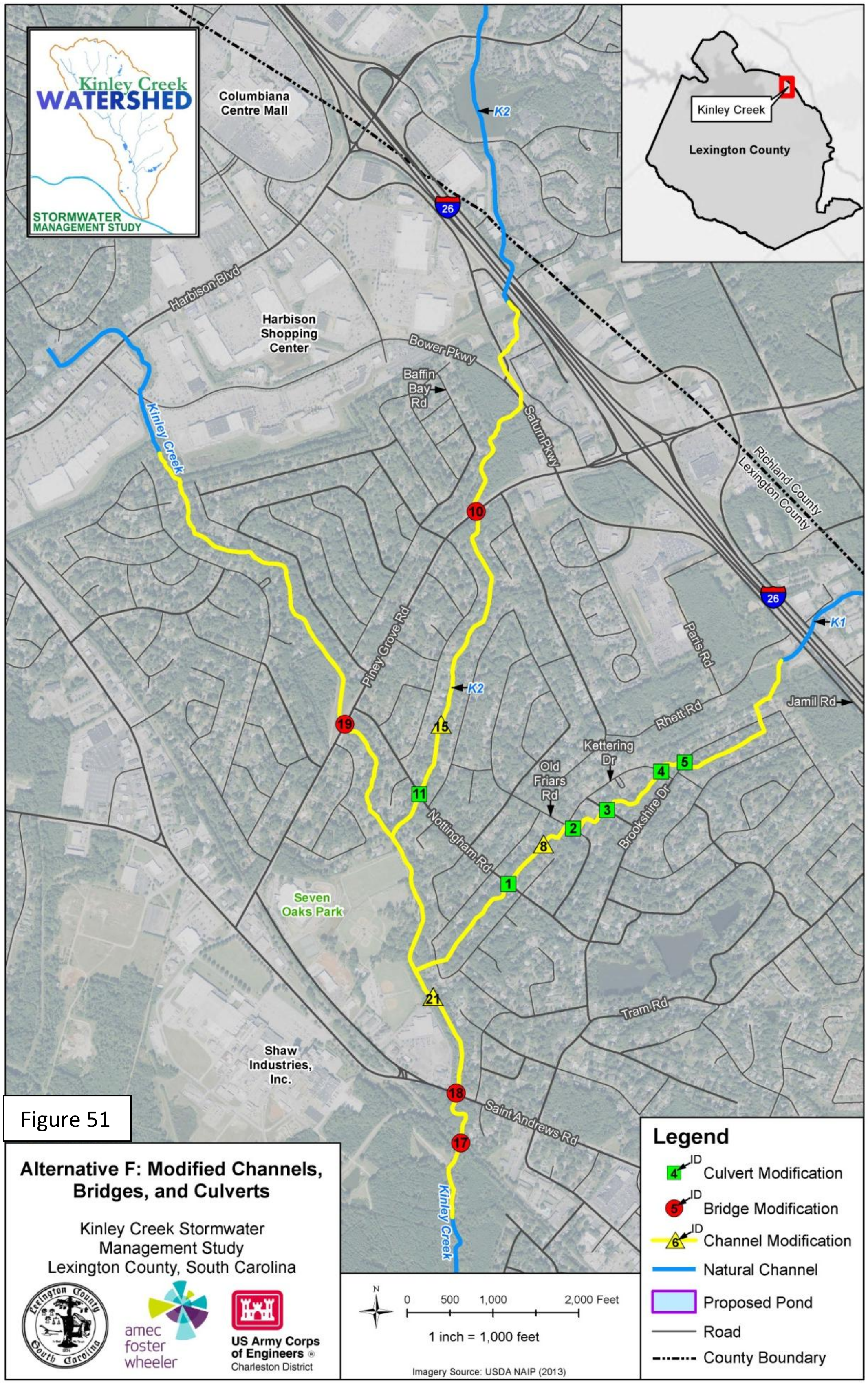



Figure 51

**Alternative F: Modified Channels, Bridges, and Culverts**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina

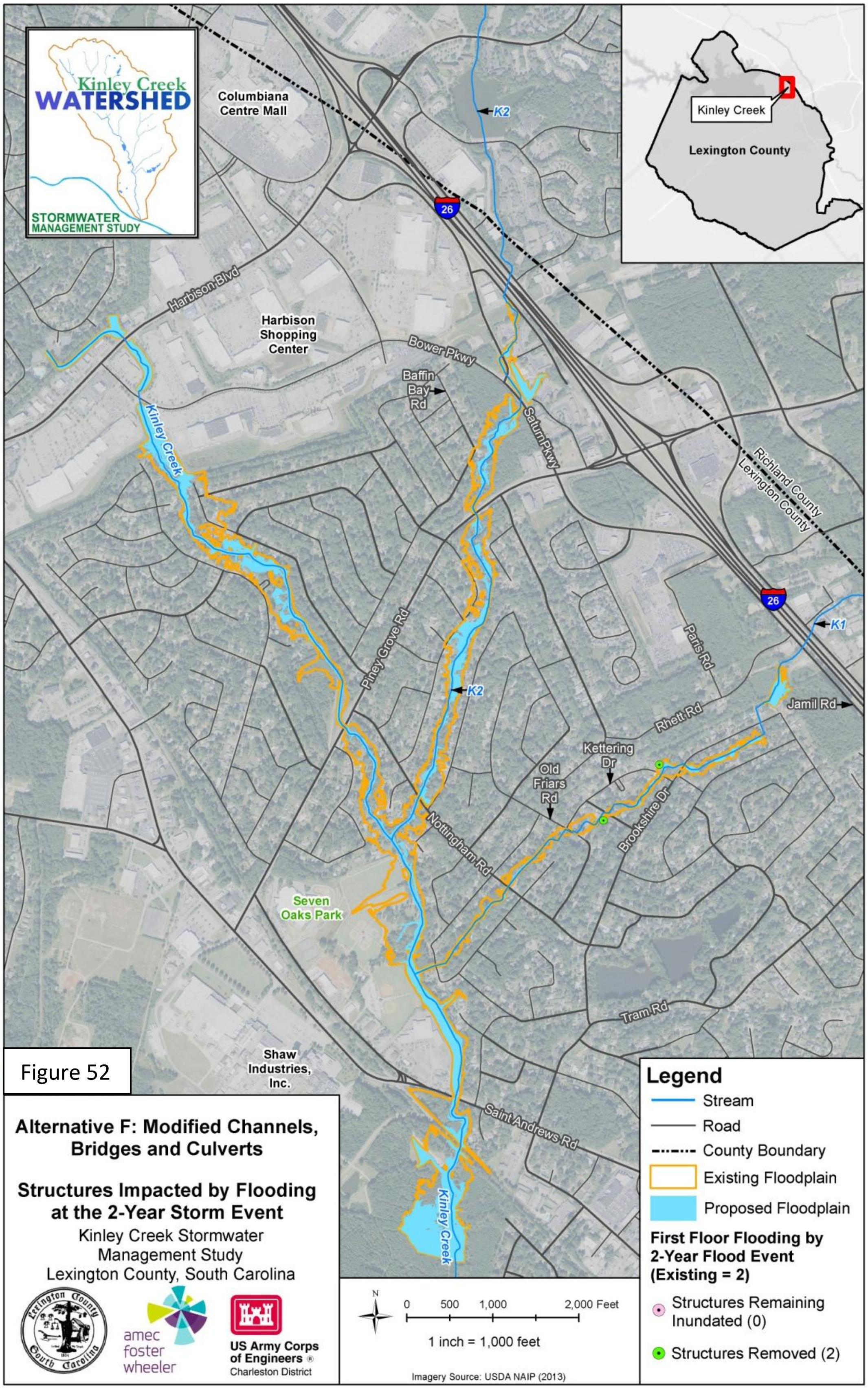



Figure 52

**Alternative F: Modified Channels, Bridges and Culverts**

**Structures Impacted by Flooding at the 2-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina

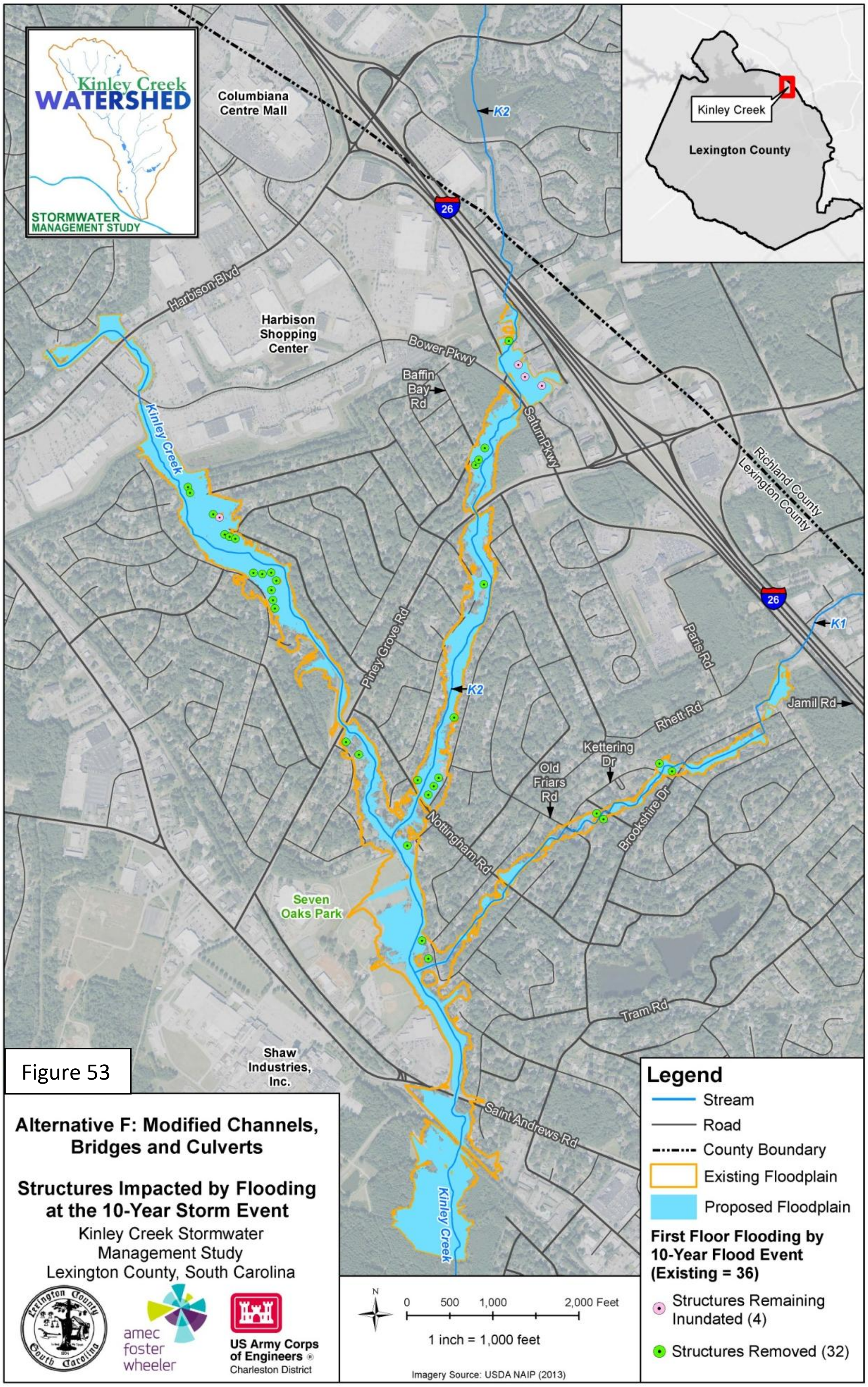
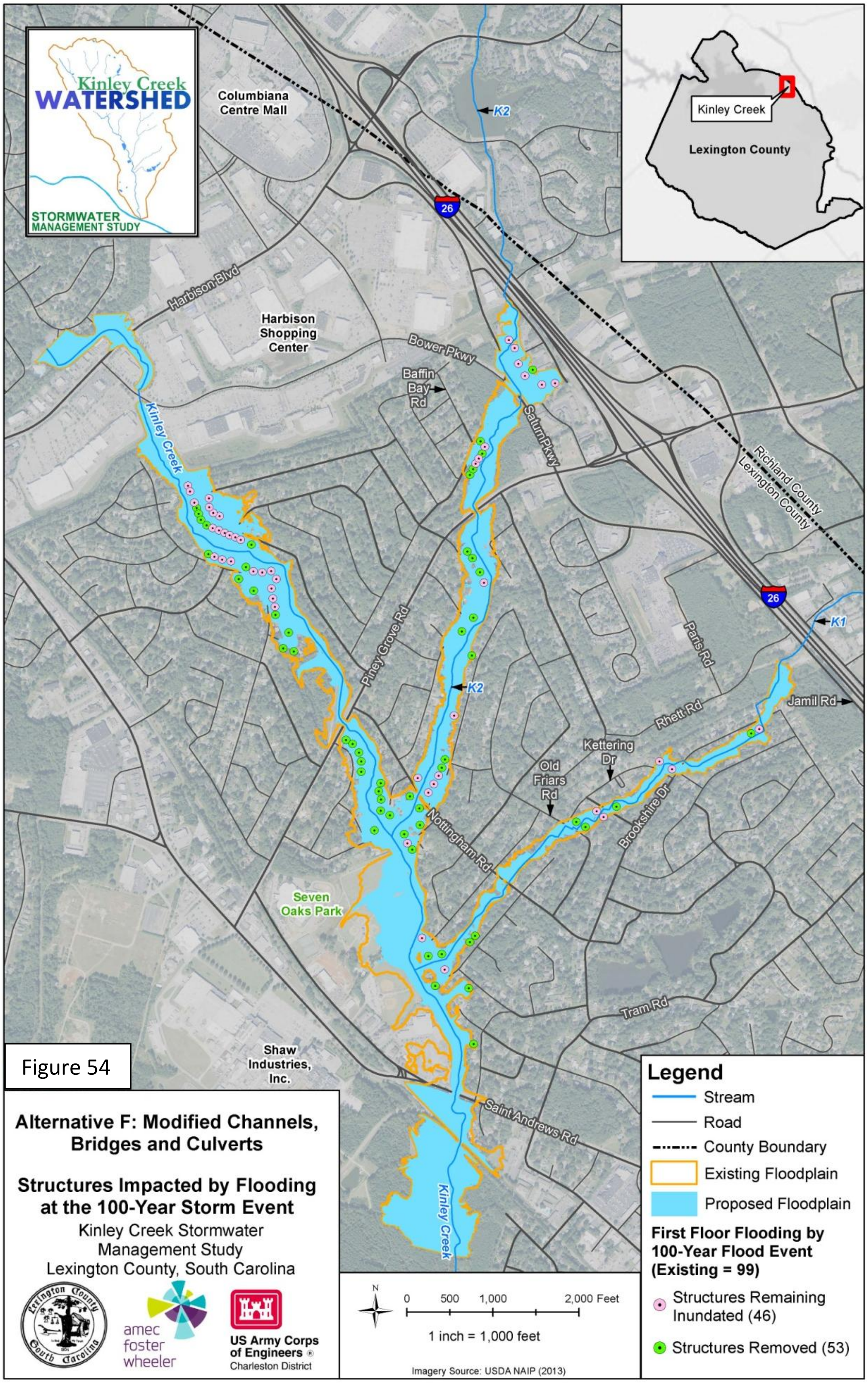



Figure 53

**Alternative F: Modified Channels, Bridges and Culverts**

**Structures Impacted by Flooding at the 10-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
K2
Kinley Creek
Lexington County
26
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
Richland County
Lexington County
26
K1
Piney Grove Rd
Paris Rd
K2
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 54
Alternative F: Modified Channels, Bridges and Culverts
Structures Impacted by Flooding at the 100-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 100-Year Flood Event (Existing = 99)
Structures Remaining Inundated (46)
Structures Removed (53)

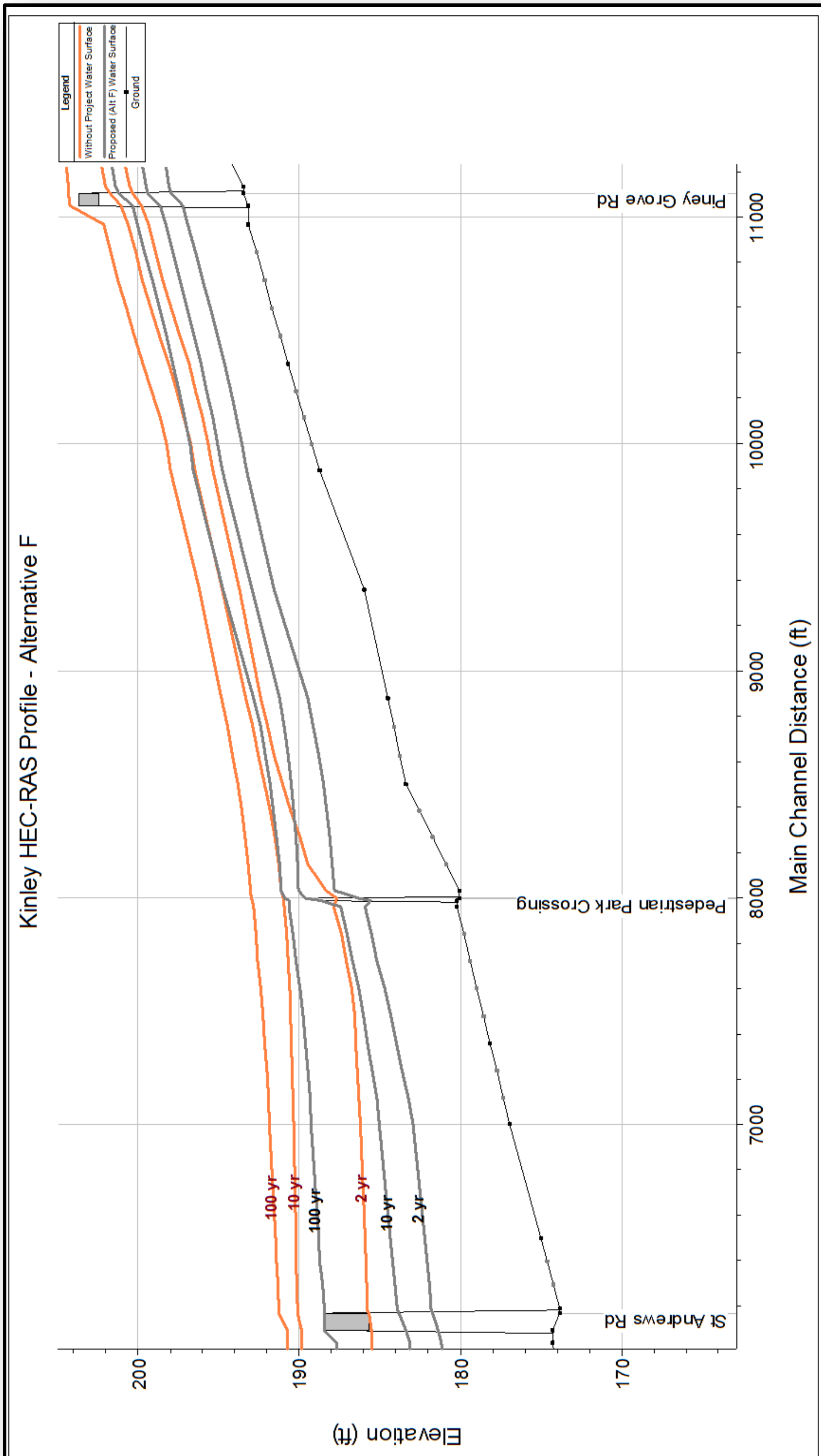



**Figure 55. Water Surface Profile Kinley Creek : Alternative F**

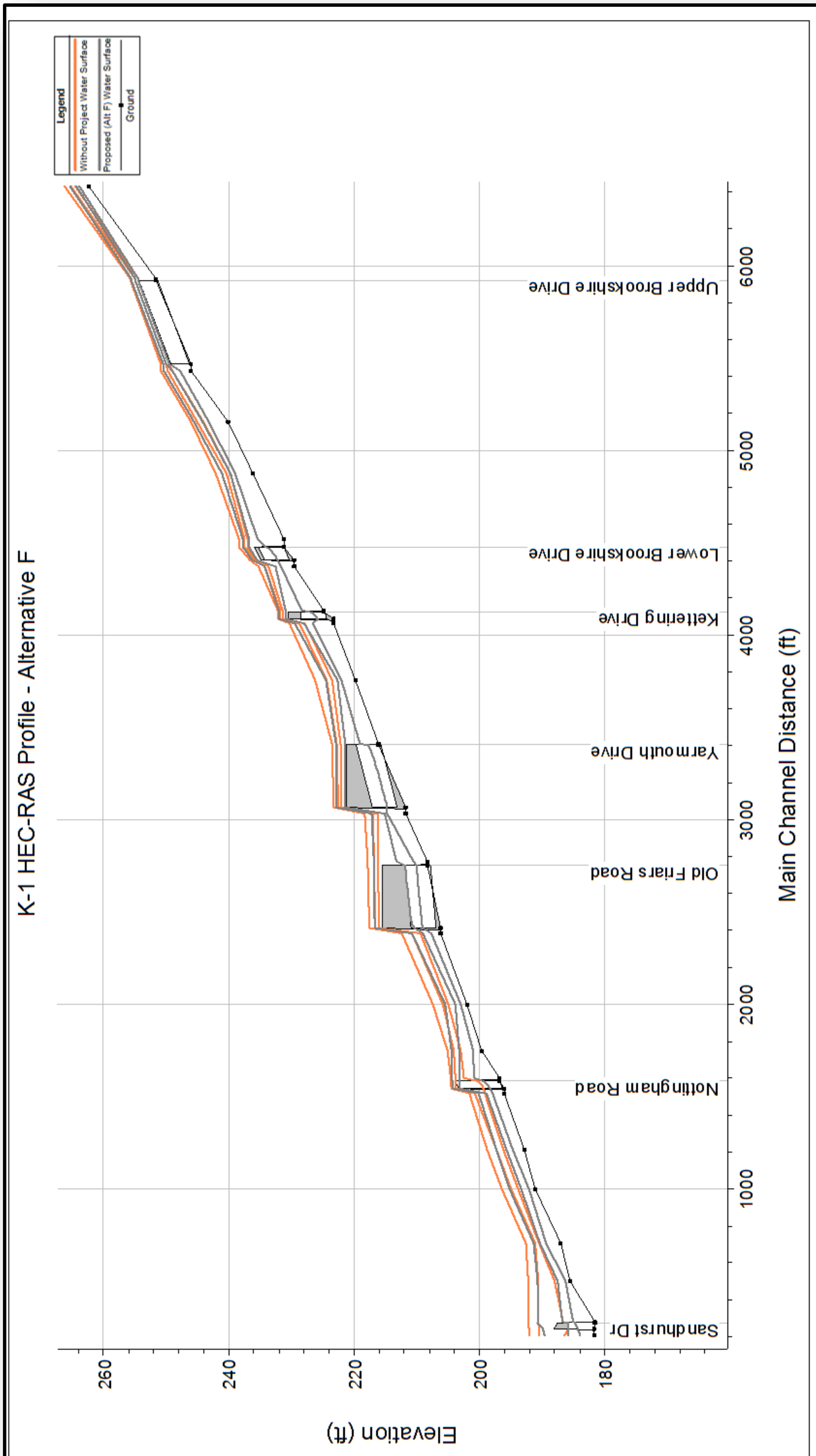



**Figure 56. Water Surface Profile K-1 : Alternative F**

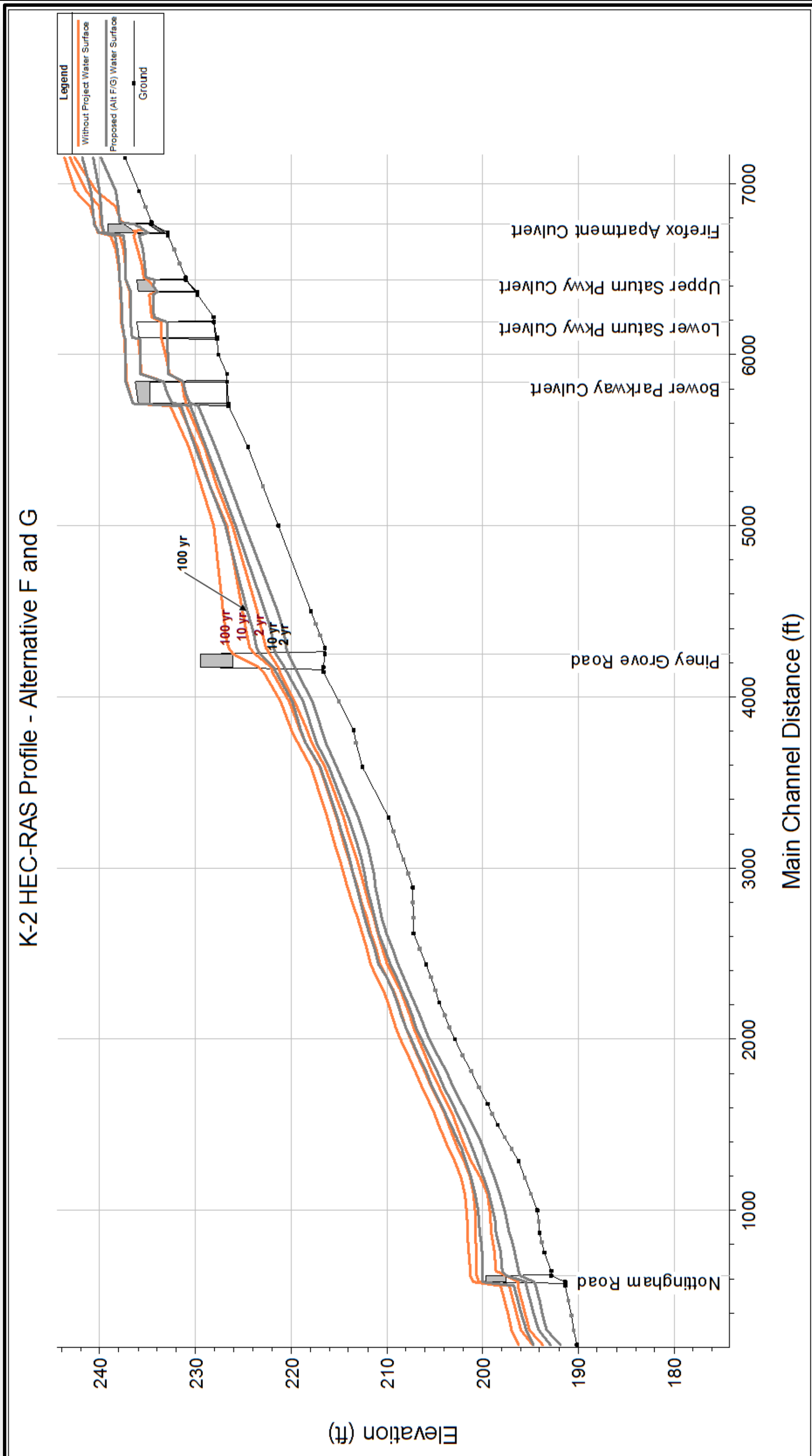



**Figure 57. Water Surface Profile K-2: Alternative F**

## 13.7 Alternative G - Modified Channels, Limited Bridges, and Culverts

**Management Measures:** This alternative combines the following measures on all three tributaries (Figure 58):

**K-1:** Add a 6 foot diameter, 42 foot long culvert to the existing culvert at Nottingham Road and extend the existing headwall. Replace the 4 foot pipe and headwall at Olds Friars Road with two 6 foot by 6 foot, 39 foot long box culverts and 45 degree wing walls. Replace the headwall and pipe at Yarmouth Culvert with two 6 foot by 5 foot, 339 foot long box culverts and 45 degree wing walls. Add 5 foot and 4 foot, 71 foot long culverts next to the existing culvert at Lower Brookshire. Replace the Kettering Culvert with two 38 feet long, 6 foot by 4 foot box culverts. Channelize a 4000 foot reach of K-1 with a 20 foot wide bench and 2:1 slopes. Channelize an additional 2500 foot reach with a 15 foot wide bench and 1.5:1 slopes.

**K-2:** Modify channel at Piney Grove Bridge by removing 4000 cubic yards from side slopes, modify channel at Nottingham Road and increase the bridge span by 20 feet, remove approximately 130 CY of material. Construct a 60 foot shelf for 600 linear feet of channel, a 40 foot wide shelf for 3757 linear feet and then a 60 foot wide channel for 2790 linear feet.

**Kinley Creek:** Modify Piney Grove Road Bridge to an 83 foot span with abutments not to exceed 4 feet. Construct a 30 foot shelf for 2988 linear feet of channel then a 60 foot wide channel for 4500 linear feet to the confluence with K-2.

**Benefits:** This alternative will remove 41 structures out of the floodplain. No structures will be left in the 2 year event, amd only two structures will remain be vulnerable to a 5 year storm event (Figures 59-61). Table 11 shows the average drop in water depth during storm events**.**

**Table 11. Average Drop in Water Depth as a Function of Storm Events if Alternative G is Implemented**

| Storm Event | Average Drop in Water Depth (ft) |
|---|---|
| 2-YR | 1.60 |
| 5-YR | 1.47 |
| 10-YR | 1.24 |
| 25-YR | 1.08 |
| 50-YR | 1.02 |
| 100-YR | 0.97 |

Water levels will be reduced through all three reaches if this Alternative is Implemented.

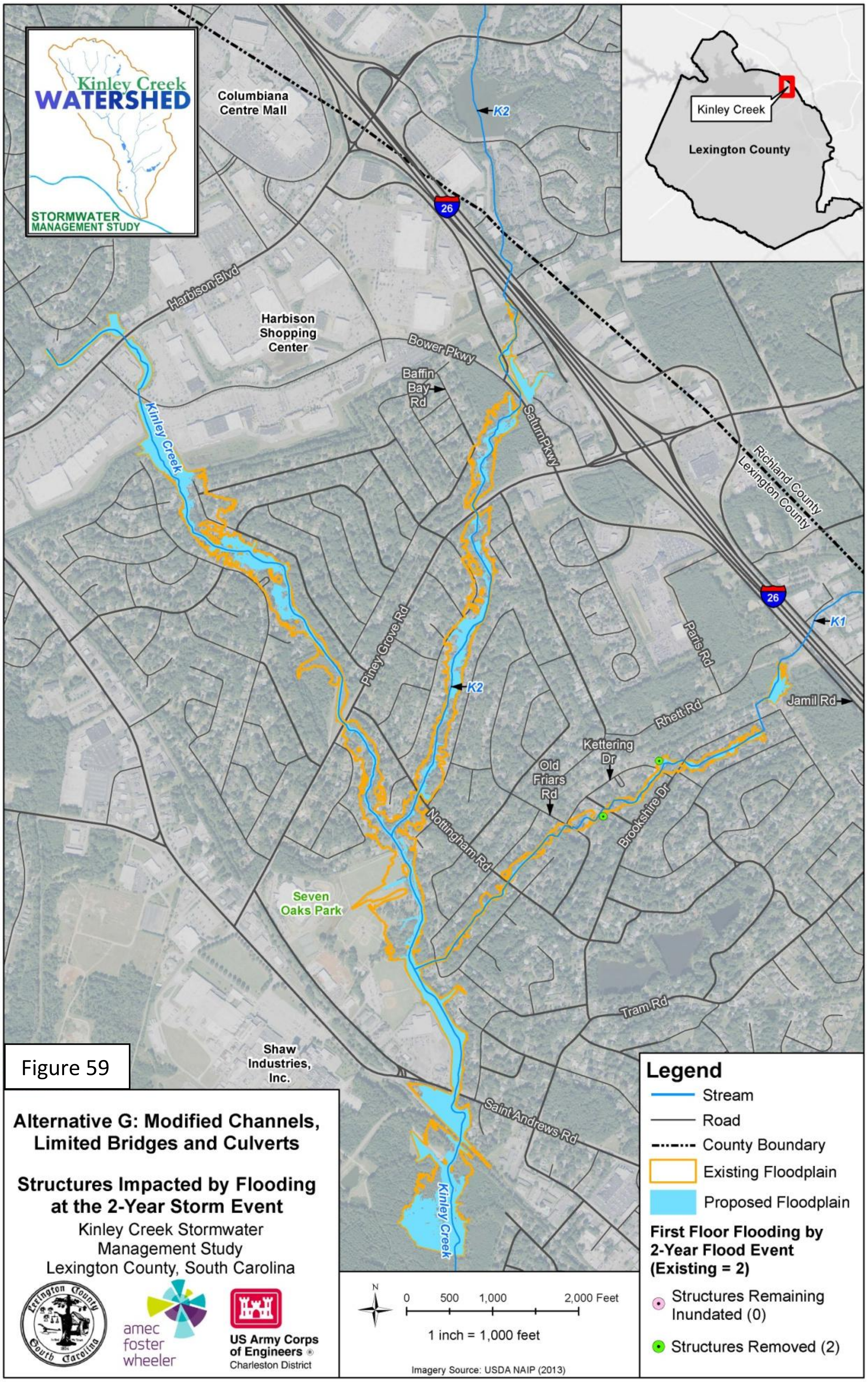
**Constraints:** Bedrock in channels may complicate construction. Multiple utility lines along work area will have to be either relocated or worked around. Mature tree removal and replacement, in addition to private property easements for construction and maintenance will be necessary. The Kinley Creek Bridge is a SCDOT bridge, which necessitates their involvement. Other bridges may require coordination with DOT. In addition, this is a permitted structure and any approval for modifications must be obtained from SCDHEC and USACE-Regulatory.

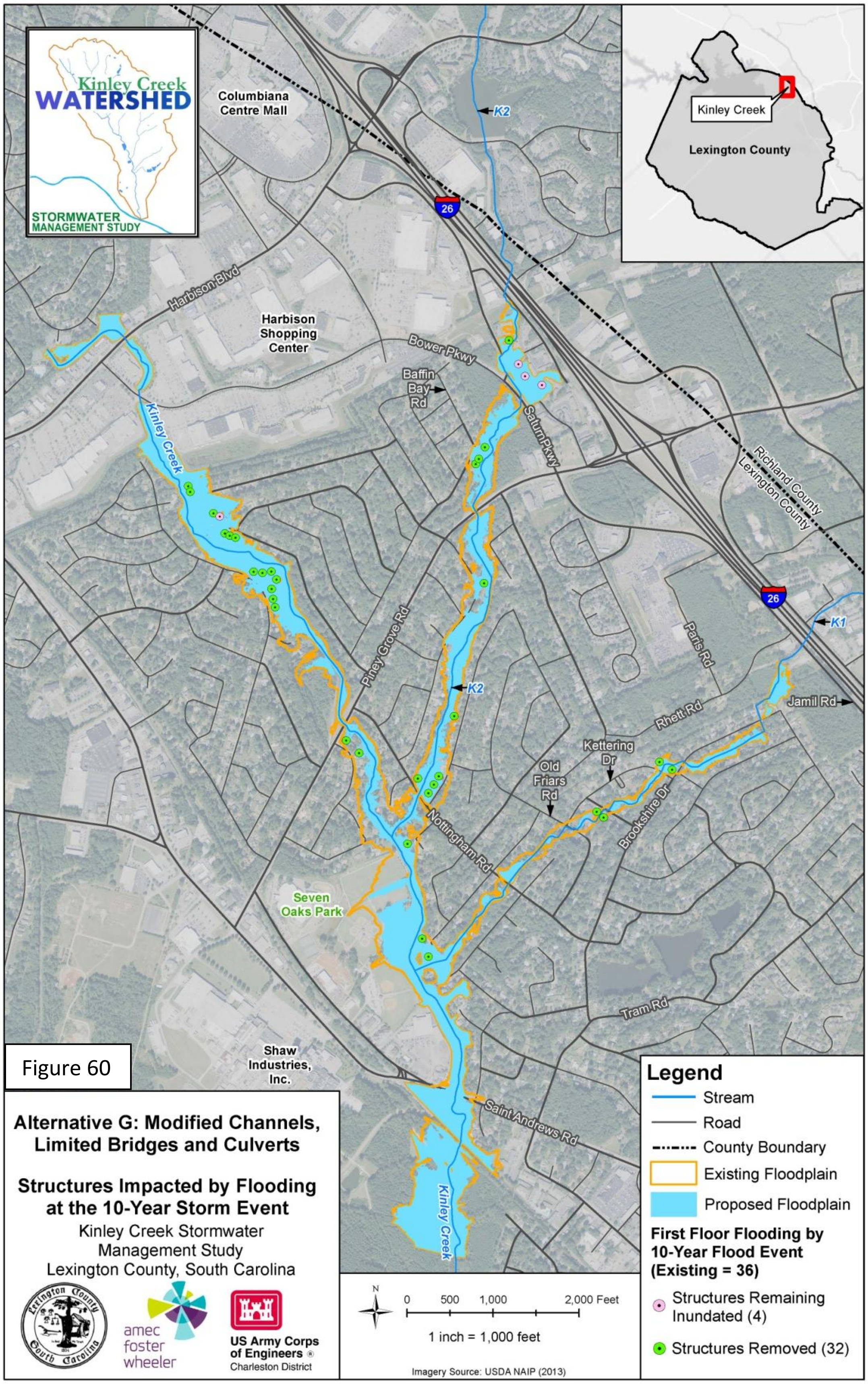
**Cost:** The estimated costs to implement Alternative G are $15,629,000.


Figure 58

**Alternative G:Modified Channels, Limited Bridges, and Culverts**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina


Kinley Creek
WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
K2
26
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
Richland County
Lexington County
26
K1
Piney Grove Rd
K2
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 59
Alternative G: Modified Channels, Limited Bridges and Culverts
Structures Impacted by Flooding at the 2-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 2-Year Flood Event (Existing = 2)
Structures Remaining Inundated (0)
Structures Removed (2)



Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Richland County
Lexington County
Kinley Creek
Lexington County
K2
K1
26
Kinley Creek
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 60
Alternative G: Modified Channels, Limited Bridges and Culverts
Structures Impacted by Flooding at the 10-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 10-Year Flood Event (Existing = 36)
Structures Remaining Inundated (4)
Structures Removed (32)

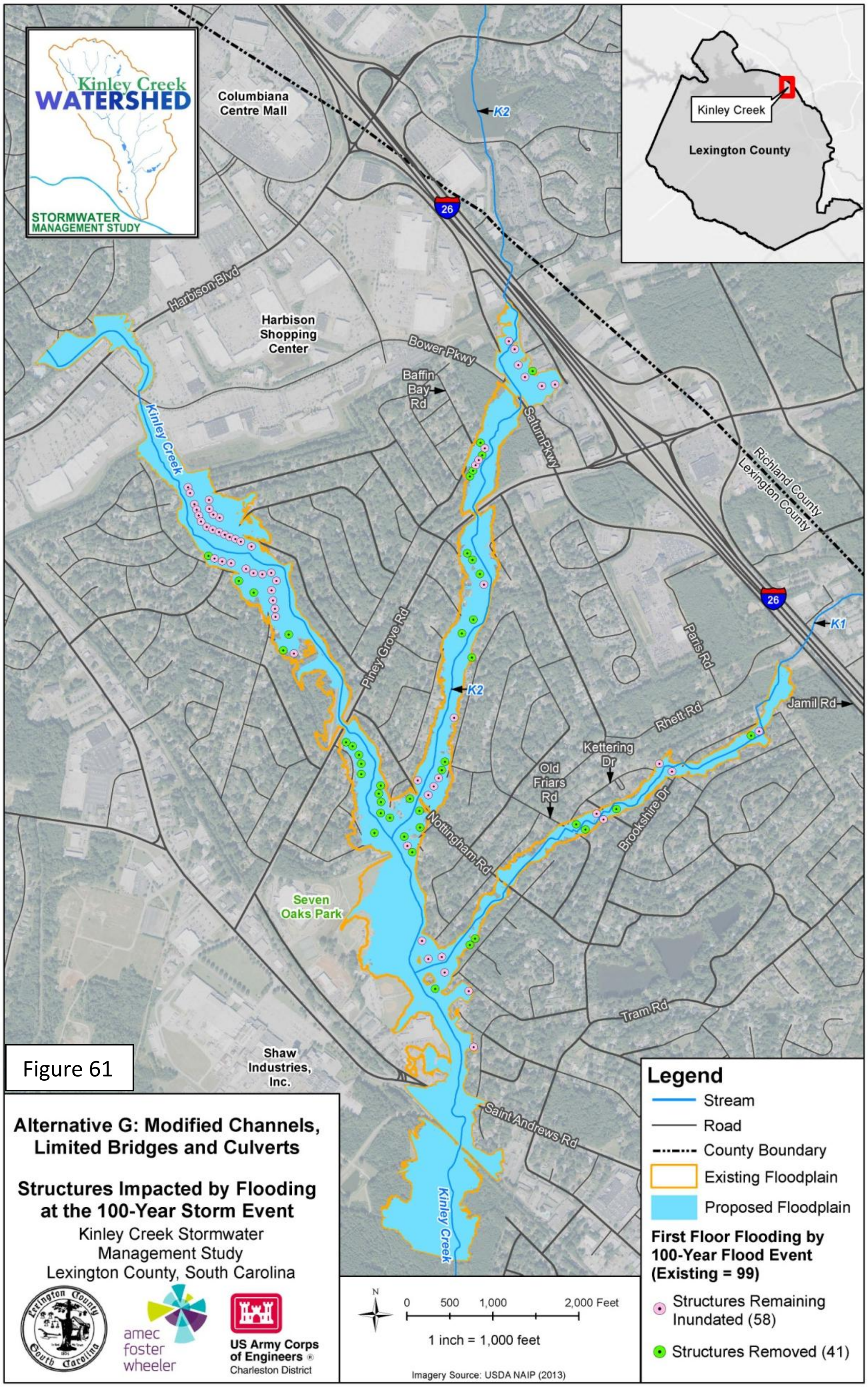



Figure 61

**Alternative G: Modified Channels, Limited Bridges and Culverts**

**Structures Impacted by Flooding at the 100-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina

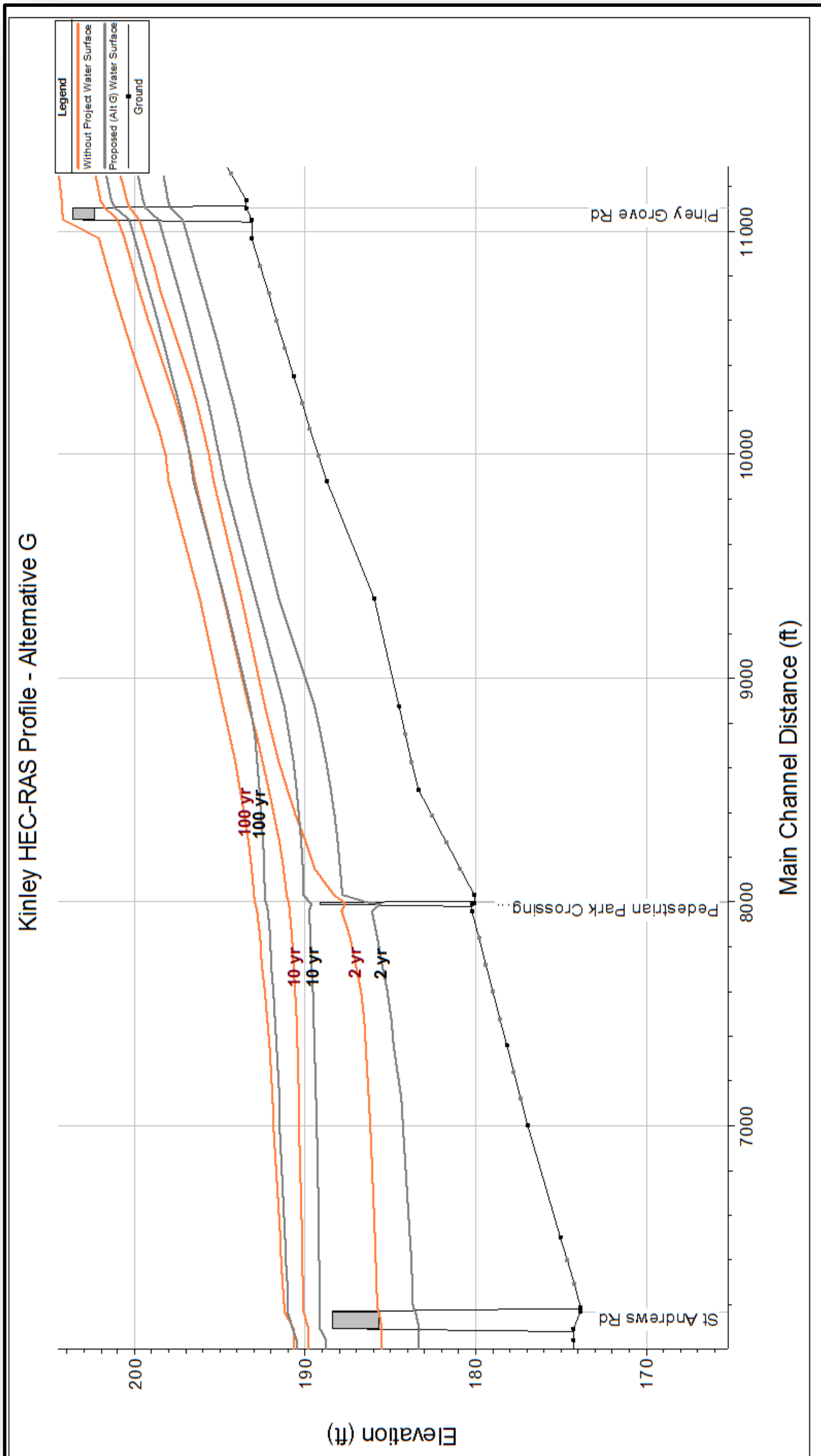



**Figure 62. Water Surface Profile Kinley: Alternative G**

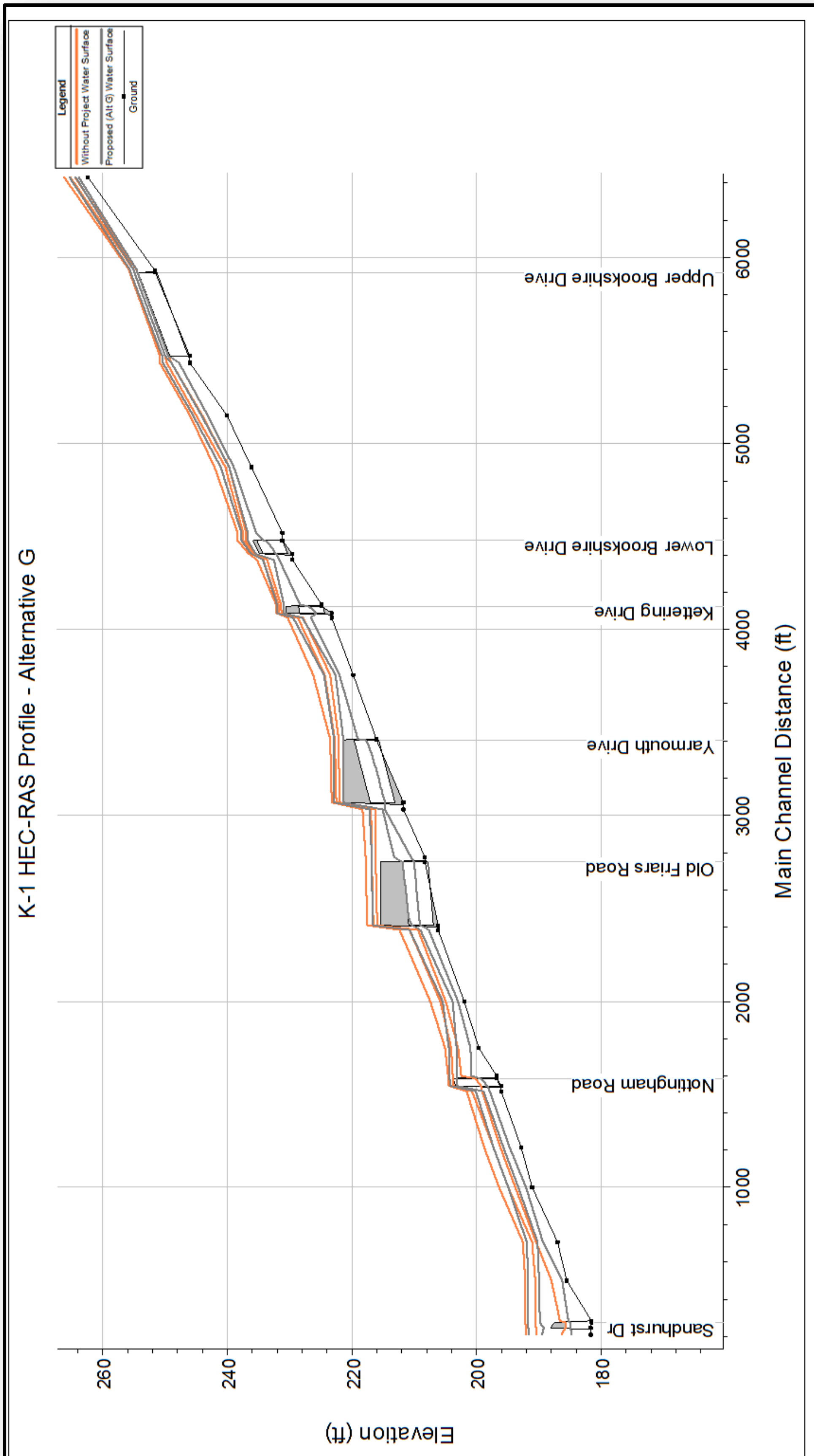



**Figure 63. Water Surface Profile K-1: Alternative G**

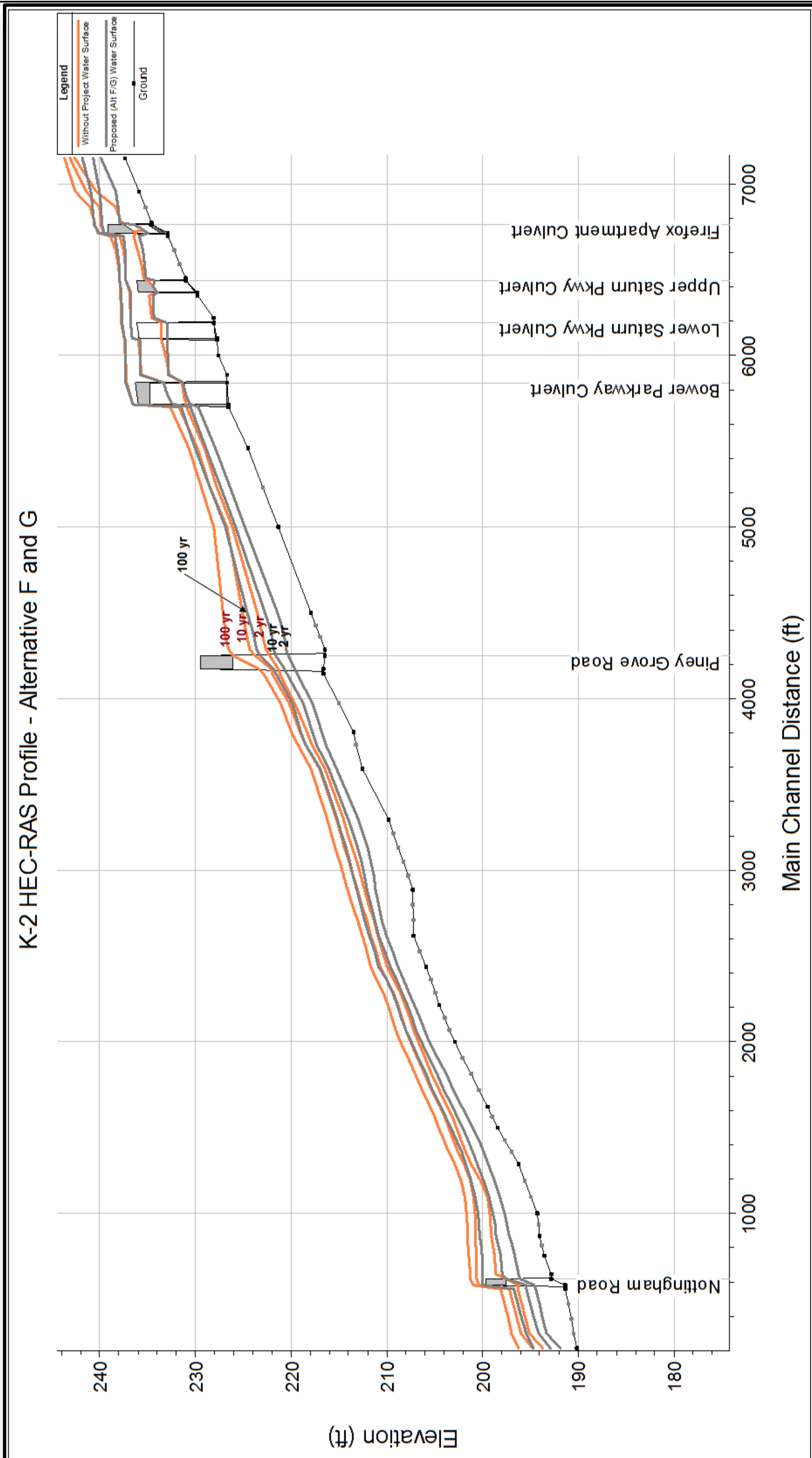



**Figure 64. Water Surface Profile K-2: Alternative G**

## 13.8 Alternative H – Upper K-2 Floodplain Bench

**Management Measure(s):** This alternative involves the construction of a 100 foot wide bench for a 700 foot reach and 50 foot wide shelf for a 700 foot reach on upper K-2. (Figure 65) This will direct flows away from structures.

**Benefits:** This alternative will remove two structures out of the floodplain. Structures will still be vunerable to 2-year and larger storm events (Figures 66-68). Table 12 shows the average drop in water depth during storm events**.**

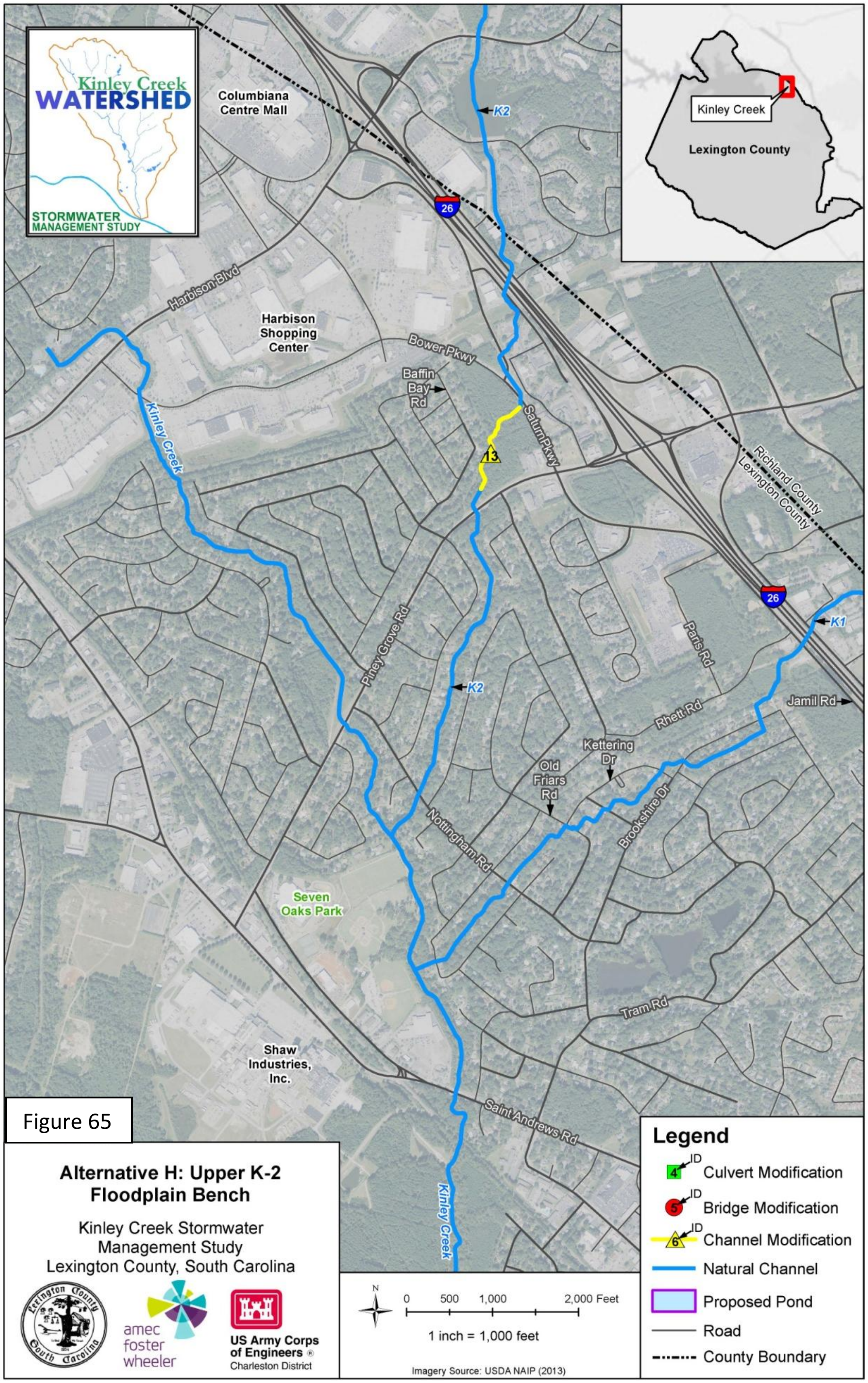
**Table 12. Average Drop in Water Depth as a Function of Storm Events if Alternative H is Implemented**

| Storm Event | Average Drop in Water Depth (ft) |
|---|---|
| 2-YR | 1.06 |
| 5-YR | 1.03 |
| 10-YR | 1.03 |
| 25-YR | 1.03 |
| 50-YR | 1.00 |
| 100-YR | 0.91 |

Water levels will be reduced through the middle reach of K-2 if this Alternative is implemented.

**Constraints:** Bedrock in channels may complicate construction. Multiple utility lines along work area will have to be either relocated or worked around. Mature tree removal and replacement, in addition to private property easements for construction and maintenance will be necessary.

**Cost:** Estimated cost for implementing Alternative H is $796,000.



Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
13
K2
K1
26
Richland County
Lexington County
Kinley Creek
Piney Grove Rd
Parts Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Alternative H: Upper K-2 Floodplain Bench
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Culvert Modification
Bridge Modification
Channel Modification
Natural Channel
Proposed Pond
Road
County Boundary


Figure 65

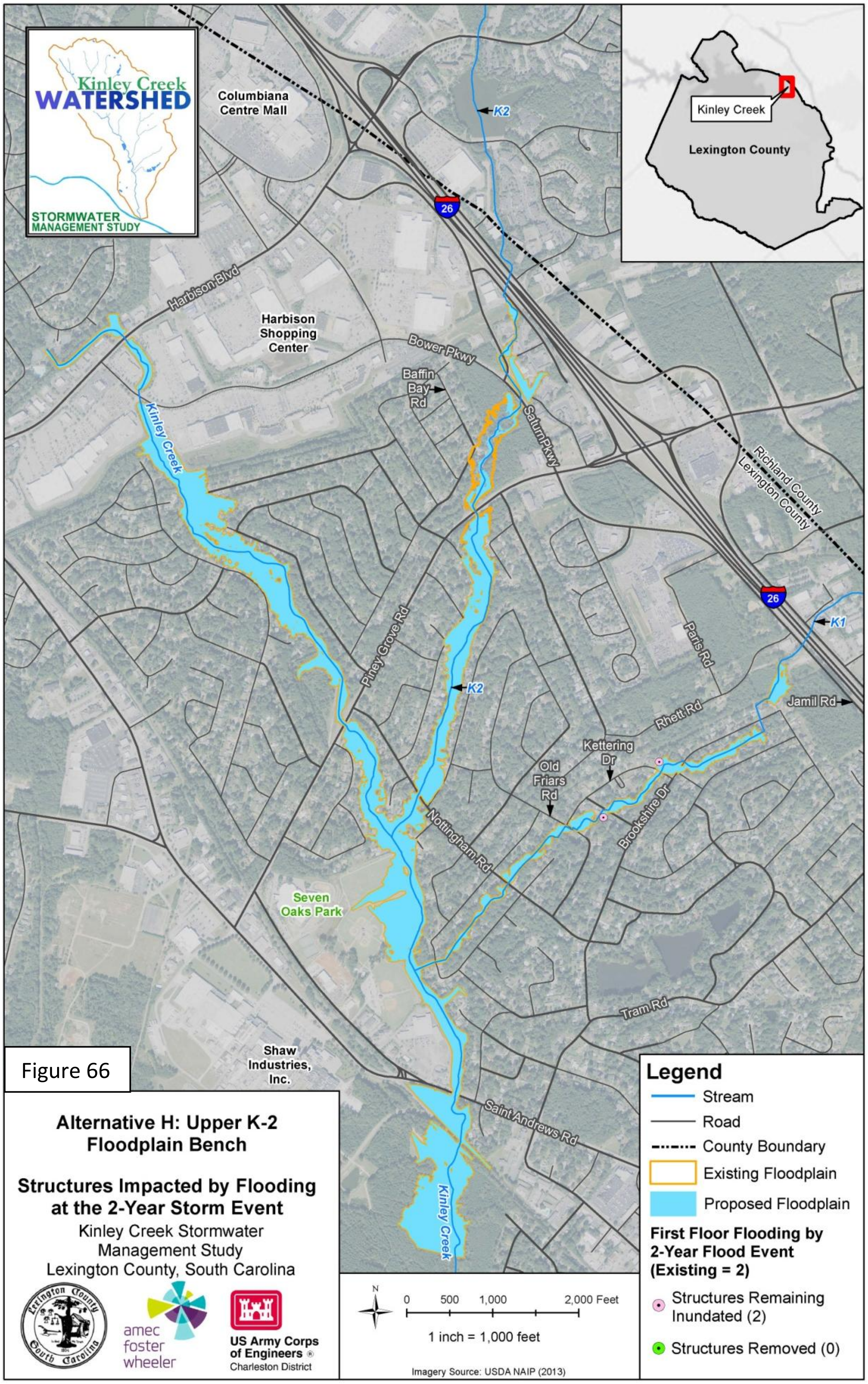



Figure 66

**Alternative H: Upper K-2 Floodplain Bench**

**Structures Impacted by Flooding at the 2-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina

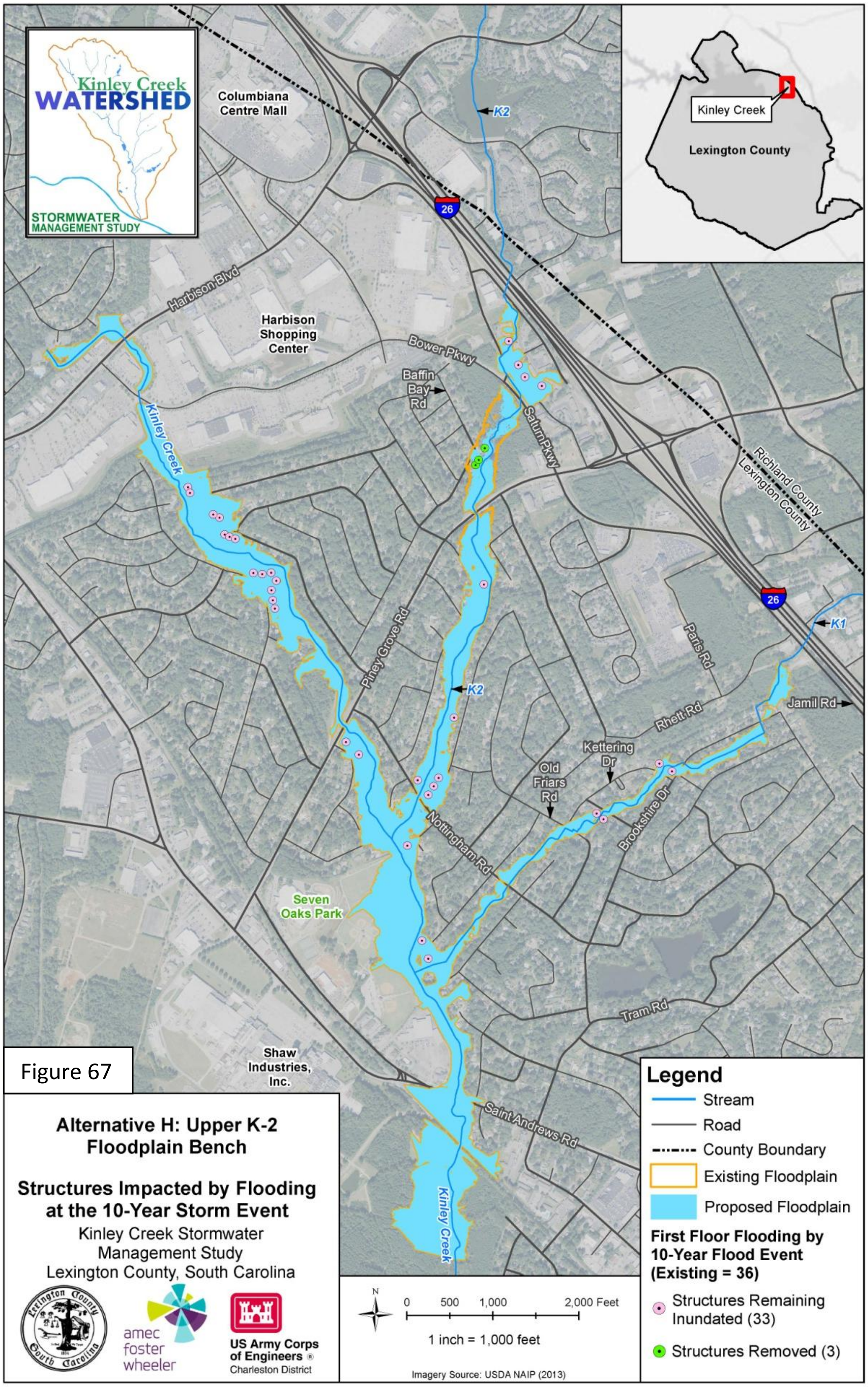
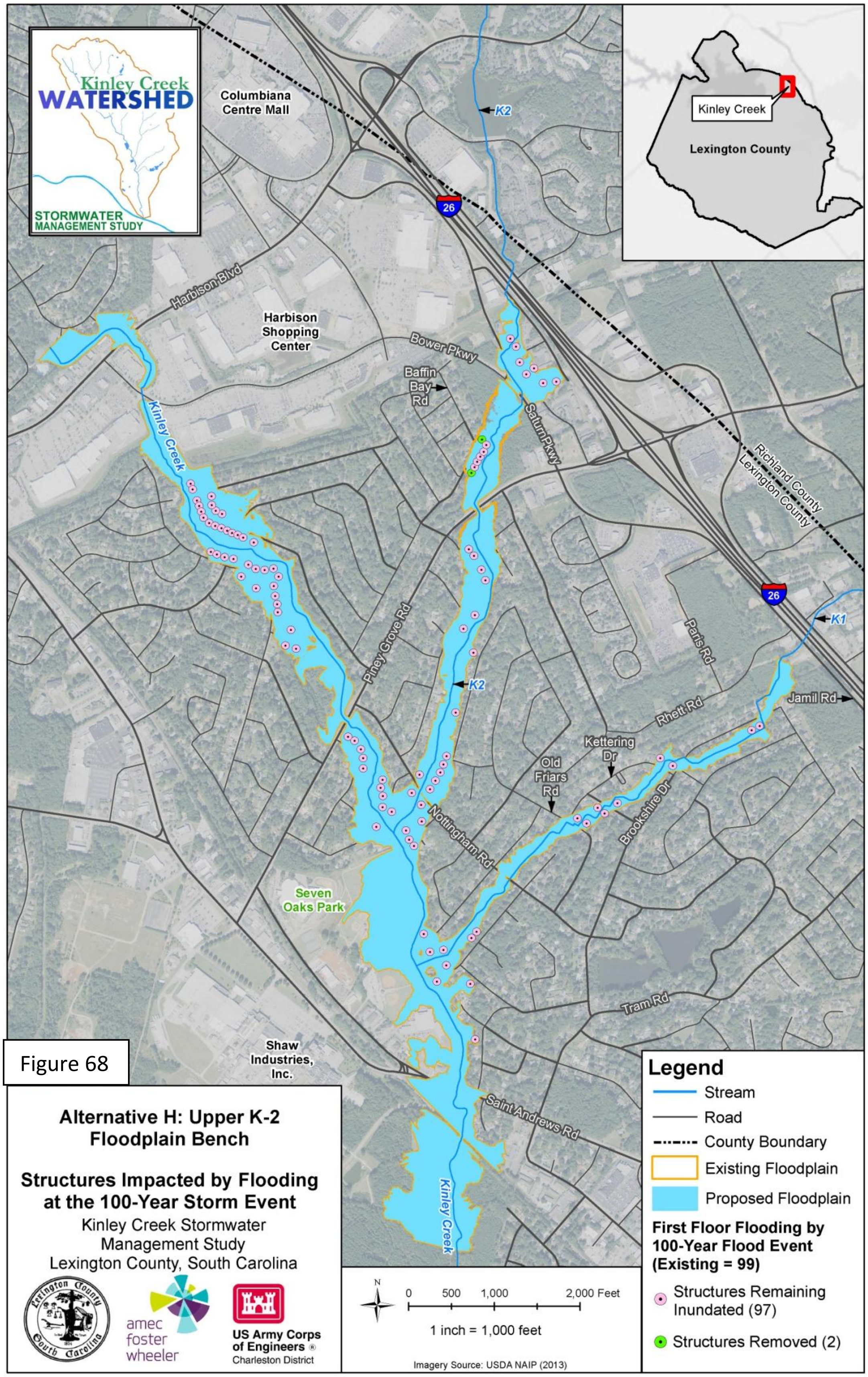



Figure 67

**Alternative H: Upper K-2 Floodplain Bench**

**Structures Impacted by Flooding at the 10-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
K2
26
Kinley Creek
Lexington County
Harbison Blvd
Harbison Shopping Center
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
Richland County
Lexington County
Piney Grove Rd
K2
K1
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 68
Alternative H: Upper K-2 Floodplain Bench
Structures Impacted by Flooding at the 100-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 100-Year Flood Event (Existing = 99)
Structures Remaining Inundated (97)
Structures Removed (2)

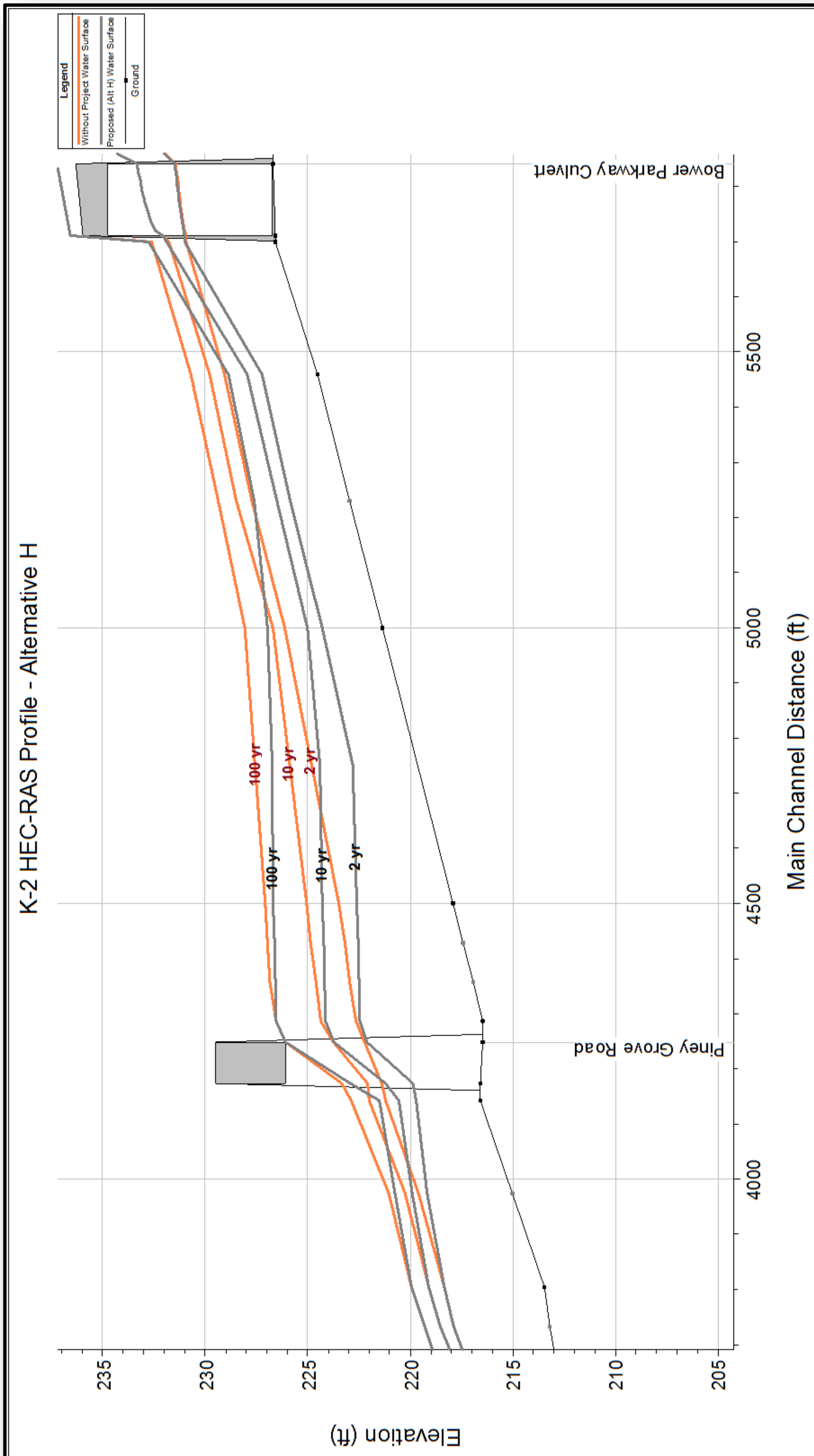



**Figure 69. Water Surface Profile K-2: Alternative H**

## 13.9 Alternative I – Selective Acquisition with Modified Channel, Limited Bridges, and Culverts

**Management Measure(s):** This alternative involves combining physical measures along the three tributaries with the acquisition of structures along the tributaries (Figure 70). The measures include:

**K-1:** Add a 6 foot diameter, 42 foot long culvert to the existing culvert at Nottingham Road and extend the existing headwall. Replace the 4 foot pipe and headwall at Olds Friars Road with two 6 foot by 6 foot, 339 foot long box culverts and 45 degree wing walls. Replace the headwall and pipe at Yarmouth Culvert with two 6 foot by 5 foot, 339 foot long box culverts and 45 degree wing walls. Replace the pipe at Kettering with two 6 foot by 4 foot parallel box culverts. Add 5 foot and 4 foot, 71 foot long culverts next to the existing culvert at Lower Brookshire. Add three, 3 foot diameter concrete culverts next to existing pipe at Upper Brookshire. Channelize a 3756 foot reach of K-1 with a 35 foot wide bench and 2:1 slopes; channelize an additional 2610 foot reach with a 30 foot wide bench and 1.5:1 slopes. Acquire eleven structures identified being too close or in way of channel path.

**K-2:** Remove approximately 400 cubic yards of rip rap at Piney Grove Bridge and 540 cubic yards of soil. Modify Nottingham Road Culvert and increase bridge span by 20 feet. Channelize a 3850 foot reach with a 70 foot wide shelf and 3:1 side slopes, a 1400 foot reach above Pine Grove Road with a 100 foot wide shelf and 4:1 side slopes, interrupted by a 50 foot wide shelf at the Piney Grove Bridge. Acquire twelve structures identified being too close or in way of channel path.

**Kinley Creek:** Construct an 85 foot bench along a 3226 foot reach, sloped, a 75 foot wide bench along a 3689 foot reach, and an 85 foot wide bench along a 4751 foot reach. All side slopes 3:1. Modify Piney Grove Road Bridge to an 83 foot span with abutments not to exceed 4 feet. Acquire sixteen structures identified being too close or in way of channel path.

**Benefits:** This alternative will remove seventy-six structures out of the floodplain. No structures will be vunerable to 2-year storm events and two structures will still be vulnerable to 5-year storm events. (Figures 71-73). Table 13 shows the average drop in water depth during storm events.

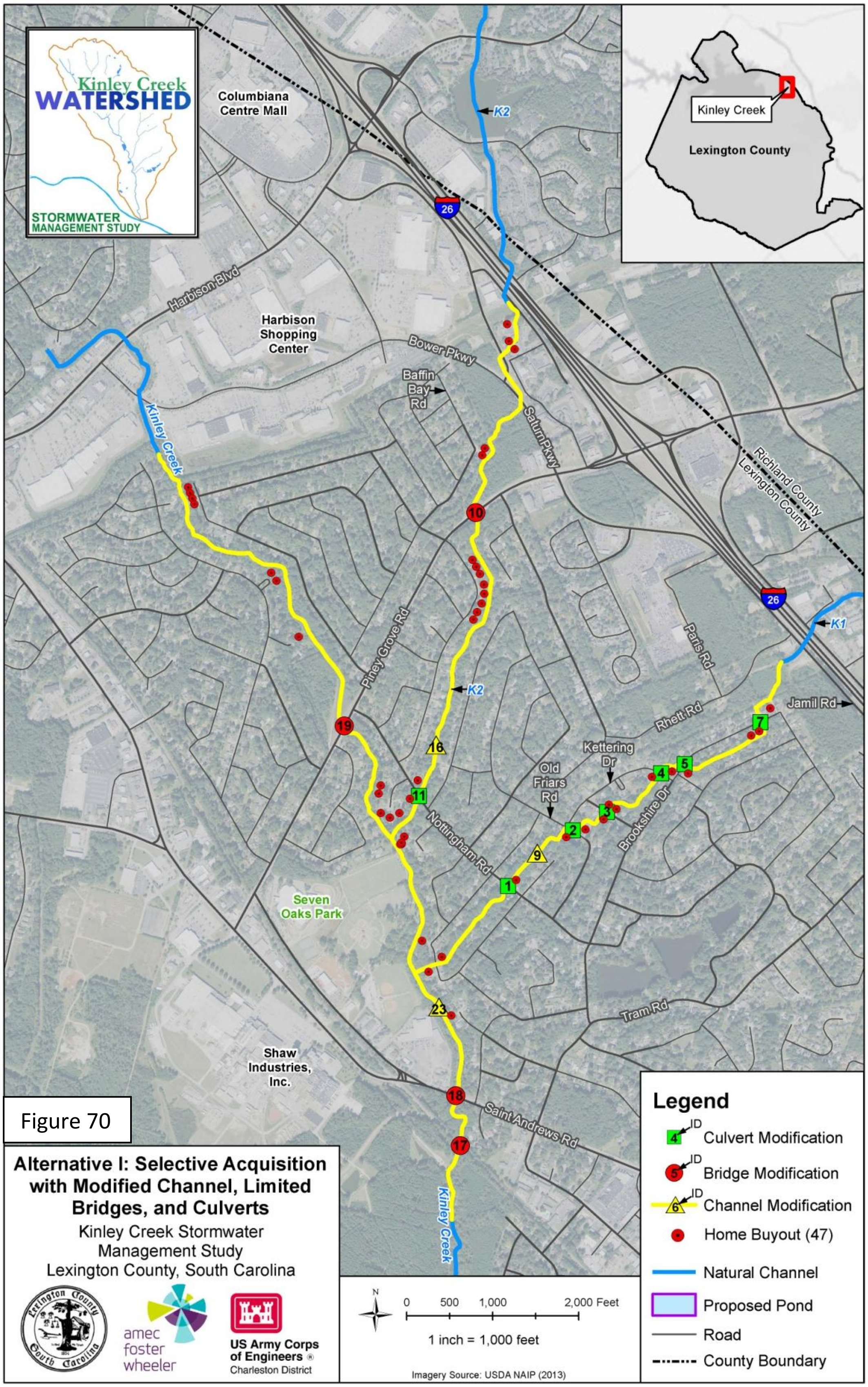
**Table 13. Average Drop in Water Depth as a Function of Storm Events if Alternative I is Implemented**

| Storm Event | Average Drop in Water Depth (ft) |
|---|---|
| 2-YR | 1.88 |
| 5-YR | 2.02 |
| 10-YR | 1.64 |
| 25-YR | 1.40 |
| 50-YR | 1.39 |
| 100-YR | 1.41 |

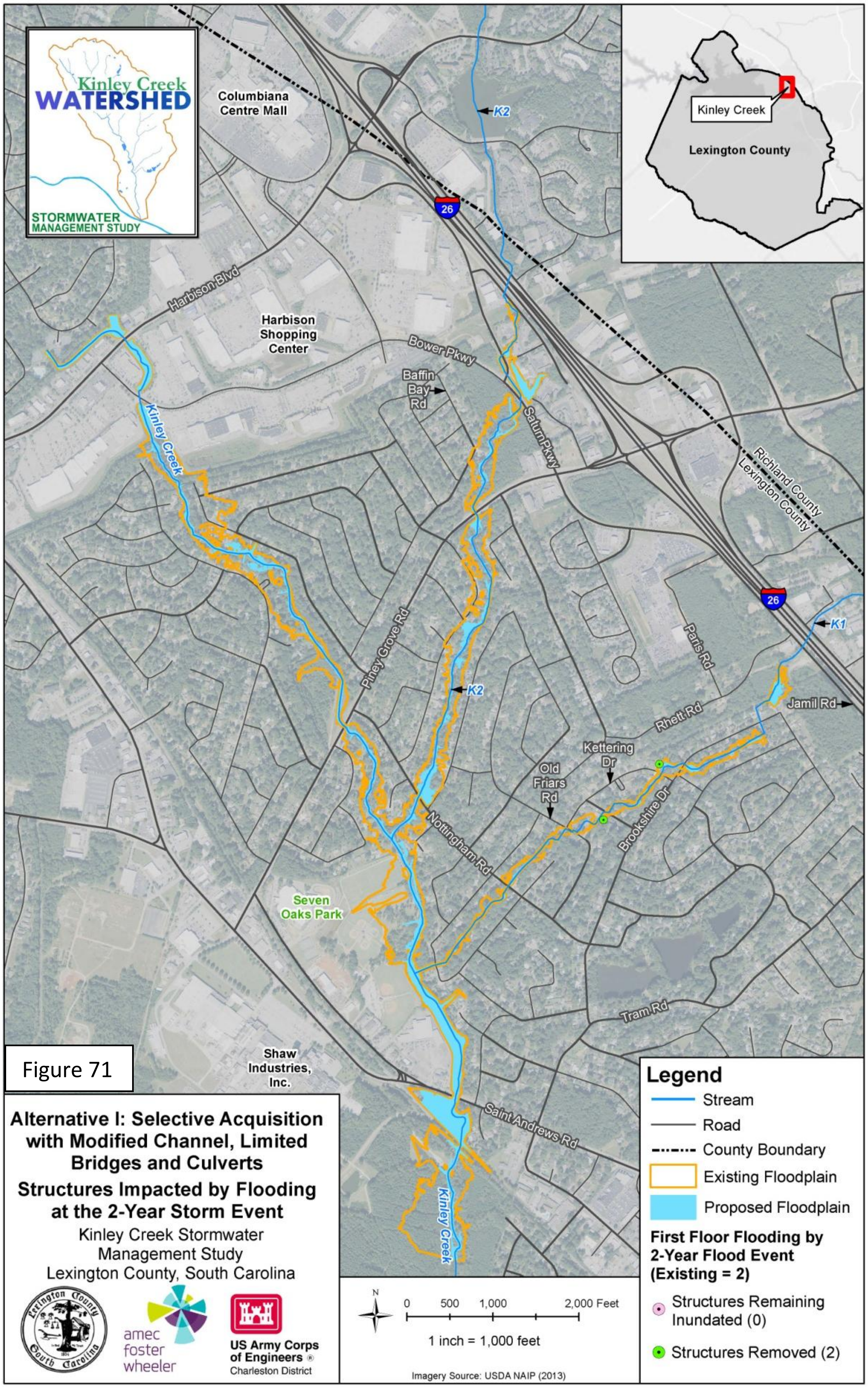
Water levels will be reduced through all three tributaries if this Alternative is implemented.

**Constraints:** Bedrock in channels may complicate construction. Multiple utility lines along work area will have to be either relocated or worked around. Mature tree removal and replacement, in addition to private property easements for construction and maintenance will be necessary. The culvert modification at Upper Brookshire will require the removal of a structure. The Kinley Creek Bridge is a SCDOT bridge, which necessitates their involvement. Other bridges may require coordination with DOT. In addition, this is a permitted structure and any approval for modifications must be obtained from SCDHEC and USACE-Regulatory. Costs of acquiring the structures may be cost prohibitive.

**Cost:** Estimated costs for implementing Alternative I is $21,392,000.



Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
K2
K1
26
Kinley Creek
Lexington County
Richland County
Lexington County
Paris Rd
Jamil Rd
Rhett Rd
Piney Grove Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Kinley Creek
Figure 70
Alternative I: Selective Acquisition with Modified Channel, Limited Bridges, and Culverts
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Culvert Modification
Bridge Modification
Channel Modification
Home Buyout (47)
Natural Channel
Proposed Pond
Road
County Boundary


Kinley Creek
WATERSHED
STORMWATER
MANAGEMENT STUDY
Columbiana
Centre Mall
Kinley Creek
Lexington County
K2
26
Harbison Blvd
Harbison
Shopping
Center
Bower Pkwy
Baffin
Bay
Rd
Saturn Pkwy
Kinley Creek
Richland County
Lexington County
26
K1
Paris Rd
Piney Grove Rd
K2
Jamil Rd
Rhett Rd
Kettering
Dr
Old
Friars
Rd
Brookshire Dr
Nottingham Rd
Seven
Oaks Park
Tram Rd
Shaw
Industries,
Inc.
Saint Andrews Rd
Kinley Creek
Figure 71
Alternative I: Selective Acquisition
with Modified Channel, Limited
Bridges and Culverts
Structures Impacted by Flooding
at the 2-Year Storm Event
Kinley Creek Stormwater
Management Study
Lexington County, South Carolina
amec
foster
wheeler
US Army Corps
of Engineers
Charleston District
N
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by
2-Year Flood Event
(Existing = 2)
Structures Remaining
Inundated (0)
Structures Removed (2)

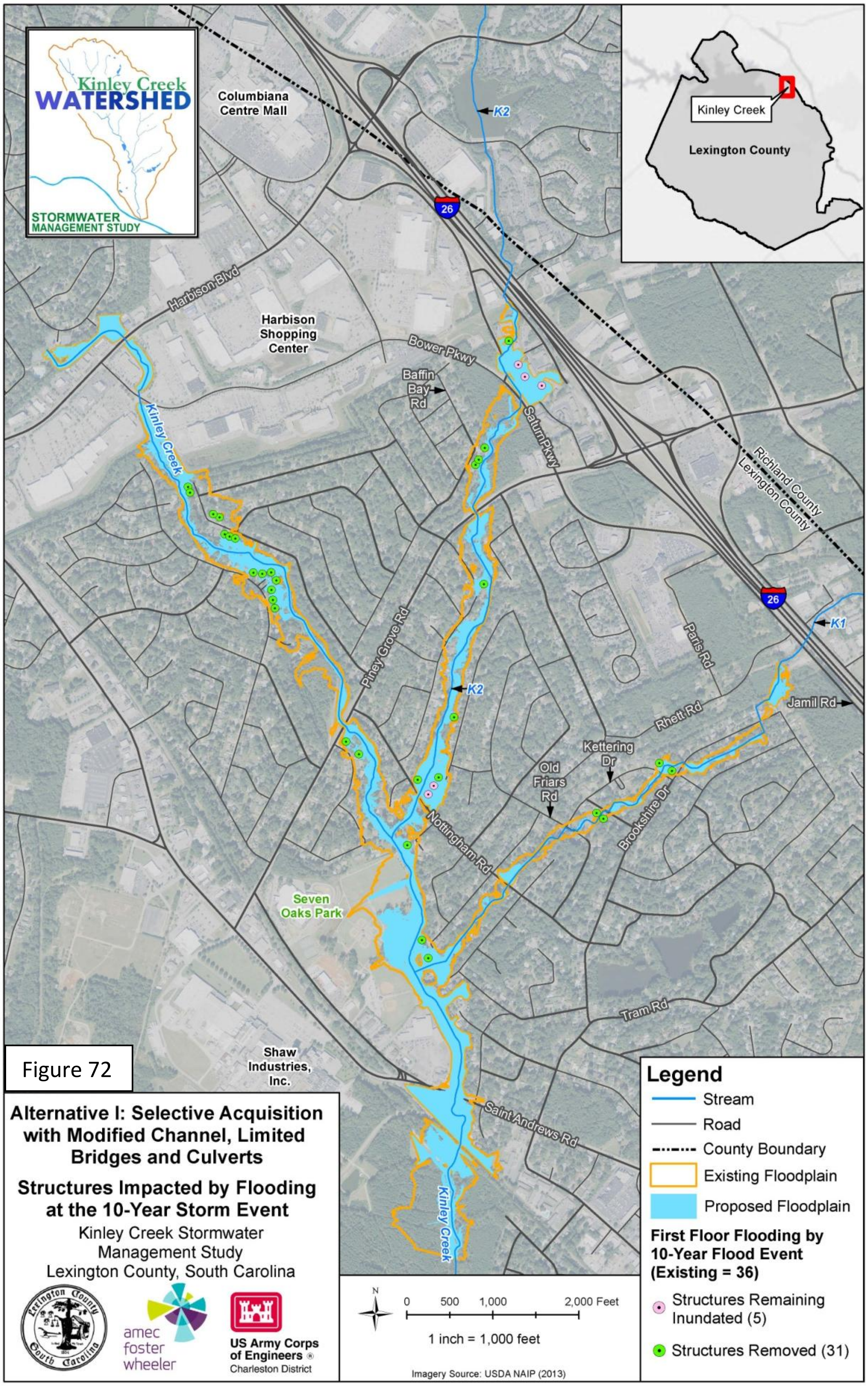
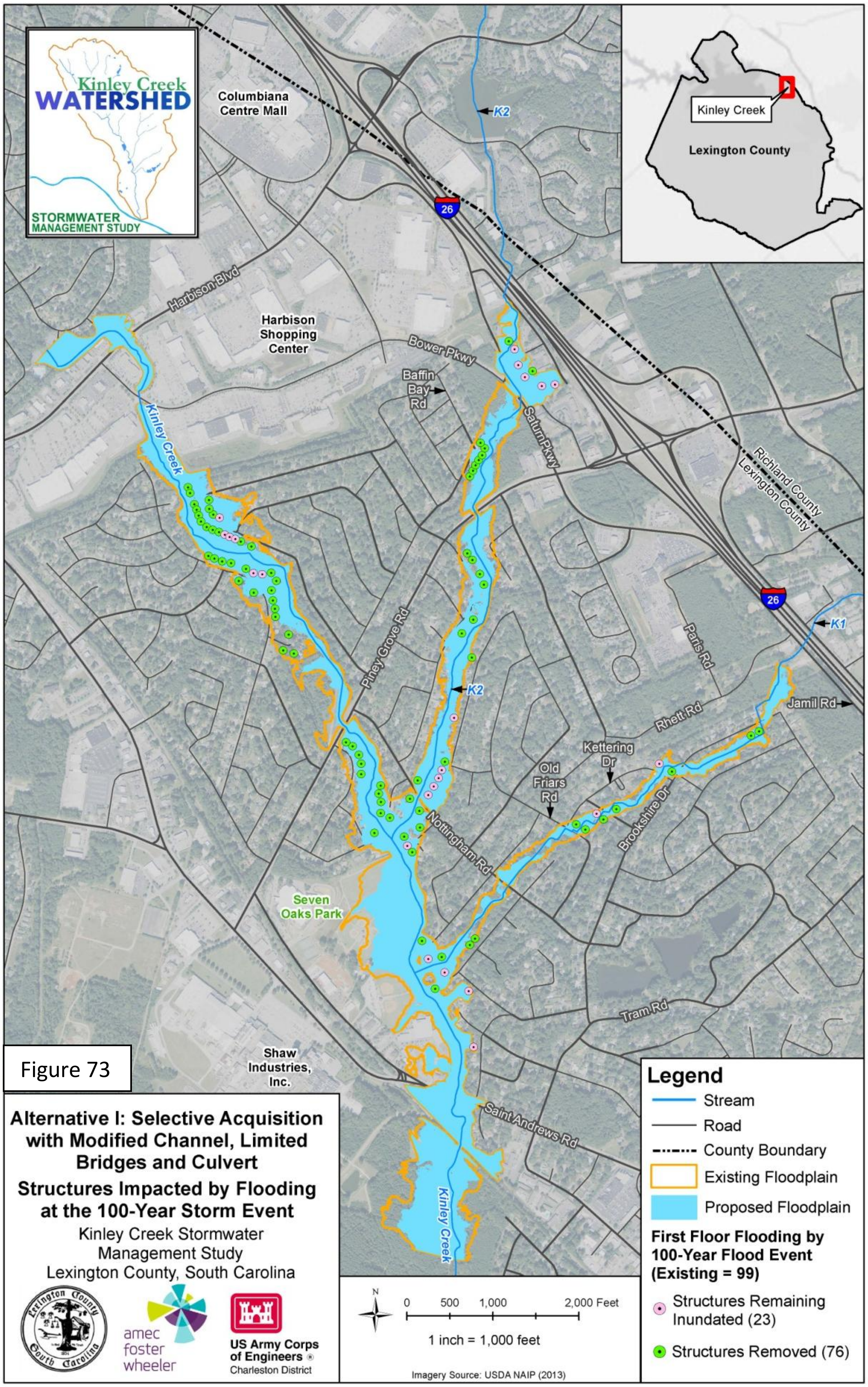



Figure 72

**Alternative I: Selective Acquisition with Modified Channel, Limited Bridges and Culverts**

**Structures Impacted by Flooding at the 10-Year Storm Event**

Kinley Creek Stormwater Management Study
Lexington County, South Carolina


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
K2
K1
26
Richland County
Lexington County
Kinley Creek
Lexington County
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 73
Alternative I: Selective Acquisition with Modified Channel, Limited Bridges and Culvert
Structures Impacted by Flooding at the 100-Year Storm Event
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers ® Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Stream
Road
County Boundary
Existing Floodplain
Proposed Floodplain
First Floor Flooding by 100-Year Flood Event (Existing = 99)
Structures Remaining Inundated (23)
Structures Removed (76)

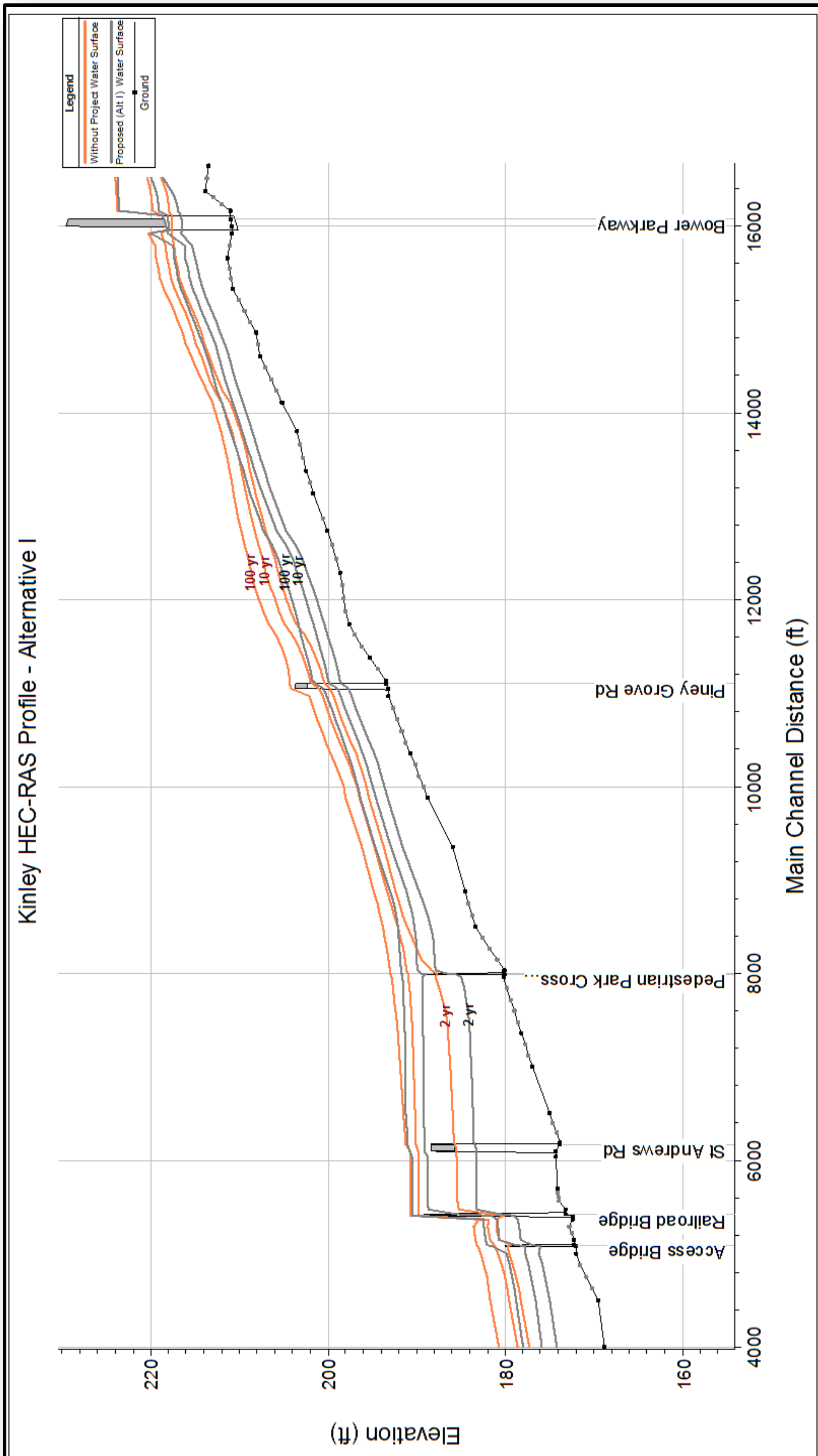



**Figure 74. Water Surface Profile Kinley: Alternative I**

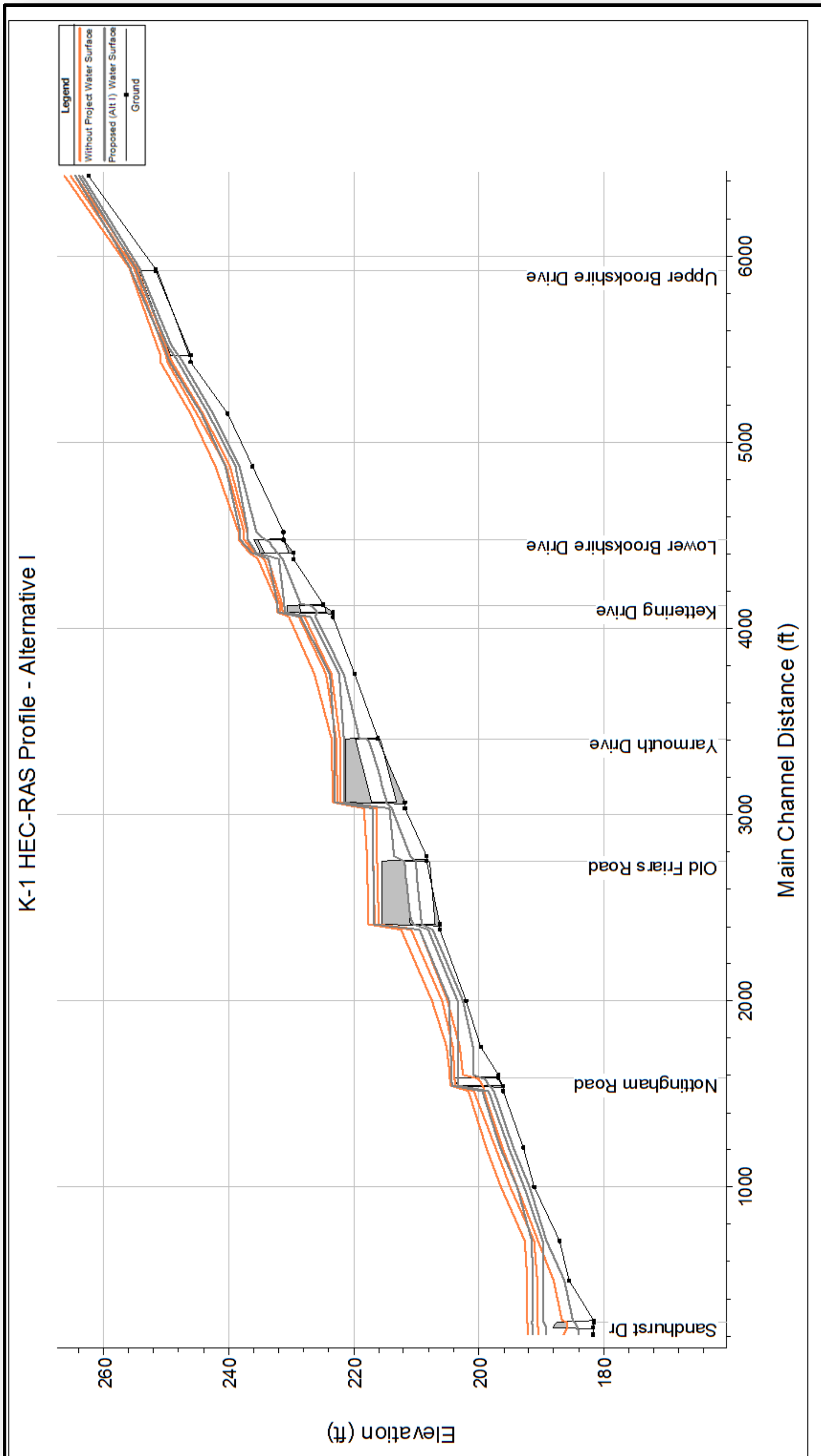



**Figure 75. Water Surface Profile K-1: Alternative I**

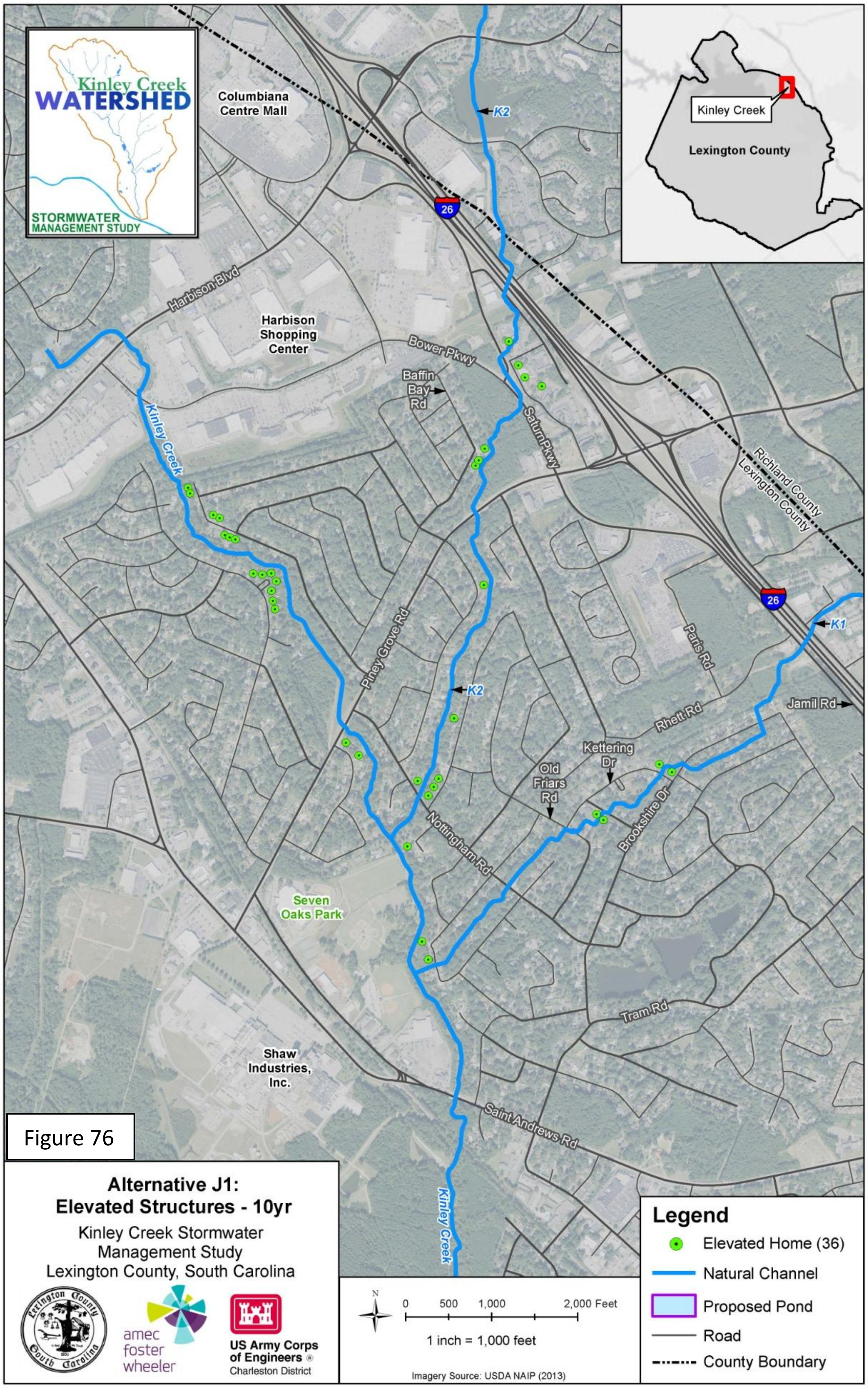
## 13.10 Elevating Existing Structures Out of the 10 Year or 100 Year Floodplain

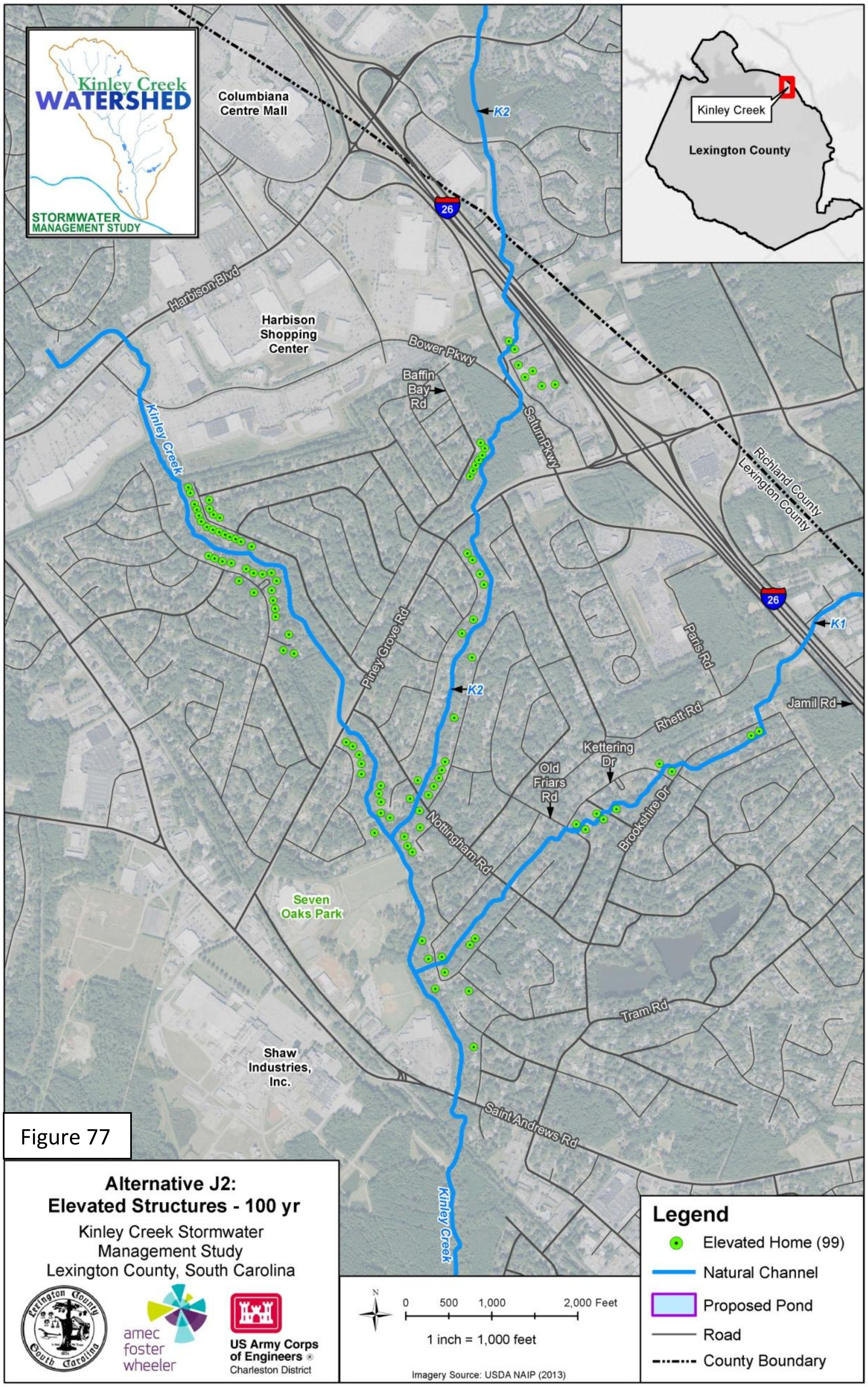
**Management Measure(s):** Physically raising all eligible structures out of either the 10-Year (J1) or the 100-Year (J2) floodplain (Figures 76 and 77).

**Benefits:** Removing structures from flood threats, limiting future damages.

**Constraints:** Reluctant property owners, structures not suitable for elevating.

**Costs:** Elevating all structures out of the 10-Year floodplain will cost $4,068,000. Elevating all structures out of the 100-Year floodplain will cost $11,187,000.


Kinley Creek
WATERSHED
STORMWATER
MANAGEMENT STUDY
Columbiana
Centre Mall
Kinley Creek
Lexington County
Harbison Blvd
Harbison
Shopping
Center
Bower Pkwy
Baffin
Bay
Rd
Saturn Pkwy
Kinley Creek
K2
26
Richland County
Lexington County
K1
Paris Rd
Piney Grove Rd
Jamil Rd
Rhett Rd
Kettering
Dr
Old
Friars
Rd
Brookshire Dr
Nottingham Rd
Seven
Oaks Park
Tram Rd
Shaw
Industries,
Inc.
Saint Andrews Rd
Figure 76
Alternative J1:
Elevated Structures - 10yr
Kinley Creek Stormwater
Management Study
Lexington County, South Carolina
amec
foster
wheeler
US Army Corps
of Engineers
Charleston District
0
500
1,000
2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Elevated Home (36)
Natural Channel
Proposed Pond
Road
County Boundary


Kinley Creek WATERSHED
STORMWATER MANAGEMENT STUDY
Columbiana Centre Mall
Harbison Shopping Center
Harbison Blvd
Bower Pkwy
Baffin Bay Rd
Saturn Pkwy
Kinley Creek
K2
K1
26
Richland County
Lexington County
Kinley Creek
Lexington County
Piney Grove Rd
Paris Rd
Jamil Rd
Rhett Rd
Kettering Dr
Old Friars Rd
Brookshire Dr
Nottingham Rd
Seven Oaks Park
Tram Rd
Shaw Industries, Inc.
Saint Andrews Rd
Figure 77
Alternative J2: Elevated Structures - 100 yr
Kinley Creek Stormwater Management Study
Lexington County, South Carolina
amec foster wheeler
US Army Corps of Engineers
Charleston District
0 500 1,000 2,000 Feet
1 inch = 1,000 feet
Imagery Source: USDA NAIP (2013)
Legend
Elevated Home (99)
Natural Channel
Proposed Pond
Road
County Boundary

## 14. Flood Damage Analysis

Structure footprint and first floor elevation (FFE) data was provided by Lexington County staff, and USACE provided HEC-RAS water surface profile data for each alternative. This data enabled allowed for the comparison of structure elevations to modeled flood elevations (Figure 78). Since it is possible for a structure to fall within a mapped floodplain but remain perched above the flood elevation, FFE data more accurately assessed which structures are likely to be damaged by different storm events. HEC-RAS provided water surface profiles (2-YR, 5-YR, 10-YR, 25-YR, 50-YR, and 100-YR) for eight different alternatives: A, C, D, E, F, G, H, and I. (Alternatives B and J were not assessed for flood damages using this process since neither included any hydrologic or hydraulic modifications). Combining the FFE data with the HEC-RAS results allowed for the evaluation of each alternative's effectiveness. Structural and contents damages to structures within the floodplain of each storm for each alternative were estimated using depth-damage curves.

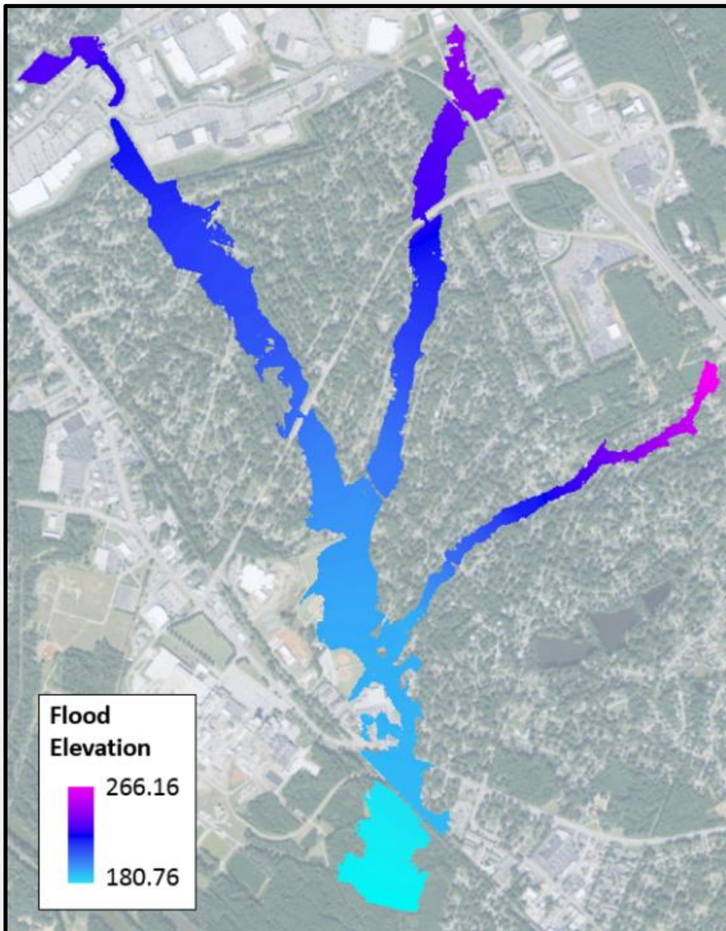



**Figure 78. Water Surface Grid for Alternative A (Without Project), 100-YR Return Interval**

Adjacent flood elevation at each structure was determined by intersecting structure polygon vertices with each water surface grid. Depth of flooding was calculated by subtracting the adjacent flood elevation from the FFE.

To translate flood depths into estimated structural and contents losses ($USD), depth-damage curves were employed Table 14, Figure 79). Structure and contents depth-damage curves (Table 15, Figure 80) were chosen for each structure based on structure type derived from FEMA's Hazus-MH (Version 2.1) defaults. Damage curves for both structure damage and content damage are shown below.

**Table 14. Depth-Damage Curves**

| *Hazus Occupancy ID* | *Description* |
|---|---|
| *R11N* | 1-story residential home, no basement |
| *R3B1N* | 1 to 2-story apartment building, at-grade |
| *C1LN* | Average retail building, at-grade, low rise |
| *C3LN* | Average personal & repair services (i.e. garage), at-grade, low rise |

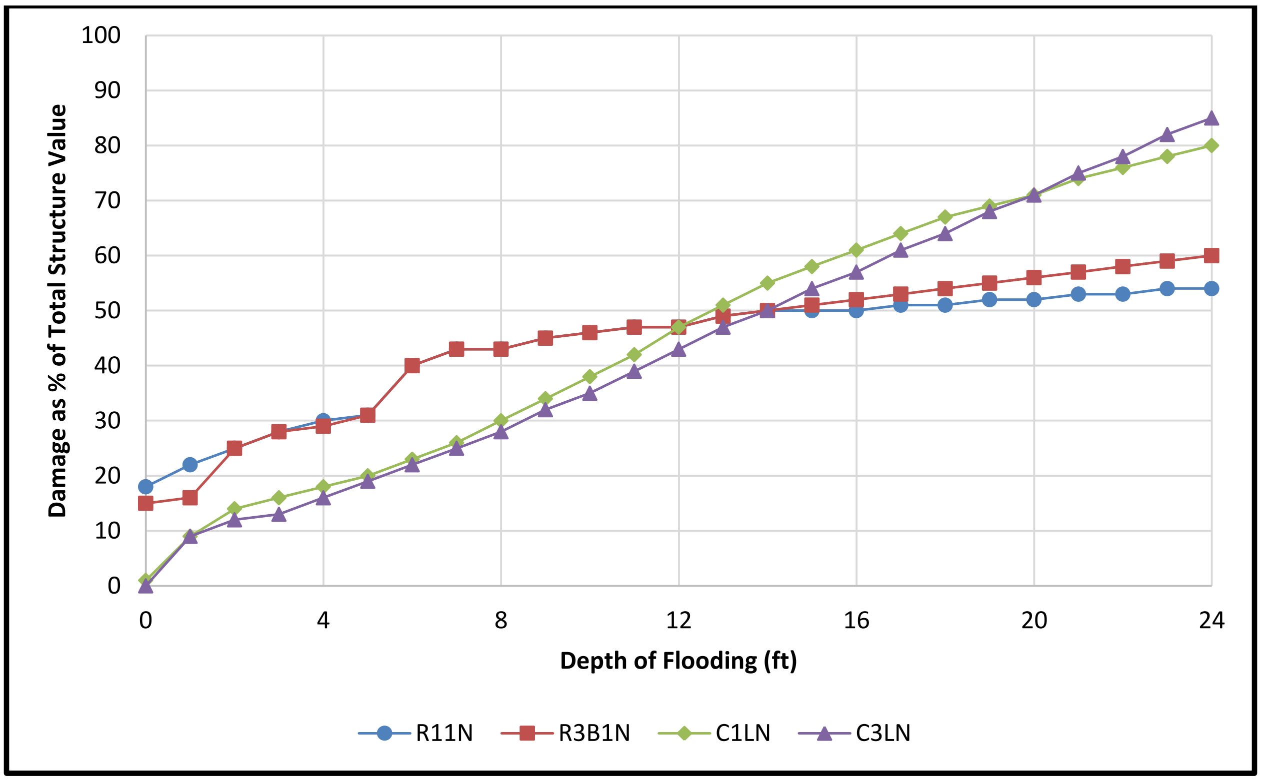



**Figure 79. Structure Depth-Damage Curves**

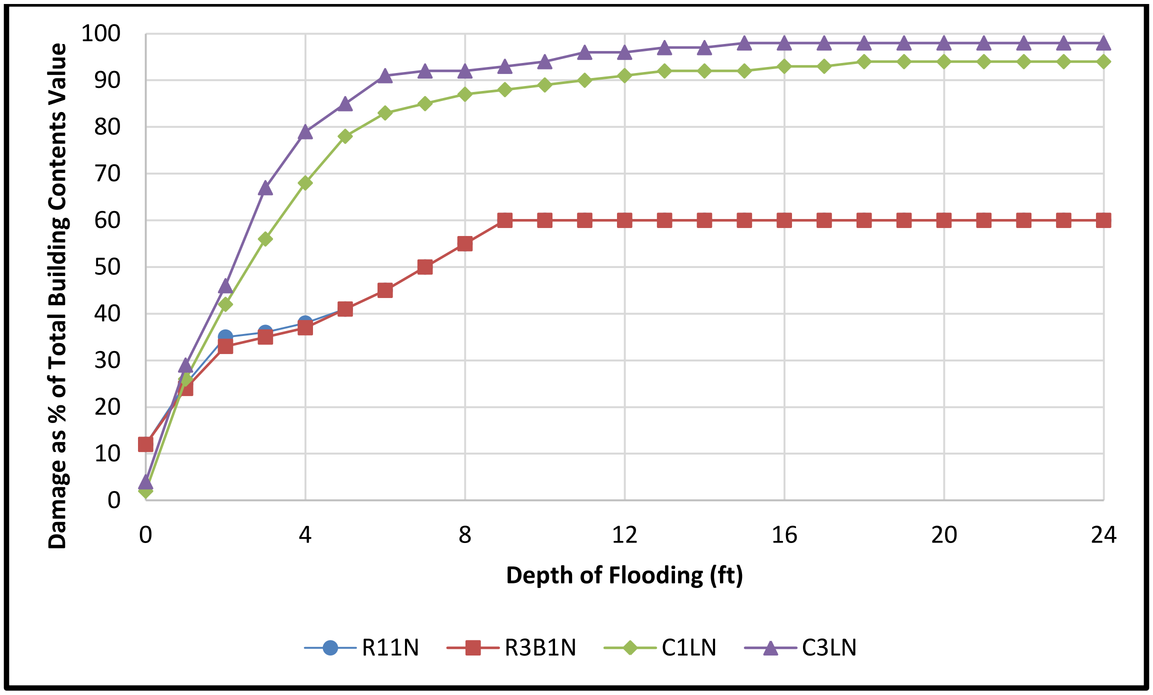



**Figure 80. Structure Contents Depth-Damage Curves**

All structures were assumed to be constructed on crawlspaces or slab foundations without basements. Single-family structures were assumed to be single-story structures; modeled flood depths did not rise above 3.25 feet above the FFE for any given structure. Assessed structure values were taken from Lexington County's parcel geodatabase. Structure contents values were derived from structure values as provided in FEMA's Hazus-MH (Version 2.1) documentation (Table 15).

**Table 15. Ratios Used to Estimate Structure Contents Values**

| ***Occupancy Class*** | ***Contents Value as % of Structure Value*** |
|---|---|
| *Single Family Dwelling (RES1)* | 50 % |
| *Multi Family Dwelling (RES3)* | 50 % |
| *Retail Trade (COM1)* | 100 % |
| *Personal and Repair Services (COM3)* | 100 % |

For a given structure, the total structure (Struct.) and contents (Cont.) losses can be calculated with the following equation:

$$Loss\ (\$) = [Struct.Value\ (\$) \times Struct.Damage\ (\%)] + [Cont.Value\ (\$) \times Cont.Damage\ (\%)]$$

Python functions to calculate flood-related losses for structures adjacent to K-1, K-2, and Kinley Creek for the aforementioned 48 different combinations of alternatives and storm events. Average annualized losses were calculated based on the combined damages and probabilities of the modeled storm events (Table 16). The following equation was used to calculate average annualized losses:

$$AAL\ (\$) = \left[(p_2 - p_5) * \frac{L_2 + L_5}{2}\right] + \left[(p_5 - p_{10}) * \frac{L_5 + L_{10}}{2}\right] + \left[(p_{10} - p_{25}) * \frac{L_{10} + L_{25}}{2}\right] + \left[(p_{25} - p_{50}) * \frac{L_{25} + L_{50}}{2}\right] + \left[(p_{50} - p_{100}) * \frac{L_{50} + L_{100}}{2}\right] + p_{100} * L_{100}$$

Where:

$p_n$ = Annual exceedence probability associated with an *n*-year storm event; $p_n = 1/n$

$L_n$ = Estimated losses ($) associated with *n*-year storm event

Table 17 below summarizes total loss estimates for each alternative modeled in HEC-RAS by USACE, for each modeled storm event and for the Average Annualized Loss (AAL), the average cost per year of cumulative storm damages. Red cells indicate higher total losses and green cells indicate lower total losses.

**Table 16. Total Estimated Structure Losses (Structural and Contents), $USD**

| Alt. | 2-YR | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR | AAL |
|---|---|---|---|---|---|---|---|
| A | $ 80,886 | $ 529,692 | $ 1,094,561 | $ 2,072,753 | $ 2,947,064 | $ 3,583,639 | $ 386,507 |
| B-1 | $ - | $ - | $ - | $ 798,725 | $ 1,563,313 | $ 2,093,320 | $ 86,798 |
| B-2 | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| C | $ 80,886 | $ 503,429 | $ 975,757 | $ 1,695,662 | $ 2,341,853 | $ 2,990,919 | $ 338,697 |
| D | $ - | $ 49,417 | $ 145,975 | $ 433,580 | $ 855,609 | $ 1,252,734 | $ 70,530 |
| E | $ 80,716 | $ 307,832 | $ 1,017,985 | $ 1,916,122 | $ 2,711,729 | $ 3,313,699 | $ 322,139 |
| F | $ - | $ 48,500 | $ 145,408 | $ 530,571 | $ 901,798 | $ 1,450,650 | $ 77,842 |
| G | $ - | $ 48,500 | $ 145,675 | $ 732,156 | $ 1,169,079 | $ 1,813,175 | $ 95,374 |
| H | $ 80,886 | $ 507,011 | $ 1,046,138 | $ 2,000,220 | $ 2,848,431 | $ 3,515,886 | $ 372,700 |
| I | $ - | $ 48,282 | $ 196,957 | $ 355,735 | $ 575,755 | $ 844,612 | $ 60,948 |

[1] Alternative A represents existing or “without project” conditions.

[2] Alternative H only includes modifications to upper K-2 but for comparison, this table includes the damages due to Kinley, K-1 and K-2 combined.

**Table 17. Estimated Reductions in Structure Losses Compared to “Without Project” Alternative A**

| Alt. | 2-YR | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR | AAL |
|---|---|---|---|---|---|---|---|
| B-1 | 100.0% | 100.0% | 100.0% | 61.5% | 47.0% | 41.6% | 77.5% |
| B-2 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| C | 0.0% | 5.0% | 10.9% | 18.2% | 20.5% | 16.5% | 12.4% |
| D | 100.0% | 90.7% | 86.7% | 79.1% | 71.0% | 65.0% | 81.8% |
| E | 0.2% | 41.9% | 7.0% | 7.6% | 8.0% | 7.5% | 16.7% |
| F | 100.0% | 90.8% | 86.7% | 74.4% | 69.4% | 59.5% | 79.9% |
| G | 100.0% | 90.8% | 86.7% | 64.7% | 60.3% | 49.4% | 75.3% |
| H | 0.0% | 4.3% | 4.4% | 3.5% | 3.3% | 1.9% | 3.6% |
| I | 100.0% | 90.9% | 82.0% | 82.8% | 80.5% | 76.4% | 84.2% |

Alternatives D, F, G, and I were found to reduce estimated average annual losses most significantly ( > 75%) with respect to the “without project” scenario (alternative A), while alternatives C, E, and H reduced average annual losses only slightly (3.6% to 16.7%). Estimated damages caused by more frequent 2-year storms were entirely eliminated in alternatives D, F, G, and I, but remained almost completely unchanged in alternatives C, E, and H. Alternatives D, F, G, and I showed especially large reductions in estimated damages for larger storm events, with Alternative I reducing estimated 100-year damages by 76.4%.

The full economic impacts of flooding within the watershed may be higher than the estimates presented in Table 16. This flood damage analysis considered structural and contents damages to structures adjacent to K-1, K-2, and Kinley Creek in order to draw comparisons between proposed alternatives. Other potential impacts not analyzed in this report include loss of personal income or business revenue, as well as damages to utilities or transportation infrastructure.

A detailed set of results, summarized by stream segments, is provided in Appendix F.

## 15. Costs

Due to the size and variance of problems in the Project Area, the management measures could be combined to form various Alternatives that could be applied to specific stream reaches to determine flood reduction. Costs are presented for both the individual management measures (Table 18) and for each alternative (Table 19).

A detailed cost analysis is found in Appendix G.

## Table 18. Costs for Individual Management Measures Analyzed

| Reach | Measure | Description | Associated Alternative | Cost |
|---|---|---|---|---|
| K-1 | Nottingham Road Culvert Modification | Install 6ft diameter pipe culvert parallel to existing 7ft pipe culvert (length=42ft), and extend headwall | D,F,G,I | $101,000 |
| K-1 | Old Friars Road Culvert Modification | Replace single 4ft diameter concrete and brick culvert (length=339ft) and headwall with two (6ftx6ft) box culverts and 45 degree wing walls | D,F,G,I | $1,258,000 |
| K-1 | Yarmouth Culvert Modification | Replace single 4ft corrugated metal pipe culvert (length=339ft) and headwall with two (6ftx5ft) box culverts and 45 degree wing walls | D,F,G,I | $1,145,000 |
| K-1 | Kettering Culvert Modification | Replace single 4ft concrete pipe culvert (length=38ft) and headwall with two box culverts (6ftx4ft) and 45 degree wing walls | D,F,G,I | $149,000 |
| K-1 | Lower Brookshire Culvert Modification | Install each a 5ft diameter and 4ft diameter concrete pipe culvert parallel to existing 4ft corrugated metal pipe culvert (length=71ft) | D,F,G,I | $235,000 |
| K-1 | K-1 Offline Pond at Jamil Rd | Construct 1.6 acre offline pond west of Jamil Road with a 100ft long lateral inlet weir and 75ft emergency spillway with outlet orifices. | D,E | $351,000 |
| K-1 | Upper Brookshire Culvert Modification | Install three 3ft diameter concrete pipe culverts parallel to existing 3ft corrugated metal | I | $635,000 |
| K-1 | Modified Channel | Modify channel to create 20ft bottom width high flow channel (length=4000ft) with 2:1 side slopes, and a 15ft bottom width high flow channel (length=2500ft) upstream with 1.5:1 side slopes | D,F,G | $1,985,000 |
| K-1 | Modified Channel | Modify channel to create 35ft bottom width high flow channel (length=3756ft) with 3:1 side slopes, and a 30ft bottom width high flow channel upstream (length=2640ft) with 2:1 side slopes | I | 2,240,000 |
| K-2 | Piney Grove Road Bridge Modification | Modify bridge abutments by removing majority of existing rip rap and grouting the remainder, and channel widened for smooth transition with bridge abutments | D,F,G,I | $125,000 |
| K-2 | Nottingham Road Culvert Modification | Bridge span widened by 20ft, with pier added to center and channel modified for smooth transition to bridge | D,F,G,I | $1,097,000 |
| K-2 | K-2 Inline Pond at Bower Pkwy | Construct 7.9 acre inline pond south of Bower Parkway, with 100ft long emergency spillway and outlet orifices | D,E | $3,905,000 |
| K-2 | Upper K-2 Bench | Modify channel to create 100ft bottom width floodplain bench (length=700ft) transitioning to a 50ft bottom width (length=700ft) on upper K-2 left bank | H | $796,000 |
| K-2 | Modified Channel Downstream of Nottingham Road | Modify channel to create 60ft bottom width high flow channel (length=600ft) with 2:1 side slopes | C | $318,000 |
| K-2 | Modified Channel | Modify channel to create 60ft bottom width high flow channel (length=600ft) with 2:1 side slopes and 40ft bottom width (length=3757ft) and 35ft bottom width (length=2790ft) | D,F,G | $3,193,000 |
| K-2 | Modified Channel | Modify channel to create 70ft bottom width high flow channel (length=3850ft) with 3:1 side slopes, 100ft bottom width high flow channel (length=1400ft) with 4:1 side slope, 50ft bottom width high flow channel (length=150ft) with 4:1 side slopes at Piney Grove Rd, and 70ft bottom width high flow channel (length=1800ft) with 3:1 side slopes | I | 3,735,000 |
| Kinley | Railroad Bridge Modification | Bridge span widened from 22ft to 57ft and two piers added | D,F,I | $1,638,000 |

## Table 18. Costs for Individual Management Measures Analyzed (Continued)

| Reach | Measure | Description | Associated Alternative | Cost |
|---|---|---|---|---|
| Kinley | St. Andrews Bridge Modification | Bridge span widened from 86ft to 112ft and one additional pier added | D,F,I | $906,000 |
| Kinley | Piney Grove Road Bridge Modification | Shallow sloping abutments replaced with steep abutments | C,D,F,G | $922,000 |
| Kinley | Modified Channel around K-2 Confluence | Modify channel to create 60ft bottom width high flow channel (length=3000ft) with 2:1 side slopes | C | $ 1,756,000 |
| Kinley | Modified Channel | Modify channel to create 40ft bottom width high flow channel (length=3400ft) with 2:1 side slopes, and 60ft bottom width high flow channel (length=7400ft) downstream with 2:1 side slopes | D,F | $5,775,000 |
| Kinley | Modified Channel | Modify channel to create 30ft bottom width high flow channel (length=2988ft), then 60ft bottom width high flow channel (=7400ft length) downstream | G | $5,419,000 |
| Kinley | Modified Channel | Modify channel to create 85ft bottom width high flow channel (length=3226ft) with 3:1 side slopes, 75ft bottom width (length=3689ft) with 3:1 side slopes, and 85ft bottom width (length=4751ft) with 3:1 side slopes | I | $ 8,978,000 |
| All | Acquisition - Alt I | Acquire selected structures on K-1, K-2, and Kinley to modify channel through parcels | I | $260,000/Structure |
| All | Acquisition - 10 YR | Acquire structures with first floor elevation below the 10-YR flood water surface elevation | B | $260,000/Structure |
| All | Acquisition - 100 YR | Acquire structures with first floor elevation below the 100-YR flood water surface elevation | B | $260,000/Structure |
| All | Elevate Structures - 10 YR | Elevate structures with first floor elevation below the 10-YR flood water surface elevation | J | $113,000/Structure |
| All | Elevate Structures - 100 YR | Elevate structures with first floor elevation below the 100-YR flood water surface elevation | J | $113,000/Structure |

**Table 19. Estimated Costs of Alternatives Evaluated**

| Alternative | Description | Measures | Cost |
|---|---|---|---|
| A | Without Project | N/A | N/A |
| B1 | Acquisition - 10 YR | K-1-H, K-2-J, Main-I | $9,000,000 |
| B2 | Acquisition - 100 YR | K-1-H, K-2-J, Main-I | $24,750,000 |
| C | Partially Modified Channel – Kinley Creek/K-2 | | $2,996,000 |
| D | Modified Channel, Bridges, Culverts, and New Ponds | K-1-A, K-1-B, K-1-C, K-1-D, K-1-E, K-1-F, K-1-G, K-2-A, K-2-B, K-2 C, K-2-E, Main-B, Main-C, Main-D, Main-E | $22,758,000 |
| E | K-1 and K-2 New Ponds | K-1-F, K-2-E | $4,256,000 |
| F | Modified Channels, Bridges, and Culverts | K-1-A, K-1-B, K-1-C, K-1-D, K-1-E, K-1-G, K-2-A, K-2-B, K-2-C, Main-B, Main-C, Main-D, Main-E | $18,529,000 |
| G | Modified Channels, Limited Bridges, and Culverts | K-1-A, K-1-B, K-1-C, K-1-D, K-1-E, K-1-G, K-2-A, K-2-B, K-2-C, Main-M, Main-E | $15,629,000 |
| H | Upper K-2 Floodplain Bench | K-2-K | $796,000 |
| I | Selective Acquisition with Modified Channel, Limited Bridges, and Culverts | K-1-A, K-1-B, K-1-C, K-1-D, K-1-E, K-1-G, K-1-H, K-1-J, K-2-A, K-2-B, K-2-C, K-2-J, Main-B, Main-E, Main-I | $21,392000 |
| J1 | Elevate Structure – 10 YR | Elevate | $4,068,000 |
| J2 | Elevate Structures- 100 YR | Elevate | $11,187,000 |

## 16. Alternative Comparisons and Recommended Plan

Tables 20 and 21 below summarize the modeling results, showing drops in water elevations and structures removed. The bolded numbers show the greatest impacts for each storm event.

**Table 20. Average Drop in Surface Water Elevation (ft.) for Modeled Alternatives**

| Storm Event | C | D | F | G | H | I |
|---|---|---|---|---|---|---|
| **2-YR** | 1.66 | **1.88** | 1.71 | 1.60 | 1.06 | **1.88** |
| **5-YR** | 1.56 | 2.01 | 1.88 | 1.47 | 1.03 | **2.02** |
| **10-YR** | 1.43 | **1.91** | 1.80 | 1.24 | 1.03 | 1.64 |
| **25-YR** | 1.49 | **1.62** | 1.57 | 1.08 | 1.03 | 1.40 |
| **50-YR** | 1.38 | **1.59** | 1.52 | 1.02 | 1.00 | 1.39 |
| **100-YR** | 1.30 | 1.28 | 1.25 | 0.97 | 0.91 | **1.41** |

**Table 21. Structures Removed from Floodplain by Alternative**

| Storm Event | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| **2-YR** | - | - | **2** | 2 | 2 | 2 | 0 | **2** | **-** |
| **10-YR** | **36** | 4 | **32** | 3 | 32 | 32 | 3 | 31 | **36** |
| **100-YR** | **99** | 13 | 60 | 9 | 53 | 41 | 2 | **76** | **99** |

The modeling results showed that implementing Alternatives D and I will have the greatest drop overall surface water elevation for all the modeled storm events. These alternatives also show the greatest number of structures protected of any of the modeled alternatives. Raising or purchasing the structures within the 10-year or 100-year floodplain would remove them all from future damages; however, it would not address the flooding situation, and may leave properties isolated during flood events.

**Table 22. Cost/Benefit Comparison of Alternatives**

| | Description | Annual Damages | Project Cost | B:C Ratio |
|---|---|---|---|---|
| A | Without Project | $ 386,507 | N/A | N/A |
| B-1 | Acquisition - 10 YR | $ 86,798 | $ 9,000,000 | 0.67 |
| B-2 | Acquisition - 100 YR | $ - | **$ 24,750,000** | 0.31 |
| C | Partially Modified Channel – Kinley/K-2 | $ 338,697 | $ 2,996,000 | 0.32 |
| D | Modified Channel, Bridges, Culverts, and New Ponds | $ 70,530 | $ 22,785,000 | 0.28 |
| E | K-1 and K-2 New Ponds | $ 322,139 | $ 4,256,000 | 0.30 |
| F | Modified Channels, Bridges, and Culverts | $ 77,842 | $ 18,529,000 | 0.33 |
| G | Modified Channels, Limited Bridges, and Culverts | $ 95,374 | $ 15,629,000 | 0.37 |
| H | Upper K-2 Floodplain Bench | $ 372,700 | $ 796,000 | 0.35 |
| I | Selective Acquisition with Modified Channel, Limited Bridges, and Culverts | $ 60,948 | $ 21,392,000 | 0.30 |
| J-1 | Elevate Structures 10 YR | $ 86,798 | $ 4,068,000 | **1.47** |
| J-2 | Elevate Structures 100 YR | $ - | $ 11,187,000 | 0.69 |

Out of the alternatives analyzed, the most benefits are gained compared to cost through elevation of the structures with first floors below the 10-YR flood inundation area, Alternative J-1 (Table 22). For many structures, however, flooding and erosion would continue to be a problem as this alternative alone has no impact on the surface water elevation for any of the tributaries in the project area. It is recommended that the structures below the estimated water surface elevation of the 10-YR storm only be elevated when access would not be restricted to the property and where flow through the property would not endanger people or cut-off emergency access. This is a strong alternative for structures that face away from the creek and sit in between the creek and the access road which runs parallel to the creek.

Benefit-Cost (B/C) ratios determined for the proposed alternatives make apparent the non-linearity of damage in each storm event due to the variation in first floor elevations and topography throughout the watershed. Since structures outside the 10-YR floodplain are affected infrequently by flooding, mitigation measures are rarely cost-effective when compared to the benefits gained. An example of how the nonlinearity complicates analyses can be seen by comparing Alternatives D, F and G (Table 23). Alternatives D and F encompassed all of the measures included in Alternative G and then some, and yet all three alternatives are expected to remove the same number of structures from the 10-YR floodplain. Damages vary for the structures remaining in the floodplain due to the variation in water surface resulting from the different management measures. In the 100-YR flooding, the management measures included in Alternatives D and F prevent additional structure damage, made obvious through additional structures removed entirely from the floodplain. The B/C ratios are higher for alternatives that achieve greater 10-YR flood risk benefits than 100-YR flood risk benefits and as such, could be prioritized for quicker completion.

Piney Grove Road was modified in the early 2000's along Kinley Creek. While the bridge can currently pass a 25-YR flood, the channel's carrying capacity is less than a 2-YR flood. Although the alternatives analyzed in this study included channel modifications in conjunction with bridges and culverts, the channel modification measure along Kinley Creek downstream of Piney Grove Road is highly effective, even if implemented as a standalone measure. Repetitive loss claims have been made downstream of Piney Grove Road and the parcels are slightly larger than in other areas of the watershed. For these reasons, it is suggested that channel modifications be considered downstream of Piney Grove Road to accommodate the flows passing through the upgraded bridge. Alternative C captured modifications through the reach downstream of Piney Grove Road, but also included modifications to the Piney Grove Road Bridge which were costly for the benefits achieved. The channel modification measure considered in Alternative C along Kinley only, is expected to have nearly doubled the B/C ratio of Alternative C as a whole. Further limiting the channel modifications to the areas of particular flooding issues on mid- and upper-Kinley, could potentially increase the B/C ratio further.

The K-1 pond is one of the least costly measures and has a B/C ratio of approximately 0.8 when analyzed independent of the K-2 pond (as both ponds were modeled concurrently for Alternative E). If acquisition is not a feasible alternative for K-1 flooding problems, the County may prefer to install the K-1 pond, although the pond has limited benefits and as an individual measure, damages would continue to occur for multiple structures along K-1.

**Table 23. Summary Comparison of all Alternatives**

| Alternatives | Storm Event | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| Drop in Water Elevation (ft.) | 2-Year | - | 1.66 | **1.88** | - | 1.71 | 1.60 | **1.88** | **1.88** | - |
| | 5-Year | - | 1.56 | 2.01 | - | 1.88 | 1.47 | **2.02** | **2.02** | - |
| | 10-Year | - | 1.43 | **1.91** | - | 1.80 | 1.24 | 1.64 | 1.64 | - |
| | 25-Year | - | 1.49 | **1.62** | - | 1.57 | 1.08 | 1.40 | 1.40 | - |
| | 50-Year | - | 1.38 | **1.59** | - | 1.52 | 1.02 | 1.39 | 1.39 | - |
| | 100-Year | - | 1.30 | 1.28 | - | 1.25 | 0.97 | 0.91 | **1.41** | - |
| Structures Removed from Floodplain | 2-Year | - | 0 | 2 | 0 | 2 | 2 | 0 | 2 | - |
| | 10-Year | **36** | 4 | 32 | 3 | 32 | 32 | 3 | 31 | **36** |
| | 100-Year | **99** | 13 | 60 | 9 | 41 | 60 | 2 | 76 | **99** |
| Costs ($) | 10-Year | 9,576,000 | 2,954,0000 | 21,825,000 | 4,224,000 | 17,601,000 | 15,366,000 | 653,000 | **26,619,000** | 4,068,000 |
| | 100-Year | **26,334,000** | | | | | | | | 11,8700,000 |
| Benefits | 10-Year | 5,994,180 | 956,200 | 6,319,540 | 1,287,360 | 6,173,300 | 5,228,660 | 276,140 | 6,511,180 | 5,994,180 |
| | 100-Year | **7,730,140** | | | | | | | | 7,730,140 |
| B/C Ratio | 10-Year | **.67** | .32 | .28 | .30 | .33 | .37 | .35 | .30 | **1.47** |
| | 100-Year | **.31** | | | | | | | | .69 |

As the tables above show, implementing Alternatives D or I would provide the greatest drops in surface water elevation throughout the project and provide protection to a large number of structures that experience flooding damage. These Alternatives, however, are two of the more expensive alternatives and the return on investing in these Alternatives (the Benefit/Cost Ratio) is low. Acquiring all Alternatives within the 100-Yr. floodplain (Alternative B-2) would eliminate future flood damages to structures, however this is the most expensive Alternative evaluated. In addition to the costs, this Alternative only removes structures and does not address flooding or lower surface water elevations.

Raising structures within the 10-Yr. floodplain (Alternative J-1) is the most cost effective alternative, and provides relief to thirty-six of the structures found within the 10-Yr. floodplain. Like the Acquisition Alternatives, this Alternative does not lower the surface water elevation, nor does it address the impacts of flood events to the infrastructure within the project area.

## 17. Environmental Permitting

Prior to initiating the construction or the placement of fill into jurisdictional waters, permits must be obtained. The following is a list of applicable permits that need to be considered.

**Federal Clean Water Act Permits:** Any work in waters of the United States (Including special aquatic sites such as wetlands) requires permitting under Sections 404 and 401 of the Clean Water Act. Section 404 allows for the placement of fill or dredged material into waters and is administered by the US Army Corps of Engineers Regulatory staff. Section 401 allows for the Environmental Protection Agency (EPA) to certify that the activities permitted under a Section 404 permit will not degrade existing water quality standards. In South Carolina, the EPA has delegated this authority to the SCDHEC Bureau of Water (BOW).

Figure 81 shows the location of potential wetlands and waters with the Project Area. While this map is accurate, it would be prudent to get a Jurisdictional Determination prior to performing any work.

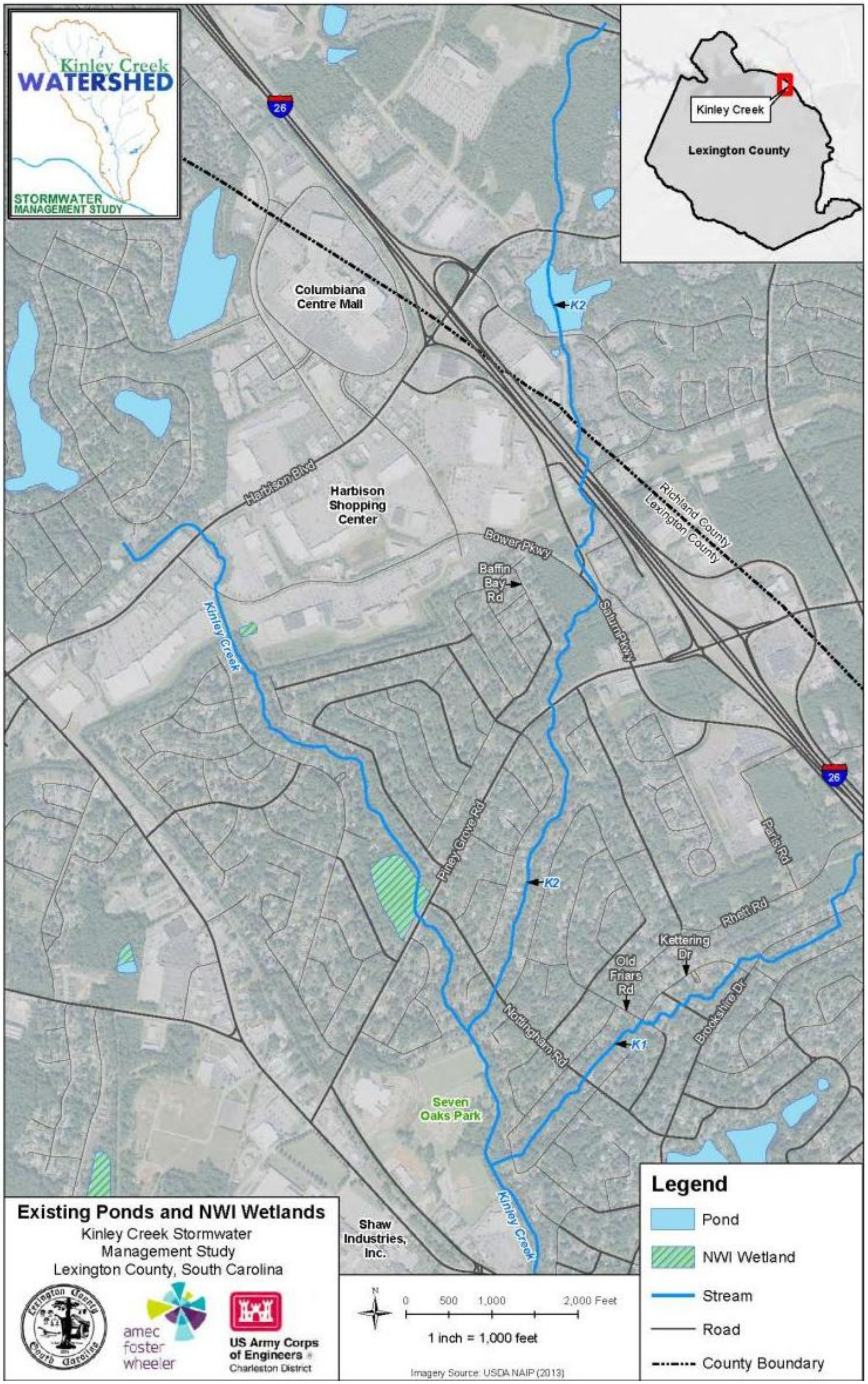



**Figure 81. Wetlands and Waters of the US in Project Area**

**Jurisdictional Determinations**: Prior to undertaking any activity, a determination of jurisdictional (JD) waters should be obtained. A JD identifies the presence and location of Waters of the United States (including wetlands) within a project area. While obtaining a JD is not mandatory, it is prudent planning. Knowing the location and boundaries of jurisdictional waters and wetlands in a project area allows for avoidance (which means no 404/401 permitting) or minimization (which allows for reducing or avoiding mitigation and associated costs) of impacts and advanced knowledge of the necessity of obtaining a permit. In South Carolina, only the Corps of Engineers can legally determine the extent of jurisdictional waters. There are four types of delineations that can be requested:

- Preliminary: Preliminary determinations identify the presence of wetlands or other waters and are presumed jurisdictional. This is usually the quickest type of JD that can be obtained,
- Approved: Approved JDs identify the presence of wetland and waters and includes their jurisdictional status. (Not all waters, such as isolated wetlands, are considered jurisdictional,
- Accurate: Accurate JDs have the location of all waters are mapped by a registered surveyor, and
- Approximate: Approximate JDs have verified wetlands, but are shown on a drawing where the wetland boundaries are not surveyed.

For the type of work shown in the alternatives, a preliminary or approximate JD is usually sufficient. While the Corps can and will do JDs for any person or entity requesting one, for larger projects, it is usually more efficient to obtain the services of a wetlands consultant, who will delineate the wetlands and have the Corps verify the delineation. The form requesting a JD is included in the Appendix H.

**Wetlands Permitting:** Depending on the size of the impact and the type of activity, a project may qualify for either a Department of Army Individual Permit or a Nationwide Permit (NWP). Individual Permits are for large impacts, usually exceeding 0.5 acre of wetland fill or 300 linear feet of stream. Nationwide Permits authorize activities that are similar in nature and cause only minimal adverse environmental impacts to aquatic resources separately or on a cumulative basis. There are fifty two Nationwide Permits and a project’s activity determines which NWP applies.

**Individual Permits:** As stated above, any impacts that exceed Nationwide Permit thresholds are evaluated as Individual or Standard Permits (IPs). IPs have a set process that starts when the Regulatory Office receives a complete permit application.
A completed permit application includes the following information:

- Description of overall project and each activity affecting the Waters of the US
- Overall and Basic Project Purpose
- Size and Type of Impact
- Statements on how Impacts have been Avoided or Minimized
- Proposed Compensatory Mitigation
- Detailed black and white drawings (on 8 x 11 paper) showing all proposed work.

(A copy of the permit application is located in Appendix H)

Once a complete application is received, the project is placed on Public Notice for review and comment. The Public Notice is sent to Resource Agencies, all adjacent landowners, and other members of the general public who request it. Comments received during the Public Notice period, as well as additional questions from Regulatory are then forwarded to the applicant to address. Once all outstanding issues and questions are addressed, the Regulatory Office issues a permit decision. Permit decisions for IPs are made on a case by case basis, with each project evaluated on its individual merits.

While each IP is different, most are processed within 180 days of receipt of a complete application.

**Nationwide Permits:** The measurement measures listed in the alternatives include activities that may fall under various Nationwide Permits (NWP). The following is a discussion of the NWP most likely to be applicable to the alternatives.

**NWP 3 Maintenance**: authorizes the repair, rehabilitation, or replacement of any previously authorized or currently serviceable structure, provided that the structure or fill is not to be put to uses differing from its original intent.

**NWP 12 Utilities:** Authorizes activities for the construction, maintenance or repair of utility lines. Any work to relocate utility lines could possibly fall under this NWP.

**NWP 13 Bank Stabilization:** Authorizes bank stabilization actives necessary to prevent erosion provided certain criteria are met.

**401 Water Quality Certification:** As previously discussed, NWPs are general permits issued by the Corps of Engineers on a nationwide basis to authorize minor activities with little delay or paperwork. These NWPs are issued for a category of activities when those activities are similar in nature and cause only minimal individual and cumulative environmental impacts or the general permit would result in avoiding unnecessary duplication of regulatory control exercised by another regulatory agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal. State Water Quality Certification pursuant to Section 401 of the Clean Water Act, or waiver thereof, is required prior to issuance or reissuance of the nationwide permits which may result in a discharge into waters of the United States.

## 18. Threatened and Endangered Species

The US Fish and Wildlife Service list 47 Threatened and Endangered species in South Carolina. Four species are suspected to occur in Lexington County: the American wood stork (*Mycteria americana*), the bald eagle (*Haliaeetus leucocephalus)* the Red-cockaded woodpecker (*Picoides borealis)* and the Smooth coneflower (*Echinacea laevigata*). There are also numerous state listed species found in the county, however, state designation does not provide for any protection except for those found on State owned land.

**Wood Stork**: Wood storks are large, long-legged wading birds, about 5O inches tall, with a wingspan of 60 to 65 inches. The plumage is white except for black primaries and secondaries and a short black tail. The head and neck are largely unfeathered and dark gray in color. The bill is black, thick at the base, and slightly decurved. Immature birds are dingy gray and have a yellowish bill. Wood storks are found in Florida, Georgia and South Carolina. Wood storks would be found in Lexington County during nesting season, however, their nesting and foraging habitats are not found within the project area. It is highly unlikely that wood storks will be encountered in the Kinley Creek watershed.

**Figure 82. Wood Stork (US Fish and Wildlife Service)**

**Bald Eagle:** The bald eagle is a large raptor with a wingspread of about 7 feet. Adults have a dark brown body and wings, white head and tail, and a yellow beak. Juveniles are mostly brown with white mottling on the body, tail, and undersides of wings. Adult plumage usually is obtained by the 6th year. In flight, the bald eagle often soars or glides with the wings held at a right angle to the body. While no longer a listed Threatened or Endangered Species, bald eagles are protected under the Bald and Golden Eagle Protection Act.

Known bald eagle nests are located on the Saluda River below the Lake Murray Dam.

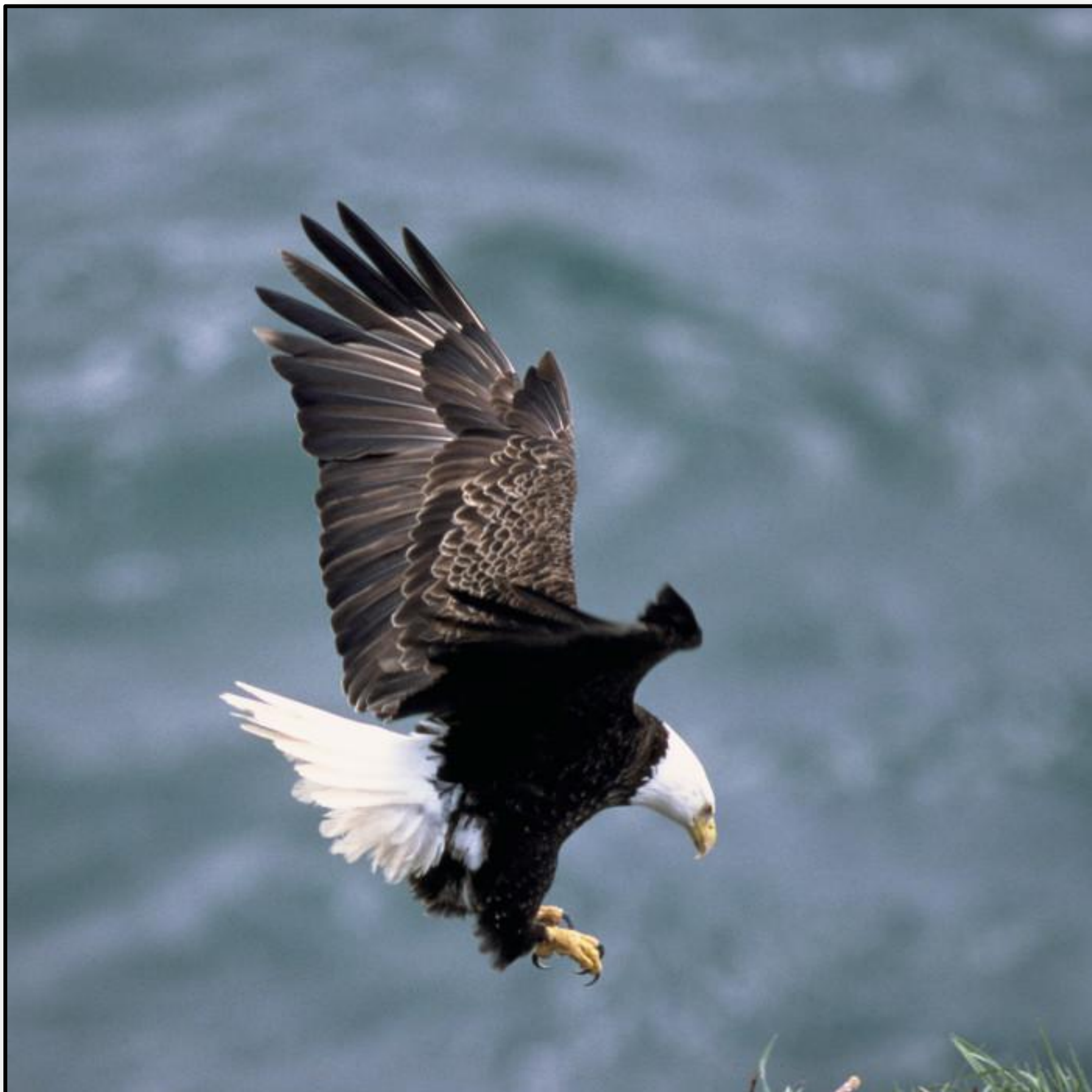


**Figure 83. Bald Eagle (US Fish and Wildlife Service)**

**Red-cockaded woodpecker:** Rather small black-and-white woodpecker with longish bill. Above black barred white. Below white with black spots on flanks. Black crown, nape and moustachial stripe border white cheeks and side of neck. The male has small red mark on the side of nape. Its preferred habitat is mature longleaf pine stands.

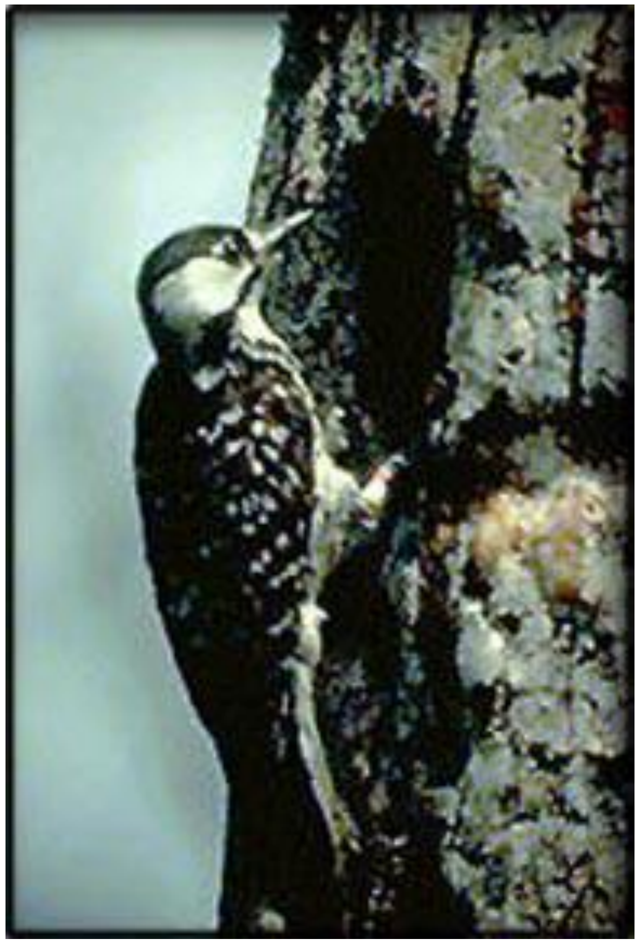


**Figure 84. Red-Cockaded Woodpecker (US Fish and Wildlife Service)**

**Smooth Coneflower:** The smooth coneflower is a perennial herb that grows to a height of about 1.5 m. It has smooth stems, few leaves, and pink to purplish flowers that appear Mat through mid-July. The plant produces fruits from late June through September. It primarily occurs in openings in woods, such as cedar barrens and clear cuts, along roadsides and utility line rights-of-way, and on dry limestone bluffs. Usually found in areas with magnesium- and calcium-rich soils. The smooth coneflower is not found in shaded areas.

**Figure 85. Smooth Coneflower (US Fish and Wildlife Service)**

A review of the SCDNR Threatened and Endangered Species database shows no know listed species or habitat within the project area. Given the build up and development of the watershed, it is highly unlikely that any of the listed species would be encountered. While this is the most current information, it is advised that informal consultation with the US Fish and Wildlife Service be initiated prior to undertaking any project.

## 19. Cultural Resources

The South Carolina Institute of Archeology and Anthropology conducted an archeological survey of Rawls and Kinley Creek for a wastewater line to be installed along the named tributaries. No significant sites were found along the Kinley Creek portion of the study. A check of the South Carolina Institute of Archeology and Anthropology and South Carolina

Department of Achieves and History database revealed no other sites within the project area (Figure 86).

Owing to the overall development within the Kinley Creek Watershed, it highly unlikely that there are any unknown cultural resources. If something is uncovered during construction, however, activities must cease and coordination with the SHPO must be initiated.

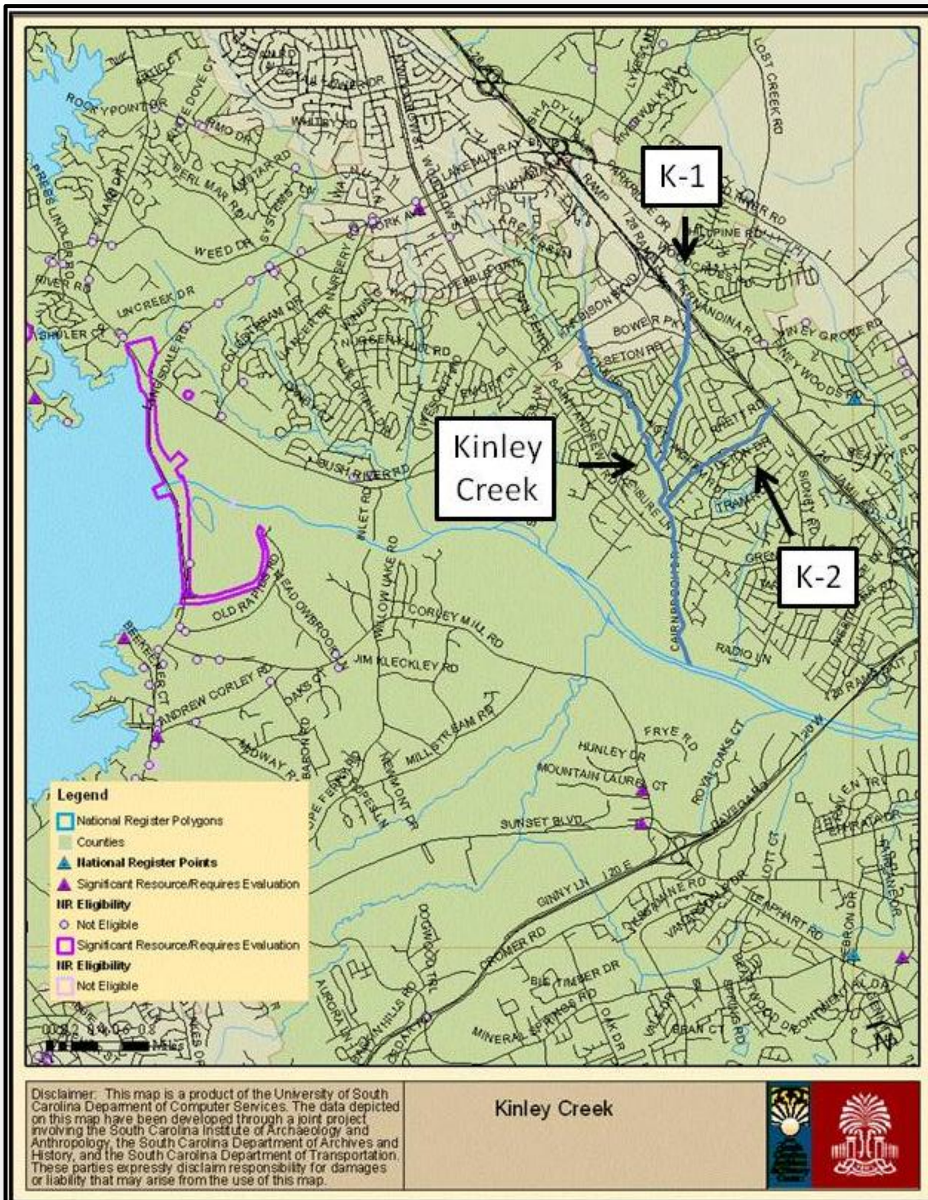



**Figure 86. Cultural Resources Proximate to Project Area**

## 20. Real Estate

Based on GIS Data provided by Lexington County, there are approximately 190 properties within the footprint of the proposed project. Although Lexington County currently maintains Kinley Creek, no easements or other rights have ever been acquired from the adjoining land owners. Easements must be obtained prior to any construction on Kinley Creek, K-1 or K-2. Easements would apply to rights-of-way and relocations, construction staging or lay down areas, disposal/borrow areas and should include the rights to construct, maintain, repair, operate, patrol and replace a drainage ditch. The project would impact numerous public road crossings and utilities. Addressing these impacts would require new or upgraded pipelines, roads and utilities. Any road crossing modifications will need to be coordinated with the appropriate State, City of County agency entities. Modifications to privately owned utilities must be accomplished under a relocation contract with the appropriate entity and will increase the estimated real estate cost.

A complete real estate summary can be found in Appendix I.

## 21. Potential Project/Funding Sources

**FEMA's Hazard Mitigation Assistance (HMA) grant programs** are designed to provide funding to protect life and property from future natural disasters. FEMA currently, has three programs:

**Hazard Mitigation Grant Program (HMGP):** The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

**Pre-Disaster Mitigation (PDM):** The PDM provides funds for hazard mitigation planning and projects on an annual basis. The PDM program was put in place to reduce overall risk to people and structures, while at the same time, also reducing reliance on federal funding if an actual disaster were to occur.

**Flood Mitigation Assistance (FMA):** The FMA provides funds for projects to reduce or eliminate risk of flood damage to structures that are insured under the National Flood Insurance Program (NFIP) on an annual basis.

**The US Army Corps of Engineers (USACE) Continuing Authorities Program (CAP)** provides for feasibility study leading to design and implementation of various small project authorities. Small refers to the scale of the Federal funds spent as compared to much larger projects. Congress appropriates money to the overall program each year, which has standing authorities for the different Corps missions. The authorities are often referred to by a section number, which represents the section of the law that authorized the program, such as Section 205 for Small Flood Control projects.

**What is the CAP process and how long does it take?**

Projects and studies under CAP vary in time and cost. However, all studies begin with an initial request from a governmental body or non-profit organization asking the Corps to assess a particular water resource problem. Once a request is received – all that's required is a letter asking for assistance – representatives from the Corps will coordinate a field visit to determine which of the CAP authorities apply to the situation. The process includes two phases:

(1) Feasibility Phase. The feasibility phase is the project formulation phase during which all planning activities are performed that are required to demonstrate that Federal participation in a specific project is warranted and to prepare for the initiation of the design and implementation phase for that project. Feasibility phase costs in excess of $100,000 require an executed Feasibility Cost Sharing Agreement and are cost shared 50/50 with the non-Federal sponsor.

(2) Design and Implementation Phase. This phase includes all post-feasibility phase activities, including design and construction, but not operation, maintenance, repair, replacement, or rehabilitation (OMRR&R) activities. Design and implementation phase costs are shared in accordance with general legislation for the applicable project purpose.

OMRR&R of all CAP projects are the responsibility of the non-Federal sponsor.

**What does it cost?**

- Initial site visits and meetings to determine applicability are at full Federal expense.
- Portions of the initial studies are at full Federal expense.
- The remaining study and construction costs are cost shared at varying percentages, depending on the particular authority. Most are 65% Federal, 35% non-Federal sponsor.
- Operation and maintenance of the completed project are at full non-Federal sponsor expense.

See Appendix J for FEMA and USACE Fact Sheets**.**

## 22. Conclusion

As previously stated, the various causalities and geographic range of the flooding within the project means that one Alternative or Management measure cannot address all, or even the majority of the flooding issues. There is no "magic bullet". By combining pieces of the Alternatives, however, a feasible plan may be developed:

- Focus on protecting structures in the 10-Yr. floodplain
- Acquire structures that have a history of repetitive losses
- Modify channel adjacent to Broken Hill Road and downstream of Piney Grove Road
- Construct pond offline of K-1

The reasons for singling out these Management Measures have been previously stated. The most cost efficient measure is elevating the structures with first floors below the 10-YR flood inundation area. Modifying the channel below Piney Grove Road would also result in significantly lowered water surface elevations with a high Cost/Benefit Ratio. While more local in its effects, constructing the off-line pond on K-1 would also lower water surface elevations downstream of the pond with a positive Cost/Benefit Ratio. These measures are recommended to be implemented first. Other measures could be implemented as funding sources are identified.

# Appendix A: Scope of Work and Other Relevant Project Documentation

# COUNTY OF LEXINGTON

**PUBLIC WORKS DEPARTMENT**

**ENGINEERING**


January 17, 2013

Lieutenant Colonel Edward P. Chamberlayne
Commander
U.S. Army Corps of Engineers
Charleston District
69A Hagood Avenue
Charleston, SC 29403-5107

Dear Lieutenant Colonel Chamberlayne:

This is in reference to the Corps of Engineers' Planning Assistance to States Program. We understand that the provisions of Section 22 of the Water Resources Development Act of 1974, as amended, authorizes the Corps to assist in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. Lexington County requests planning assistance for flooding problems in the Kinley Creek watershed, in Lexington County, South Carolina.

Lexington County government understands that the cost of a Planning Assistance to States study is shared 50 percent Federal funds and 50 percent non-Federal funds, and that the non-Federal share can be in cash or in-kind services. Lexington County is committed to providing the required fifty percent non-Federal share of total study costs. We would like to discuss the availability of information, required schedule, and level of effort required in order to negotiate the appropriate legal agreement to initiate a Planning Assistance to States study. Please contact Randy Edwards at 803-785-8205 to arrange a further discussion of this inquiry.

Thank you,

J. Randy Edwards, P.E.

County Engineer

ORIGINAL

PLANNING ASSISTANCE TO STATES AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
LEXINGTON COUNTY, SOUTH CAROLINA
FOR
KINLEY CREEK WATERSHED STORMWATER MANAGEMENT STUDY

THIS AGREEMENT is entered into this ~~12th~~ 23rd day of September 2013, by and between the Department of the Army (hereinafter the "Government"), represented by the District Engineer, and Lexington County, South Carolina (hereinafter the "Sponsor"), represented by Mr. William B. Banning, Sr., Lexington County Council Chairman, Lexington County, South Carolina.

WITNESSETH, THAT:

WHEREAS, Section 22 of the Water Resources Development Act of 1974 (WRDA 1974), Public Law 93-251, as amended, authorizes the Secretary of the Army (Secretary), acting through the Chief of Engineers, to cooperate with any State in the preparation of comprehensive plans for the development, utilization, and conservation of the water and related resources of drainage basins, watersheds, or ecosystems located within the boundaries of such State and also authorizes the Secretary, at the request of a government agency or non-Federal interest, to provide, at Federal expense, technical assistance to such agency or non-Federal interest in managing water resources;

WHEREAS, Section 319 of the Water Resources Development Act of 1990 (WRDA 1990), Public Law 101-640, specifies the cost-sharing requirements applicable to the provision of Federal assistance pursuant to Section 22 of WRDA 1974, as amended;

WHEREAS, Section 2013 of the Water Resources Development Act of 2007, Public Law 110-114, amended Section 22 of the Water Resources Development Act of 1974, Public Law 93-251, as amended (42 U.S.C. 1962d-16) to increase the amount of in-kind contributions the Sponsor may provide toward its required contribution of Study Costs from 50 percent to 100 percent and to increase the statutory limitation on the amount that may be expended to carry out comprehensive plans in any one year in any one State from $500,000 to $2,000,000;

WHEREAS, the Sponsor may provide up to 100 percent of its required contribution of Study Costs by the provision of services, materials, supplies or other in-kind services;

WHEREAS, the Sponsor has identified the need for technical and planning assistance as described in the Scope of Work, Attachment A, incorporated into this Agreement; and

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in cost-sharing and financing in accordance with the terms of this Agreement.

NOW, THEREFORE, the Government and Sponsor agree as follows:

## ARTICLE I - DEFINITIONS

A. The term "*Study*" shall mean the tasks identified in the attached Scope of Work.

B. The term "*Study Costs*" shall mean all disbursements by the Government pursuant to this Agreement, from Federal appropriations or from funds made available to the Government by the Sponsor and all negotiated costs of work performed by the Sponsor pursuant to this Agreement. *Study Costs* shall include, but not be limited to: labor charges; direct costs; overhead expenses; supervision and administration costs; the costs of participation in Study Management and Coordination in accordance with Article IV of this Agreement; the costs of contracts with third parties, including termination or suspension charges; and any termination or suspension costs (ordinarily defined as those costs necessary to terminate ongoing contracts or obligations and to properly safeguard the work already accomplished) associated with this Agreement.

C. The term "*estimated Study Costs*" shall mean the estimated cost of performing the *Study* as of the effective date of this Agreement, as specified in Article III.A. of this Agreement.

D. The term "*study period*" shall mean the time period for conducting the *Study*, commencing with the release to the U.S. Army Corps of Engineers, Charleston District of initial Federal funds following the execution of this Agreement and ending when the Charleston District provides the planning report to the Sponsor.

E. The term "*SOW*" shall mean the Scope of Work, which is attached to this Agreement and which shall not be considered binding on either party and is subject to change by the Government, in consultation with the Sponsor.

F. The term "*fiscal year*" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

G. The term "*negotiated costs*" shall mean the costs of in-kind contributions to be provided by the Sponsor in accordance with the SOW.

H. The term "*Federal program funds*" shall mean funds provided by a Federal agency, other than the Department of the Army, plus any non-Federal contribution required as a matching share therefore.

ARTICLE II - OBLIGATIONS OF PARTIES

A. The Government, using funds and in-kind contributions provided by the Sponsor and funds appropriated by the Congress of the United States, shall expeditiously prosecute and complete the *Study*, substantially in compliance with the *SOW* described in Attachment A and in conformity with applicable Federal laws and regulations and mutually acceptable standards of engineering practice.

B. In accordance with this Article and Article III.A., III.B. and III.C. of this Agreement, the Sponsor shall contribute cash or in-kind contributions equal to fifty (50) percent of *Study Costs*. In-kind contributions may comprise 100 percent of the Sponsor's contributions.

C. The Non-Federal Sponsor shall not use *Federal program funds* to meet any of its obligations for the *Study* under this Agreement unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the *Study*.

D. The award and management of any contract with a third party in furtherance of this Agreement which obligates Federal appropriations shall be exclusively within the control of the Government.

ARTICLE III - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties, current projections of *Study Costs*, and current projections of each party's share of *Study Costs*. At least quarterly, the Government shall provide the Sponsor a report setting forth this information. As of the effective date of this Agreement, *estimated Study Costs* are **$332,000**, and the Sponsor's share of *estimated Study Costs* is **$166,000**. In order to meet the Sponsor's cash payment requirements for its share of *estimated Study Costs*, the Sponsor must provide a cash contribution currently estimated to be **$0**. The dollar amounts set forth in this Article are based upon the Government's best estimates, which reflect the scope of the studies described in the *SOW*, projected costs, price-level changes, and anticipated inflation. Such cost estimates are subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Sponsor.

B. The Sponsor shall provide its cash contribution required under Article II.B. of this Agreement in accordance with the following provisions:

1. No later than 30 calendar days prior to the scheduled date of the Government's issuance of the solicitation for the first contract for the *Study* or for the Government's anticipated first significant in-house expenditure for the *Study*, the Government shall notify the Sponsor in writing of the funds the Government determines to be required from the Sponsor to meet its share of *Study Costs*. No later than 30 calendar days thereafter, the Sponsor shall provide the Government the full amount of the required funds by delivering a check payable to "FAO, USAED, CHARLESTON DISTRICT" to the District Engineer or an Electronic Funds Transfer in accordance with procedures established by the Government.

C. Within 90 calendar days after the conclusion of the *Study Period* or termination of this Agreement, the Government shall conduct a final accounting of *Study Costs*, including disbursements by the Government of Federal funds and cash contributions by the Sponsor and shall furnish the Sponsor with the results of this accounting. Within 30 calendar days thereafter, the Government, subject to the availability of funds, shall reimburse the Sponsor for the excess, if any, of cash contributions and credits given over its required share of *Study Costs*, or the Sponsor shall provide the Government any cash contributions required for the Sponsor to meet its required share of *Study Costs*.

## ARTICLE IV - STUDY MANAGEMENT AND COORDINATION

To provide for consistent and effective communication, the Government's Project Manager for the *Study* and the Sponsor's designated representative shall communicate regularly until the end of the *Study Period.*

## ARTICLE V - DISPUTES

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. Such costs shall not be included in *Study Costs*. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

## ARTICLE VI - MAINTENANCE OF RECORDS AND AUDIT

A. Within 60 calendar days of the effective date of this Agreement, the Government and the Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Sponsor shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of design and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Sponsor is required to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits shall be included in total *Study Costs* and cost shared in accordance with the provisions of this Agreement.

## ARTICLE VII - RELATIONSHIP OF PARTIES

The Government and the Sponsor act in independent capacities in the performance of their respective rights and obligations under this Agreement, and neither are to be considered the officer, agent, or employee of the other.

## ARTICLE VIII - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Sponsor and the Government shall comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto and Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

## ARTICLE IX - TERMINATION OR SUSPENSION

A. This Agreement shall terminate at the conclusion of the *Study Period*, and neither the Government nor the Sponsor shall have any further obligations hereunder, except as provided in Article III.C.; provided that, prior to such time and upon 30 calendar days written notice, either party may terminate or suspend this Agreement. In addition, the Government shall terminate this Agreement immediately upon failure of the Sponsor to fulfill its obligation under Article III of this Agreement. In the event that either party elects to terminate this Agreement, both parties shall conclude their activities relating to the *Study* and proceed to a final accounting in accordance with Article III.C. of this Agreement. Upon termination of this Agreement, all data and information generated as part of the *Study* shall be made available to both parties.

B. Any termination of this Agreement shall not relieve the parties of liability for any obligations previously incurred, including the costs of closing out or transferring any existing contracts.

## ARTICLE X – NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsor:

Mr. William B. Banning, Sr.
Lexington County Council Chairman
212 South Lake Drive
Lexington, SC 29072

If to the Government:

US Army Corps of Engineers
Charleston District
69A Hagood Ave
Charleston, SC 29403-5107

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the District Engineer.

DEPARTMENT OF THE ARMY

BY: ______________________

JOHN T. LITZ, PMP
Lieutenant Colonel, U.S. Army
Commander, U. S. Army Engineer District

DATE: 23 SEP 13

LEXINGTON COUNTY, SC

BY: Bill Banning

WILLIAM B. BANNING, SR.
Lexington County Council Chairman
Lexington County, SC

DATE: Sept. 11, 2013

Attachment A - Scope of Work

**CERTIFICATE OF AUTHORITY**

I, Jeff M. Anderson, do hereby certify that I am the principal legal officer of LEXINGTON COUNTY, SOUTH CAROLINA, that LEXINGTON COUNTY is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and LEXINGTON COUNTY in connection with the studies referenced in the Scope of Work in Attachment A to this Agreement, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended (42 U.S.C. 1962d-5b), and that the persons who have executed this Agreement on behalf of LEXINGTON COUNTY have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 12th day of September, 2013.

Jeff M. Anderson

JEFF M. ANDERSON
Lexington County Legal Officer

## CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal Contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Stand Form – LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this Certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a pre-requisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Bill Banning

WILLIAM B. BANNING, SR.
Lexington County Council Chairman

# Appendix B:  Project Delivery Team

PROJECT DELIVERY TEAM (PDT)

| Name | Role/Organization |
|---|---|
| Colt Bowles | Plan Formulator/Environmental (SAC) |
| Sara Brown | Hydraulics & Hydrology (SAC) |
| Annie McCartney | Civil Engineer (SAC) |
| Jeff Fersner | Cost Engineer (SAC) |
| John Hinely | Real Estate (SAS) |
| Brian Nutter | Office of Counsel (SAC) |
| Dudley Patrick | Project Manager (SAC) |
| Mary Creese | Project Analyst (SAC) |

RESOURCE MANAGERS:

| Name | Role/Organization |
|---|---|
| Brian Williams | Chief, Programs & Project Management Branch (SAC) |
| Bret Walters | Chief, Planning & Environmental Branch (SAC) |
| Carole Works | Chief, Engineering Division (SAC) |
| Jon Jellema | Chief Counsel (SAC) |

NON-FEDERAL SPONSOR:

| Name | Role/Organization |
|---|---|
| Jim Barker | Hydrologist, Lexington County (SC) Public Works |
| Chris Stone | Floodplain Manager, Lexington County (SC) Public Works |
| Tim Shumpert | Engineering Associate III, Lexington County (SC) Public Works |
| Derrick Pratt | Engineering Associate I, Lexington County (SC) Public Works |
| Paul Dorroh | Engineering Associate I, Lexington County (SC) Public Works |
| Alison Sengupta | GIS Analyst, Lexington County (SC) Planning and GIS |
| Steve Pierce | GIS Technician II, Lexington County (SC) Planning and GIS |
| Alan Rickenbaker | GIS Technician I, Lexington County (SC) Planning and GIS |

NON-FEDERAL SPONSOR A&E:

| Name | Role/Organization |
|---|---|
| William Lamb | Project Manager, Amec Foster Wheeler, Inc. |
| Matthew Breen | Associate Engineer, Amec Foster Wheeler, Inc. |
| Jennifer McGee | Senior 1 Engineer, Amec Foster Wheeler, Inc. |
| Tanner Arrington | Tech Professional 1, Amec Foster Wheeler, Inc. |
| Thomas Williams | Tech Professional 3, Amec Foster Wheeler, Inc. |
| Katherine Resler | Tech Professional 3, Amec Foster Wheeler, Inc. |
| Andrew Simko | Tech Professional 2, Amec Foster Wheeler, Inc. |
| Brett Sexton | Tech Professional 1, Amec Foster Wheeler, Inc. |
| Angela Vandelay | Senior 1 Engineer, Amec Foster Wheeler, Inc. |
| Troy Biggs | Associate Engineer, Amec Foster Wheeler, Inc. |
| Jessica Brady | Administrative Staff 2, Amec Foster Wheeler, Inc. |
| Sravan Krovidi | Tech Professional 3, Amec Foster Wheeler, Inc. |
| Brandon Cramer | Tech Professional 2, Amec Foster Wheeler, Inc. |
| Marshall Gibson | Technician 2, Amec Foster Wheeler, Inc. |
| Kelly Creswell | Tech Professional 1, Amec Foster Wheeler, Inc. |

# Appendix C:  Hydraulic Analysis

**Hydraulic Summary**

Data provided:

Data on flooding was reported many times over the last 35 years

FEMA provided data, hydraulic and hydrologic models

City of Columbia and Lexington County provided GIS data

Corps of Engineers and Lexington County performed a site visit in 2008/09.

Lexington County, AMEC, and Corps of Engineers performed site visits on two occasions. Corps of Engineers and Lexington County performed an additional site visit for creek data, and AMEC and Lexington County performed an additional site visit for pond data

Lexington County provided additional survey data, high water mark elevations, storm data, and collected questionnaire responses.

Corps of Engineers created questionnaire and Lexington County distributed it to residents immediately adjacent to Kinley Creek and its tributaries.

Flood damages occur as a result of the proximity of structures to areas subject to flooding, development in adjacent portions of the watershed, and undersized creek and crossings (bridges and culverts).

FEMA Existing Flows

| Upstream Location | Stream | 2 yr | 5 yr | 10 yr | 25 yr | 50 yr | 100 yr | 500 yr |
|---|---|---|---|---|---|---|---|---|
| 17771 | Kinley | 907.6 | 1308.6 | 1639.8 | 2115.2 | 1750 | 2036 | 2892 |
| 12740 | Kinley | 949 | 1376 | 1737 | 2254 | 2685 | 3156 | 4817 |
| 11382 | Kinley | 959 | 1376 | 1741 | 2285 | 2721 | 3207 | 4884 |
| 9356 | Kinley | 1560 | 2149 | 2686 | 3577 | 4388 | 5283 | 7800 |
| 7598 | Kinley | 1742 | 2387 | 2881 | 3842 | 4872 | 5980 | 8978 |
| 5472 | Kinley | 1747 | 2417 | 2944 | 3915 | 4866 | 6064 | 9283 |
| 7147 | K-2 | 660 | 944 | 1191 | 1558 | 1872 | 2217 | 3136 |
| 3804 | K-2 | 720 | 985 | 1244 | 1693 | 2090 | 2544 | 3750 |
| | K-1 | 239* | 359* | 466 | 627 | 767 | 922 | 1338 |

*From HMS

Revised Existing Condition Flows (From AMEC updated HMS)

| Upstream Location | Stream | 2 yr | 5 yr | 10 yr | 25 yr | 50 yr | 100 yr |
|---|---|---|---|---|---|---|---|
| 18029 | Kinley | 402.9 | 619.4 | 829.6 | 1137.6 | 1403.3 | 1709.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17059 | Kinley | 948.6 | 1366.7 | 1714.7 | 2212.1 | 2625.9 | 3077.5 |
| 14866.4 | Kinley | 910.2 | 1301.8 | 1646.2 | 2148 | 2568.4 | 3018.7 |
| 12016 | Kinley | 908.3 | 1294.3 | 1645.1 | 2147.2 | 2567.9 | 3018.3 |
| 10967 | Kinley | 909.8 | 1296.6 | 1648.1 | 2156.4 | 2582.7 | 3037.3 |
| 9356 | Kinley | 1370.3 | 1899.6 | 2341.6 | 3119 | 3782.8 | 4467.2 |
| 7598 | Kinley | 1494.1 | 2045.1 | 2520 | 3238.8 | 3942.7 | 4825.4 |
| 5472 | Kinley | 1575.8 | 2161.7 | 2673.7 | 3410.7 | 4167.4 | 5179.8 |
| 7147 | K-2 | 309.7 | 443.2 | 559.6 | 732.9 | 881.5 | 1044.9 |
| 5699 | K-2 | 575 | 817.3 | 1026.8 | 1335.6 | 1605.5 | 1901.4 |
| 5000 | K-2 | 558 | 792.5 | 1000.4 | 1231 | 1475.1 | 1870.2 |
| 4143 | K-2 | 595.6 | 841 | 1059 | 1307.3 | 1566 | 1952.5 |
| 3296 | K-2 | 593.7 | 835.8 | 1052.7 | 1320.6 | 1577.8 | 1939.5 |
| 2141.3 | K-2 | 553.5 | 754 | 1003.8 | 1284.7 | 1534.8 | 1847.7 |
| 6432 | K-1 | 139.1 | 219.8 | 279.5 | 386.9 | 456.4 | 550.8 |
| 5928 | K-1 | 140 | 220.4 | 339.9 | 573.8 | 746.4 | 902.9 |
| 4873 | K-1 | 261.5 | 374.2 | 483 | 723.4 | 951.7 | 1203.6 |
| 3409 | K-1 | 218.6 | 347.5 | 470.3 | 708.8 | 929.3 | 1177.2 |
| 2774 | K-1 | 204.2 | 328.4 | 454.5 | 679 | 885.4 | 1118.3 |
| 1601 | K-1 | 191.5 | 302.6 | 437.3 | 636.5 | 836.5 | 1029.5 |

Historic Flows (CFS) at Piney Grove Rd

| Year | 1987 | 2012 |
|---|---|---|
| 2 | 362 | 949 |
| 5 | | 1376 |
| 10 | 1000 | 1737 |
| 25 | 1411 | 2254 |
| 50 | 1766 | 2685 |
| 100 | 2056 | 3156 |

## GEOTECHNICAL ASSESSMENT

32. The channel bottom through the proposed improved channel section appears to be sand or loose gravel and small boulders which would be relatively easy to excavate. There are a few places where small rock ledges would have to be excavated. A geological assessment revealed that the rock is a moderately high grade metamorphic rock with high angle foliation which strikes across the creek.

33. Blasting of rock is not a viable option, due to the proximity of homes to the creek, and because the depth of cut is generally two feet or less. Therefore, the proposed channel cut would have to be made with a bulldozer, backhoe, or a non-explosive expansive cracking agent. These three methods of excavation are subject to limitations as follows:

a. Bulldozer - A 20-foot width of cut is near the minimum needed for a 14-foot wide "D8" dozer blade.

b. Backhoe - Rock excavation would be more difficult than with a dozer.

c. Non-explosive expansive cracking agent - Relatively new product with a performance record which shows mixed results.

Hydraulic modeling was performed in HEC-RAS software (US Army Corps of Engineers, Hydrologic Engineering Center, River Analysis System, Version 4.1.0). HEC-RAS is a backwater hydraulic model used for studying open channel flow. Stormwater drainage networks, with the exception of ponds, were not studied in detail as part of this study. It is apparent from Lexington County staff and field observations, that stormwater in the area discharges directly into Kinley Creek and its tributaries and thus high water levels in the creek pose a potential hindrance to all drainage, the extent of which is unknown. HEC-RAS models provided by FEMA for lower and upper Kinley Creek, K-1 and K-2 tributaries, referred to herein as the "original HEC-RAS models", were used as the starting point for establishing the Existing and Without Project conditions.

**Hydraulic Modeling of the "Without Project" Conditions**

. The original HEC-RAS models obtained from FEMA did not include a high level of detail throughout the study area, as would be needed for assessing alternative solutions for the flooding issues in the region. There was also a gap in the models between the lower and upper reaches of Kinley Creek (adjacent to the Harbison shopping area). LiDAR data from Lexington County was used for additional cross-sections to bridge the two models provided. Additional LiDAR cross-sections were also added in areas where the original HEC-RAS model did not include sufficient data for our study purposes, paying particular attention to the areas were flooding was reported. The team visited the Kinley Creek watershed in December 2013, July 2014, and December 2014 to obtain detailed field data for verification and improvement of the HEC-RAS models. The field data obtained guided the minor revision of roughness coefficients, bank stations, ineffective flow areas, and structure inputs. Cross-sections were interpolated between the original and added cross-sections, for the purpose of smoothing out model results and cleaning up model warnings, and then compared to the model without interpolated cross-sections to verify that this did not cause significant changes to the water surface and that the interpolated cross-sections were realistic. Boundary conditions on tributary K-1 and K-2 were adjusted to meet the water surface of Kinley at their respective confluences. The HEC-RAS results were cross-checked with known problem areas to calibrate and verify accuracy of the revised models. Flows developed by the team working in HEC-HMS were added to the revised HEC-RAS models and further revisions were made in multiple iterations to clean-up HEC-RAS model warnings and to calibrate the model to known flooding data.

The modeling results were output from HEC-RAS to Esri ArcMap, Version 10.1, and analyzed using the HEC-GeoRAS toolbar to view the extent of flooding for the 2-yr, 10-yr and 100-yr return intervals, and to obtain a baseline by which all proposed solutions could be compared. This model is referred to as the "Without Project" condition since it is assumed that without any future projects proposed by this study or others, the conditions will remain approximately stable in the future.

**Hydraulic Modeling of Proposed Measures**

Overview:Channel, culvert, and bridge improvements were modeled to identify their potential benefits for the communities in the Kinley Creek subwatershed. Due to the extent of flood risk in various areas of the watershed and due to various causes of flooding, localized solutions can be implemented to achieve localized reduction of flood impacts. A watershed-wide solution would be best, but is likely to be very costly and require cooperation of nearly all properties along the Creek.

Efforts were focused to identify solutions for the high damage areas most frequently flooded and to reduce the frequency of flood damages throughout the subwatershed. Structure modifications were considered after this step, as an alternative where other alternatives did not provide sufficient benefits, and also for cost comparison. Since most culverts and bridges are sized to contain similar flows as the existing channel, they would need to be improved in conjunction with channel improvements. In the Without Project HEC-RAS model, K-1 overtops 5 out of its 6 road crossings in the 2-yr return interval storm, thus demonstrating the severely undersized infrastructure. Alternatives were identified and modeled that maximize benefits within the existing topography and structures. Alternatives with limited benefits observed were removed from further analyses.

Levees were not considered a reasonable alternative and were not considered due to the limited space between structures and the creek, maintenance required, and internal drainage problems they could create.

Ponds were modeled in HEC-RAS based on the outputs from revised HEC-HMS models generated by the team.

**Developing Independent Hydraulic Measures**

The hydraulic measures that were modeled using HEC-RAS included:

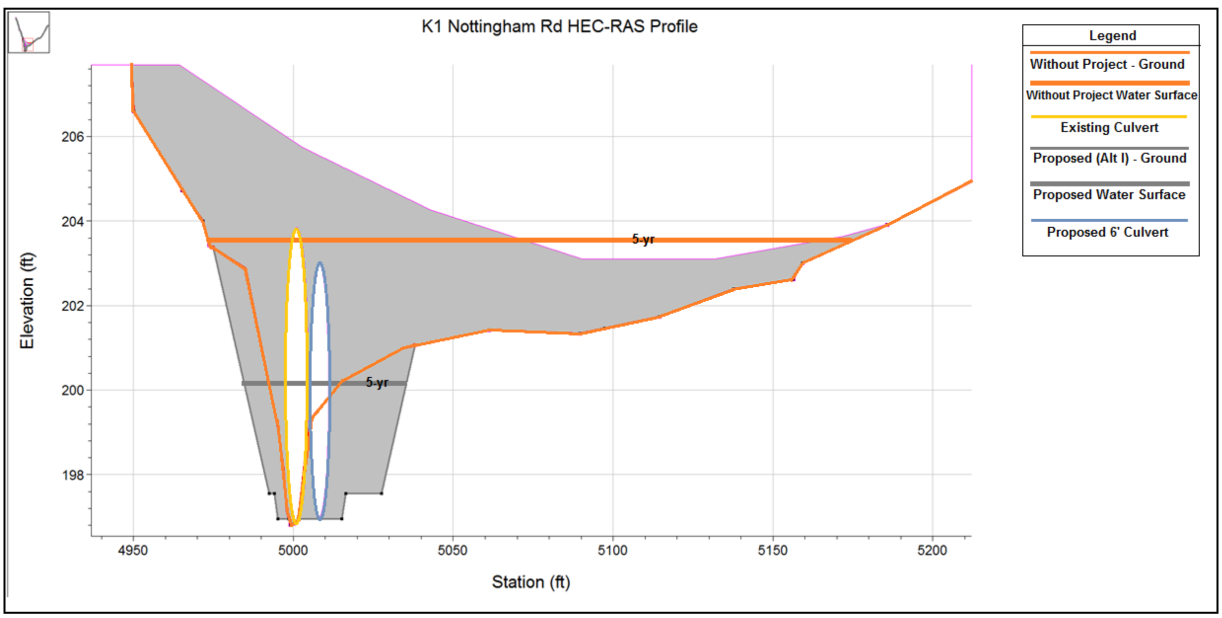
| Reach | Measure |
|---|---|
| K-1 | Sandhurst Road Bridge Modifications |
| K-1 | Nottingham Road Culvert Modification |
| K-1 | Old Friars Road Culvert Modification |
| K-1 | Reduce Minor Losses at Old Friars Road |
| K-1 | Yarmouth Drive Culvert Modification |
| K-1 | Kettering Drive Culvert Modification |
| K-1 | Lower Brookshire Road Culvert Modification |
| K-1 | Upper Brookshire Road Culvert Modification |
| K-1 | Channel Modifications |
| K-2 | Nottingham Road Bridge Modification |
| K-2 | Piney Grove Road Bridge Modification |
| K-2 | Lower Channel Modifications |
| K-2 | Upper Channel Modifications |
| K-2 | Full Reach Channel Modifications |
| K-2 | Relocate Upper Channel |
| K-2 | Add Fill or Wall at Upper K-2 Bend |
| Kinley | Railroad Bridge Modification |
| Kinley | St. Andrews Road Bridge Modification |
| Kinley | Sandhurst Road Bridge Modification |
| Kinley | Piney Grove Road Bridge Modification |
| Kinley | Channel Modification Starting at Harbison Shopping Area and Heading Downstream |
| Kinley | Channel Modifications along Broken Hill Road |
| Kinley | Channel Modifications at Confluence with K-2 |
| Kinley | Clearing and Grubbing |

The bridges and culverts in close proximity to flooding issues were fully removed one at a time from the Without Project HEC-RAS model to determine their relative impact to water surface elevations and extent. The Sandhurst Road Bridge over K-1 and the Sandhurst Road Bridge over Kinley were eliminated from further consideration following this quick test, due to limited improvements observed.

Initially, the proposed measures were modeled individually to optimize the desired dimensions. The Without Project HEC-RAS model was copied as the starting point for each measure and modifications were entered based on quick hand calculations of required capacity for the 10-yr and 100-yr return intervals. Due to the proximity of homes and utilities, and the low slope along many reaches, the ideal capacity was not always feasible and, as such, the measures were modified to maximize the available space. Additionally, all channel modifications are limited by rocky terrain in the channels which will make modifications to the channel bottom very difficult and costly. For this reason, and due to the large difference between the base flow and storm flows in the Kinley watershed, all channel modifications proposed have limited revisions to the bottom of the channel. It is assumed that the rocky and highly vegetated side slopes will allow for slightly steeper slopes to be recommended than are typically used in Lexington County and thus proposed alternatives include side slopes ranging from 1.5:1 to 3:1. Note that the modifications proposed in this study were assessed at a preliminary screening level and full plans and specifications have not been prepared. Any measures identified as desirable for future projects will need to be re-assessed at a higher level of detail.

| K-1 | Nottingham Road Culvert Modification |
|---|---|

Nottingham Road is owned by the South Carolina Department of Transportation (DOT) and K-1 crosses below the road through a 7 ft pipe culvert. The pipe culvert location does not coincide with the low point in the road, and thus water overtops the road prior to filling the culvert. The culvert is the optimal size already for the existing channel, and thus modifications are only proposed in conjunction with modifications to the inlet and outlet channel dimensions. It was determined that addition of a 6 ft pipe culvert would provide enough increased capacity to accommodate more frequent storms, while fitting beneath the existing road deck with proper cover depth. It may be possible to raise the road elevations or shift the culverts to provide further benefits, although that was not assessed in detail as part of this study.




Proposed Nottingham Road Culvert Addition and Associated Reduction in Water Surface Elevation

| | |
|---|---|
| K-1 | Old Friars Road Culvert Modification (and Reduce Minor Losses) |

Old Friars Road is owned by Lexington County and K-1 crosses below the road through a single 4 ft concrete pipe, and brick culvert. The culvert path zigzags across the road at an angle, including six 90-degree bends, and passes underground through yards on the upstream and downstream side of the road, for a total length of 339 ft. This culvert is severely undersized, only providing 13 $ft^2$ whereas a 10-yr storm in K-1 would require a minimum cross-sectional area of 60 $ft^2$. The proposed modifications are limited by the location of nearby homes and depth under the road. Two 6 ft-by-6 ft box culverts are proposed which would extend the culvert opening to the low point of the road and maximize the available space to accommodate the more frequent storms and reduce flooding in larger, less-frequent storms. Additionally, minor benefits would be gained by reducing the zigzag pattern down to two 45-degree bends and by the reduced friction provided by the proposed culverts compared to the existing culvert.

| | |
|---|---|
| K-1 | Yarmouth Drive Culvert Modification |

Yarmouth Drive is owned by SC DOT and K-1 crosses below the road through a single 4 ft corrugated metal pipe. The culvert path zigzags across the road at an angle, including three 45-degree bends, and passes underground through yards on the upstream and downstream side of the road, for a total length of 339 ft. Significant flooding has occurred at the homes adjacent to K-1 at Yarmouth Dr. and the force of floodwaters over yards and the road were enough to detach an exterior AC unit from a house on the upstream side of Yarmouth Drive and carry it to the garage door of the home on the downstream side. The proposed modifications are limited by the location of nearby homes and depth under the road. Despite the limited access, it is imperative that the culvert at this location be as large as possible in order to improve the flooding and thus, two 6 ft by 5 ft box culverts are proposed.

Inlet to Yarmouth Dr Crossing

Outlet of Yarmouth Dr Culvert

Without Project Conditions (July 2014)

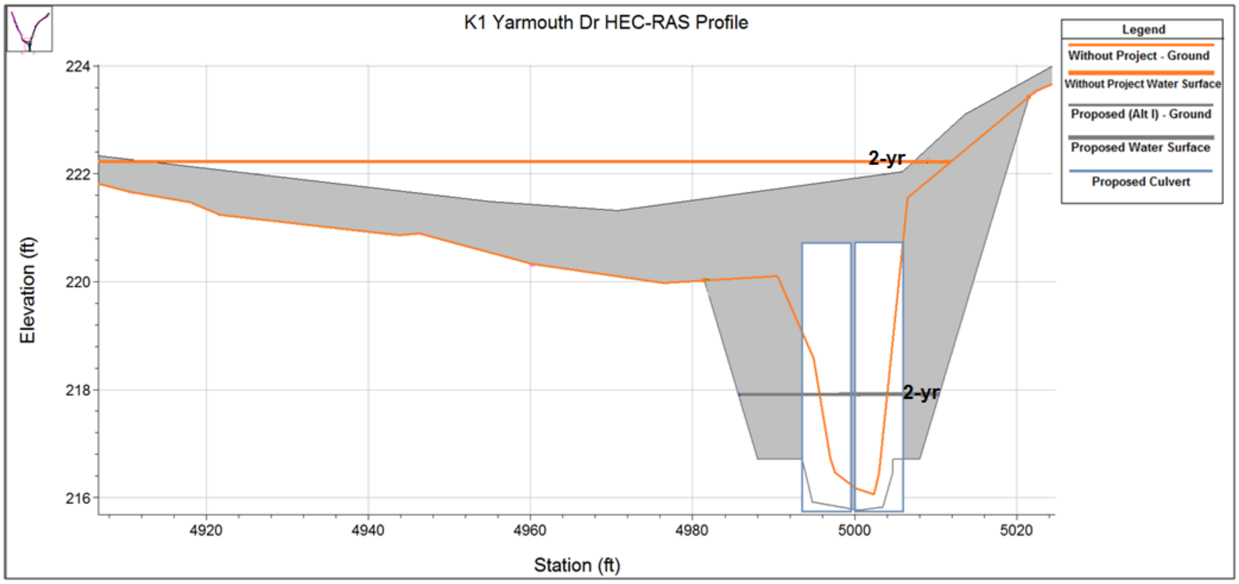



Figure X. Proposed Yarmouth Dr Culvert and Associated Reduction in Water Surface Elevation (At Inlet)

| | |
|---|---|
| K-1 | Kettering Drive Culvert Modification |

Kettering Drive is owned by Lexington County and K-1 crosses below the road through a single 4 ft concrete pipe. Flooding has been documented at the home on the upstream side of Kettering Dr. Two concrete 6 ft-by-4 ft box culverts are proposed.

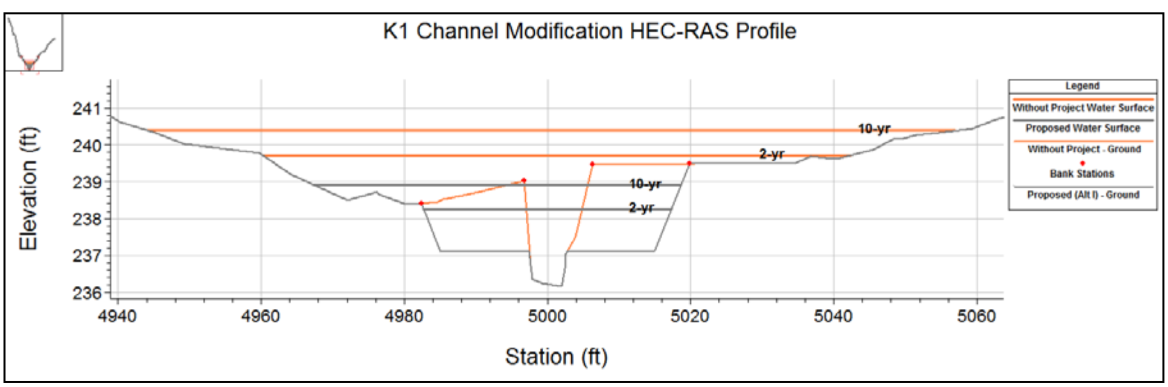
Flooding at home between Kettering and Lower Brookshire Drive.

| K-1 | Lower and Upper Brookshire Drive Culvert Modifications |
|---|---|

Brookshire Drive is owned by Lexington County and K-1 crosses Brookshire Drive at the upstream end and again just before it meets with Kettering Drive. At the lower Brookshire Drive crossing, addition of a 5 ft diameter and a 4 ft diameter concrete pipe parallel to the existing 4 ft corrugated metal pipe culvert are proposed and were modeled in HEC-RAS. At the upper Brookshire Drive crossing, there is not sufficient space or slope to modify the 3 ft diameter corrugated metal culvert in the existing alignment. The existing 3 ft diameter pipe culvert meets with two pipes with larger total capacity but the increased dimensions are not modeled due to the upstream limitation of the 3 ft diameter pipe. In combination with acquisition or modification of homes, it could be feasible to re-route the upper crossing to the lowest path and to increase the culvert capacity. There is a gasline easement that crosses K-1 upstream of Brookshire Drive, further limiting options for improvement. Flood waters have been reported to flow down Brookshire Drive during storms, temporarily blocking access to homes.

| K-1 | Channel Modifications |
|---|---|

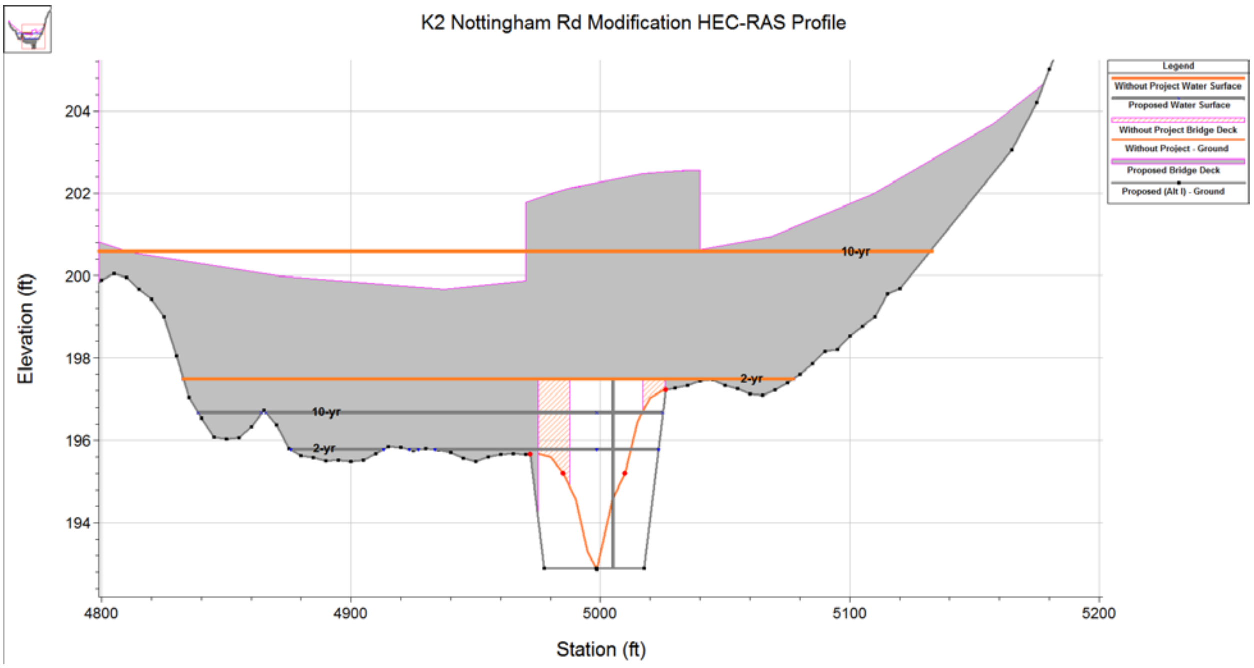
Channel modification options on K-1 are very limited due to space available between homes. The alignment alternates between open channel and pipe flow, with over 1400 ft of K-1 being piped through yards and under roads. Benefits gained from increased channel capacity are only realized in close proximity to the modified area and, thus, only alternatives that modify the full length of K-1 have been assessed. Channel modifications were made in HEC-RAS with locations of homes guiding the boundary locations, and then again ignoring the location of homes in order to contain the 10-yr storm peak flows where ever possible, which is only possible when combined with property acquisitions. Additionally, baseflows in K-1 are very low and thus a low flow channel was maintained in proposed modifications. The low flow channel proposed does not exceed a foot of depth since K-1 is only a few feet in some areas and wide floodplain benches are proposed.




Proposed Channel Modification Cross-Section

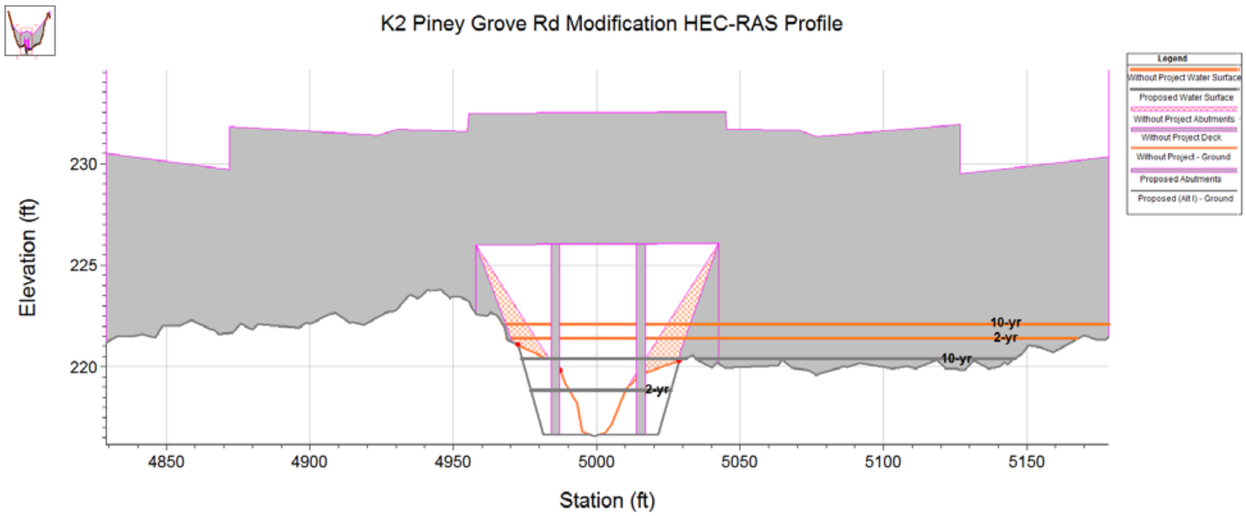
| K-2 | Nottingham Road Bridge Modification |
|---|---|

Nottingham Road is owned by SC DOT and K-2 crosses under it through a bridge. In conjunction with channel modifications, the bridge was modified in HEC-RAS to have a 20 ft wider span which accommodated 2-yr storm peak flows and eliminated road overtopping past the 10-yr flood, as shown in Figure X. This modification lowered peak flood water surface elevations in all modeled floods.




| K-2 | Piney Grove Road Bridge Modification |
|---|---|

Piney Grove Road is owned by SC DOT and K-2 crosses under it through a bridge. Piney Grove Road Bridge has low-slope abutments of rip-rap that extend into the channel and rip-rap that extends upstream and downstream of the bridge. The rip-rap reduces the capacity of undersized channel. Abutments were modified in conjunction with the channel in HEC-RAS in order to provide additional capacity. Water surface elevations were lowered, as shown in Figure X.




Piney Grove Road Abutment Modifications for 2-yr and 10-yr Peak Floods

| K-2 | Full Reach Channel Modifications |
|---|---|

Similar to the K-1 channel modifications, K-2 was modified to increase the capacity while maintaining a low-flow channel. Utilities and proximity of homes to K-2 is limiting, and large flows enter K-2. Channel modifications were made with locations of homes guiding the boundary locations, and then again ignoring the location of homes in order to contain the 10-yr storm peak flows where ever possible, which is only possible when combined with property acquisitions.

In order to allow for flexibility in upgrading infrastructure as funding permits, the K-2 channel modification model was also separated to identify benefits gained through modified shorter reaches.

| K-2 | Lower Channel Modifications |
|---|---|

Due to reported flooding in the Holborn Ct. neighborhood, lower K-2 channel was modified to provide increased flood capacity. A 60 ft wide channel, with a small low flow channel, was modeled in HEC-RAS for the first 600 ft of K-2 from Kinley.

| K-2 | Relocate Upper Channel/Increase Capacity |
|---|---|

Due to reported flooding along Baffin Bay Road, and open space to the east of K-2, a large floodplain bench was modeled. This alternative reduced flooding in the Baffin Bay neighborhood but the neighborhood is at lower elevations than most of the open space and thus, flooding could not be fully prevented.

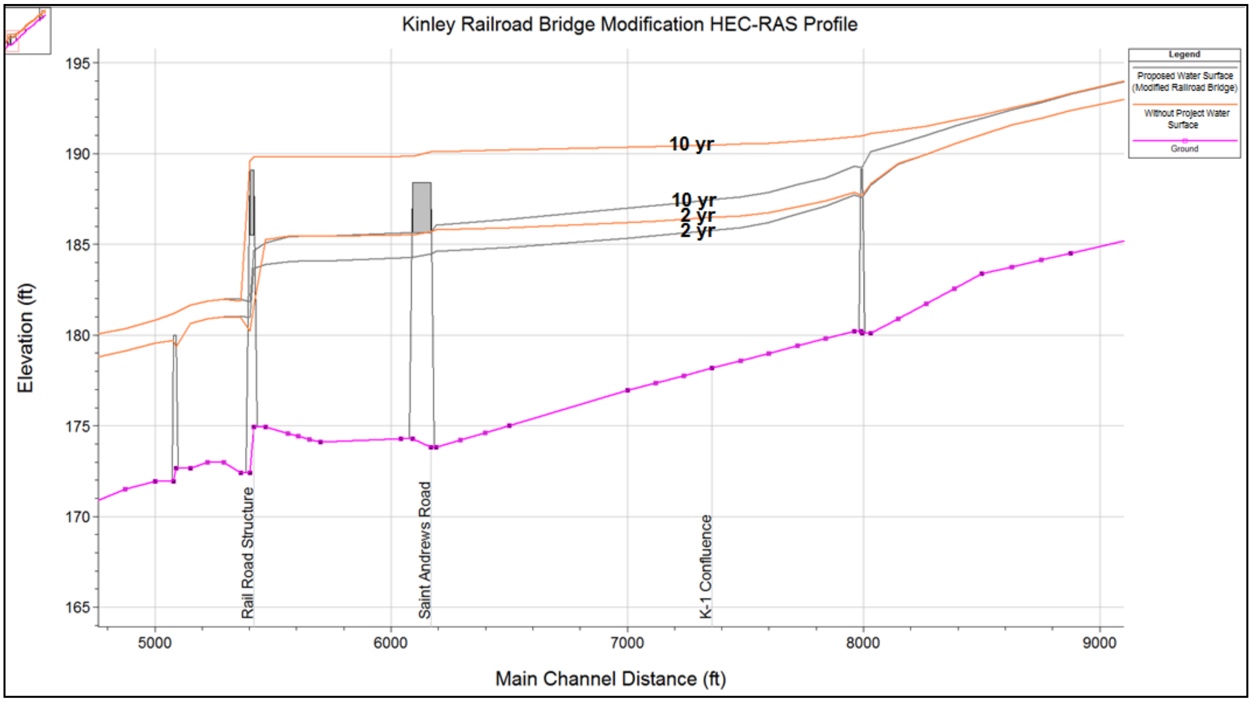
| | |
|---|---|
| K-2 | Add Fill or Wall at Upper K-2 Bend |

This measure consisted of the addition of bank material at a low point along K-2 where the tributary bends around homes and water flows out of the banks and into the street. The measure has been eliminated upon review of the maps due to the limited space available behind homes and because the slightly raised banks will not add enough capacity to remedy flood risk.


Flooding from K-2 adjacent to Lewisham Court.

| | |
|---|---|
| Kinley | Railroad Bridge Modification |

The railroad bridge over Kinley Creek is small, with only a 22 ft span. Water backs up behind the crossing but backwater from the Saluda River extends further upstream than this crossing, which may control the water levels according to the FEMA Flood Insurance Study Flood Profiles. If localized flooding occurs from Kinley Creek when the Saluda River is not at flood stage, then the railroad bridge effects will be apparent since the water surface in Kinley Creek is the starting elevation for the water surface on the tributaries. More coordination efforts for this measure would be required since the railroad company owns this bridge. The backwater impacts of the bridge upstream extend for more than 2500 ft but are downstream of the majority of reported flooding locations. Modification of this bridge was modeled to include a 57 ft span and a high point in the channel upstream of the bridge was removed.  The Figure below shows the water surface elevations surrounding the bridge and the modified bridge, without modification to the high point in the stream.




Water Surface Profiles With and Without Modifications to the Railroad Bridge

Kinley St. Andrews Road Bridge Modification

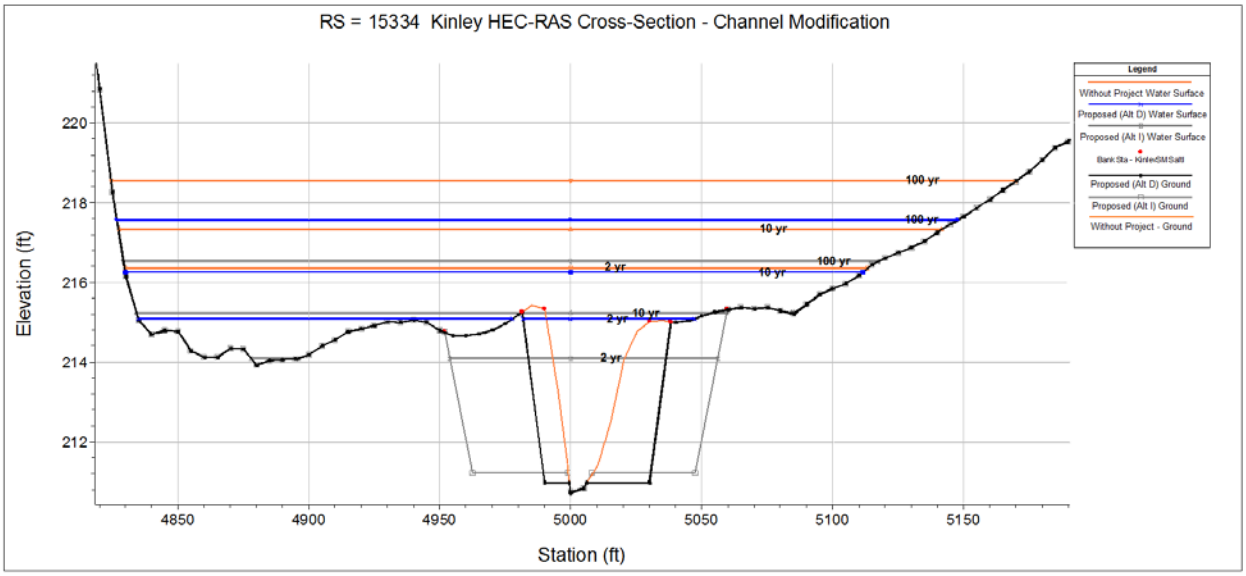
The St. Andrews Road Bridge is owned by SC DOT. A modification was proposed to expand the span from 86 ft to 112 ft. Since the downstream Railroad Bridge is not likely to be expanded as wide as this bridge, this measure was only carried forward in conjunction with modifications to the Railroad Bridge. Reductions in water surface were achieved by modifying this bridge in the Kinley model but the impacts of this bridge are small compared to those caused by the railroad bridge. St. Andrews Road is an unlikely cause of flooding upstream.

Kinley Piney Grove Road Bridge Modification

Similar to the Piney Grove Road Bridge proposed modifications along K-2, revisions to the bridge abutments were proposed to add additional capacity. The Piney Grove Road bridge was recently expanded but this measure would match the bridge with proposed channel modifications and prevent the likelihood of overtopping.

Kinley Channel Modification From Harbison Shopping Area to Saluda River

The channel of Kinley Creek was modified to increase the capacity while maintaining a low-flow channel. Utilities, sewer lines in particular, run along and cross over Kinley Creek. Just as with the K-2 channel modifications, this measure was first designed to accommodate more flow between the existing neighborhoods, and later was modified again to contain the 10-yr flood, which required that some homes were removed in conjunction with the channel modifications. The width of the modified upper channel was 40 ft, and if homes were removed the width was expanded to 85 ft. Channel modifications around Piney Grove Rd were designed to smoothly transition through the bridge. Without acquiring any homes, the proposed channel could be modified to 60 ft wide.




Kinley Channel Modification Measures

| | |
|---|---|
| Kinley | Channel Modifications along Broken Hill Road |

Channel modifications were made to Kinley Creek for the portion of channel between Broken Hill Road and Lockner Court where significant flooding has been reported. This measure was assessed as a less intensive alternative that might be more easily accomplished than some of the more expansive modifications.

| | |
|---|---|
| Kinley | Channel Modifications at Confluence with K-2 |

This measure was another less intensive alternative modeled to determine the potential for localized reductions in flooding between Piney Grove Road and where K-2 enters Kinley Creek. Repeated flooding has been reported along this portion of the creek (See photograph of flooding in Figure X). As discussed in previous measures, the utilities in close proximity to Kinley Creek complicate any modifications.

Pipe crossing Kinley Creek with collected debris, immediately upstream of K-2 confluence.


Flooding at Home on Holborn Ct.

| | |
|---|---|
| Kinley | Clearing and Grubbing |

In order to model the effect of clearing and grubbing alone, roughness coefficients were reduced. This measure provided additional channel capacity and increased velocities, which reduced the water surface elevations. This measure should occur when channel modifications are made and was not analyzed extensively as an independent measure. If construction is unlikely to occur in the near future, this measure should be performed for short-term benefits.

Fallen Tree in Kinley Creek and multiple trees with exposed roots along Kinley Creek.

**Transforming Measures into Alternatives**

After modeling all of the proposed measures, the effective measures were combined into eight alternatives for a more manageable dataset. Measures were grouped based on whether they could be realistically implemented together. A Kinley, a K-1, and a K-2 model were created for each alternative, although some models were duplicated between alternatives to isolate modifications to a smaller area. Boundary conditions were adjusted in K-1 and K-2 HEC-RAS models to incorporate the combined modification impacts obtained from the results of the Kinley HEC-RAS models through the use of a known water surface elevation. Additional alternatives were not modeled but were included for cost-benefit analysis, which included elevating structures and acquisition of structures. The final list of alternatives is provided in Table X. Individual measures could be implemented independently if funding, timing, or other constraints do not allow for a watershed-wide solution to be implemented.

# Appendix D:  Hydrologic Analysis

## *Introduction*

Amec Foster Wheeler was tasked to develop possible hydrologic solutions to address frequent flooding problems in Lexington County, South Carolina along Kinley Creek and two tributaries (K1 and K2). This project was coordinated with the United States Army Corps of Engineers (USACE), whom were tasked with developing hydraulic solutions. Proposed hydrologic improvements included retrofits to existing stormwater facilities and constructing new flood-mitigating detention ponds.

## *Original Hydrologic Model*

The Original Kinley Creek hydrologic model was developed by AECOM using USACE's Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS), Version 3.5.0. AECOM developed the model under contract with the South Carolina Department of Natural Resources (SCDNR) for the purposes of updating Digital Flood Insurance Rate Maps (DFIRMs) and Flood Insurance Studies (FIS). AECOM used the HEC-HMS model to determine the peak flood discharges into Kinley Creek and its two tributaries for the 2-, 5-, 10-, 25-, 50-, 100-yr, and 500-yr return intervals (meaning the largest expected storm event within a period of time, based on historical data). For the remainder of this report, AECOM's model will be referred to as the Original HEC-HMS model. Amec Foster Wheeler utilized the original HEC-HMS model for an in-progress flood study of Lexington County as a starting point to subsequently develop and analyze potential solutions.

The Original Kinley Creek HMS model contained 14 sub-basin elements, 9 junction elements, 8 Modified Puls routing elements, and 2 reservoir elements. Precipitation depth inputs were obtained from NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, Volume 2, Version 3, at precipitation gage station Columbia WSFO AP (ID: 381939):

Table # - Precipitation Depths

| Storm Return Interval | Precipitation Depths (Inches) |
|---|---|
| 2-year | 3.62 |
| 5-year | 4.52 |
| 10-year | 5.28 |
| 25-year | 6.39 |
| 50-year | 7.33 |
| 100-year | 8.36 |
| 500-year | 11.10 |

Curve number (CN) inputs were calculated by intersecting landuse, soils, and basin shapefiles. Basins were delineated using a digital elevation model (DEM) which was derived from Light Detection and Ranging (LiDAR). Soil Survey Geographic (SSURGO) data is publicly available from the United States Department of Agriculture (USDA), and land use data was based on National Land Cover Dataset (NLCD) 2006. AECOM grouped the NLCD land cover classes into 6 general land use types to calculate curve numbers. The NRCS Technical Release 55, Urban Hydrology for Small Watersheds, (TR-55) land use and soils relationships were then used to calculate composite CNs at each of the basins. A summary of CNs developed to support the original hydrologic model is shown below:

Table # - Original HMS Model Curve Number Summary

| Landuse Description | Soil Type | Curve Number |
|---|---|---|
| Forest | A | 33 |
| Forest | A/D | 56 |
| Forest | B | 58 |
| Forest | B/D | 68 |
| Forest | C | 72 |
| Forest | C/D | 75 |
| Forest | D | 78 |
| Open Space | A | 49 |
| Open Space | A/D | 67 |
| Open Space | B | 69 |
| Open Space | B/D | 77 |
| Open Space | C | 79 |
| Open Space | C/D | 82 |
| Open Space | D | 84 |
| Low Intensity | A | 59 |
| Low Intensity | A/D | 73 |
| Low Intensity | B | 74 |
| Low Intensity | B/D | 80 |
| Low Intensity | C | 82 |
| Low Intensity | C/D | 84 |
| Low Intensity | D | 86 |
| Medium Intensity | A | 77 |
| Medium Intensity | A/D | 84 |
| Medium Intensity | B | 85 |
| Medium Intensity | B/D | 88 |
| Medium Intensity | C | 89 |
| Medium Intensity | C/D | 91 |
| Medium Intensity | D | 92 |
| High Intensity | A | 92 |
| High Intensity | A/D | 94 |
| High Intensity | B | 94 |
| High Intensity | B/D | 95 |
| High Intensity | C | 96 |
| High Intensity | C/D | 96 |
| High Intensity | D | 96 |
| Open Water | A | 100 |
| Open Water | A/D | 100 |
| Open Water | B | 100 |
| Open Water | B/D | 100 |
| Open Water | C | 100 |
| Open Water | C/D | 100 |

| | | |
|---|---|---|
| Open Water | D | 100 |

Time of concentration (TC) values were calculated according to methods defined in TR-55. For each basin, longest flow paths were determined using a hydro-corrected terrain dataset and breaklines.

The Modified Puls method was used to calculate reach routing in the Original HEC-HMS model. Manning's equation was used to calculate initial storage-discharge curves for each routing element. The curves were incorporated into the HEC-HMS model to compute initial flows for the 2-, 5-, 10-, 25-, 50-, and 100-yr events. The initial flows were then entered into detailed HEC-RAS models of the streams to obtain more accurate storage-discharge curves. The new storage-discharge curves were then input back into the HEC-HMS models and new discharges were calculated. This process was done for 3 iterations or until the discharges differed by +/-10%.

### *Updated Hydrologic Model*

Before any proposed facilities or retrofits could be modeled, Amec Foster Wheeler updated the Original HEC-HMS model to meet the needs of this study. The original model did not include site-level details such as stormwater control facilities and pipe networks, which were necessary to include in the existing conditions hydrologic model to quantify impacts of proposed solutions.

Sub-basins in the Original HEC-HMS model were further subdivided to account for stormwater facilities and to determine the effects of sheet runoff on the peak flows in the streams. Sub-basins were divided in the Harbison Boulevard shopping area and along both K1 and K2 to accommodate stormwater infrastructure alternatives. The Harbison shopping area stormwater infrastructure GIS layer was provided by the City of Columbia, including the shopping area along Harbison Boulevard, adjacent to Kinley Creek. This data was used to delineate the drainage areas feeding into each of the stormwater ponds. Stormwater infrastructure information could not be obtained for other areas in Lexington County. Without stormwater network details for remaining areas, basins were delineated using the DEM. Sub-basins were also divided at existing structures identified using Lexington County orthoimagery, such as bridges, culverts, pond inlet and outlet locations, and stormwater pipe outlets. .

Seven (7) existing stormwater dry ponds (stormwater ponds without a permanent pool) were added to the Original HMS model. Due to the absence of formal pond names, these existing stormwater detentions ponds have been given naming conventions for the purposes of this study. The Walmart Upper, Walmart Lower, Shopping Cart, and Dick's ponds are located in the Harbison shopping area. These ponds are connected together via underground pipes and ultimately discharge into Kinley Creek. The Sam's Club pond receives runoff from the west side of the Harbison shopping area and discharges into K2. The Shadow Brook and Car Max ponds are located east of K2 and both directly discharge into K2 through underground stormwater pipes. Storage data was obtained for each of the ponds using the DEM in ESRI ArcGIS.

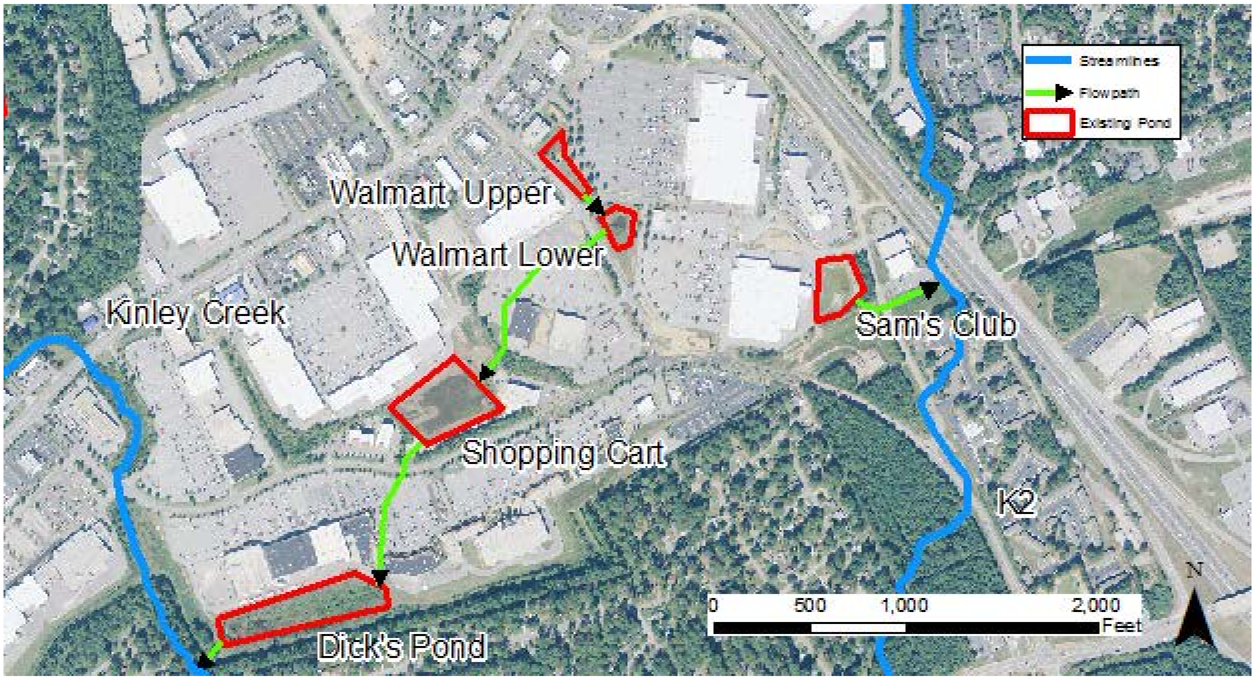


Figure #: Harbison Shopping Area Stormwater Ponds

HydroCAD was used to develop stage-discharge curves for each of the existing ponds. Storage data developed in ArcGIS was transferred into HydroCAD to produce stage-area curves. The outlet for the Car Max pond was modeled based on as-built plans provided by Lexington County. For all other ponds, Lexington County officials surveyed the outlet structures and provided that information to Amec Foster Wheeler. Once the stage-area and outlet structure information was incorporated into HydroCAD, stage-discharge curves were calculated for each of the ponds. The stage-discharge curves and stage-area curves were then added to the HEC-HMS model.

To remain consistent with the methodology used to create the Original HEC-HMS model, Amec Foster Wheeler used the land use descriptions and CN relationships created by AECOM which were outlined in Table -. The NLCD 2011 was used to more accurately reflect current land use.

Times of concentration were calculated according to the methods outlined in TR-55. Since pipe and hydraulic structure information was unavailable for most of the watershed, longest flowpaths were primarily determined based on the DEM and observations in the orthoimagery.

The addition of new junctions, stormwater ponds, and sub-basins in the HEC-HMS necessitated the development of new routing curves for Kinley Creek, K1, and K2. Preliminary HEC-RAS models for the streams were provided by USACE. A wide range of flows were entered into these models to produce storage-discharge curves for each of the stream segments. Using the Modified Puls routing method, these storage-discharge curves were then inserted into the HMS model.

## *Identification and screening of potential mitigation measures*

Lexington County provided a survey of flooded homes along Kinley Creek, K1, and K2. Each surveyed home was given a relative score based on the reported frequency of flooding and damage severity. Amec Foster Wheeler developed scoring system is shown in Table-. The flows from the updated existing conditions HEC-HMS model were incorporated into the preliminary HEC-RAS model to produce floodplains for the 2-, 5-, 10-, 25-, 50- and 100-yr return intervals. The surveyed homes and floodplains were then georeferenced using ArcGIS. As expected, the homes that experienced the most frequent and severe flooding fell within the floodplains of higher-frequency storms.

Flood Damage Levels Reported

| Score | Description |
|---|---|
| 0 | No flooding reported |
| 1 | Occasional yard flooding |
| 2 | Frequent yard flooding |
| 3 | Occasional flooding to building crawl space |
| 4 | Frequent flooding to building crawl space |
| 5 | Very frequent flooding resulting in damage to the crawl space, basement, garage, and first floor |

Retrofits to the existing stormwater ponds and construction of new flood-mitigating ponds were proposed as potential hydrologic solutions. These proposed ponds were modeled and iterated upon in HEC-HMS to determine their effects on peak discharges within Kinley Creek, K1, and K2. Figure X in Appendix X shows all the existing and proposed pond locations at were modeled for this study.

After the proposed hydrologic improvements were modeled in HEC-HMS, the resulting flows were used as inputs in HEC-RAS to generate floodplains. The proposed condition floodplains were compared to existing conditions floodplains to assess the number of properties protected from flooding based on proposed improvements.

## *Retrofits to existing ponds in Harbison shopping area*

The initial evaluation focused on retrofits to existing stormwater pond outlet structures, particularly in the Harbison shopping area. County staff expressed concern that flooding increased after the development of the Harbison shopping area. County staff also noted that the ponds in the Harbison shopping area rarely filled during rain events, which suggested that the pond outlets were oversized, resulting in the underutilization of the available storage.

Upon completion of the updated existing conditions HMS model, retrofits to the existing ponds were modeled for the 2-, 5-, 10-, 25-, 50-, and 100-yr events to determine the potential impact of modifications to the Harbison stormwater ponds on the peak discharges in Kinley Creek, K1, and K2. Table # shows the peak volumes in each of the ponds for the 2-, 10-, and 100-year events. The model also showed peak outflow at each pond were between 23% and 77% less than the peak inflow for the 100-yr recurrence intervals. These results indicated that the ponds were utilizing storage as intended not necessarily oversized as suggested. Furthermore, it was determined that the existing Harbison shopping area stormwater facilities do not have the potential to significantly reduce peak flows in the watershed. This is unsurprising because the drainage area to Kinley Creek upstream of the Harbison shopping area is 3.04 square miles, and total drainage area to the ponds in the Harbison shopping area is 0.26 square miles. It was determined that retrofitting existing stormwater ponds in the Harbison shopping area would not significantly reduce downstream flooding and was excluded from further analyses. A summary of the peak discharges in Kinley Creek immediately downstream of the Harbison shopping area are shown below:

Table #: Peak Volumes for the Harbison Shopping Area Ponds

| Pond | Maximum Storage Volume (ac-ft) | 2-yr Peak Volume (ac-ft) | 10-yr Peak Volume (ac-ft) | 100-yr Peak Volume (ac-ft) |
|---|---|---|---|---|
| Walmart Upper | 0.8 | 0.4 | 0.7 | 0.8 |
| Walmart Lower | 5.5 | 2.2 | 3.3 | 4.9 |
| Shopping Cart | 31.2 | 7.5 | 13.2 | 25.1 |
| Dick's Pond | 26.3 | 5.9 | 8.2 | 14.3 |

Table 3: Peak Discharge at the Harbison shopping area

| Storm Return Interval | Peak Discharge from Harbison shopping area (cfs) | Peak Discharge in Kinley Creek upstream of Harbison shopping area (cfs) | Peak Discharge in Kinley Creek downstream of Harbison shopping area Outlet (cfs) |
|---|---|---|---|
| 2-yr | 38.2 | 904.7 | 948.6 |
| 5-yr | 55.4 | 1306.1 | 1366.7 |
| 10-yr | 70.1 | 1637.5 | 1714.7 |
| 25-yr | 86.4 | 2113.4 | 2212.1 |
| 50-yr | 97.6 | 2511.8 | 2625.1 |
| 100-yr | 108.0 | 2947.8 | 3077.5 |

## *Proposed Ponds*

Four new storage ponds were proposed in order to reduce peak flows along Kinley Creek, K1, and K2. Preliminary stage-storage curves were developed by Amec Foster Wheeler in AutoCAD. Beginning with the updated existing conditions model, HEC-HMS models were created for each of the proposed ponds.

The ponds were modeled as either offline or inline structures. For offline ponds, flow from the stream is diverted into the pond once the water elevation reaches an elevation higher than the inlet weir. For inline ponds, all stream flow enters the storage pond.

The “outlet structures” method was selected to model proposed pond outlets directly within HMS. The HMS “diversion creation tool” was used to model offline pond lateral weirs. Once the weir length and elevation are built into HEC-HMS, the diversion tool utilizes stream rating curves developed in HEC-RAS to calculate the amount of flow diverted into the ponds during a storm event. Inlet and outlet structure elevations and sizes were iterated upon in HEC-HMS to arrive at preliminary pond designs with appropriate reductions in flow during 2-, 5-, 10-, 25-, 50- and 100-yr return intervals.

Reductions in flow may not directly translate to significant reductions in the floodplain extents. Reductions in flood elevations are the primary goals, as analyzed in HEC-RAS. Inputs for calculating flood elevations in HEC-RAS include channel geometry, obstructions such a bridges, and flow velocity in addition to peak flow. See Section X for results on how these proposed ponds affected the peak flood elevations.

## K1 Offline Pond

The proposed pond on K1 was modeled in HEC-HMS as an offline facility. Flow from K1 enters the pond through a lateral weir. Peak flow reductions are therefore dependent on the water elevation within the channel. Despite achieving high peak flow reductions, the pond had minimal effect on reducing peak flows within K1 for the lower return intervals. However, greater reductions within K1 were achieved for the higher return intervals. This trend is illustrated in Figures # to #. This is due to higher water surface elevations in the channel, resulting in more flow overtopping the lateral weir. This proposed solution was helpful in reducing discharges immediately downstream of the proposed pond. However, the model showed that the benefits from decreased flow rates quickly diminish further downstream as runoff from other areas are introduced into the channel. The K1 offline pond is located at the upstream end of K1 with a total drainage area of 76.2 acres. In comparison, the drainage area downstream of the K1 offline pond is 206.3 acres. Thus the majority of the K1 discharge will not enter the pond. While the proposed K1 offline pond effectively reduces flooding risk immediately downstream of the pond outlet, areas further downstream are still subject to flooding.

K1 Offline Pond Design:

- Bottom elevation = 256’.
- Top elevation = 26’.
- Inlet is a 100’ lateral weir at elevation 260’.
- Outlet is a 1’ diameter orifice at elevation 257.5’.
- The emergency spillway is 75’ long at elevation 260’.

Table #: K1 Offline Pond Peak Flows

| Storm Return Interval | Peak Inflow (cfs) | Peak Outflow (cfs) | Reduction (%) |
|---|---|---|---|
| 2-year | 66.6 | 0 | 100 |
| 5-year | 115.2 | 2.7 | 98 |
| 10-year | 158.6 | 4.4 | 97 |
| 25-year | 219.9 | 15.7 | 93 |
| 50-year | 273 | 93.5 | 66 |
| 100-year | 332.3 | 184.4 | 45 |

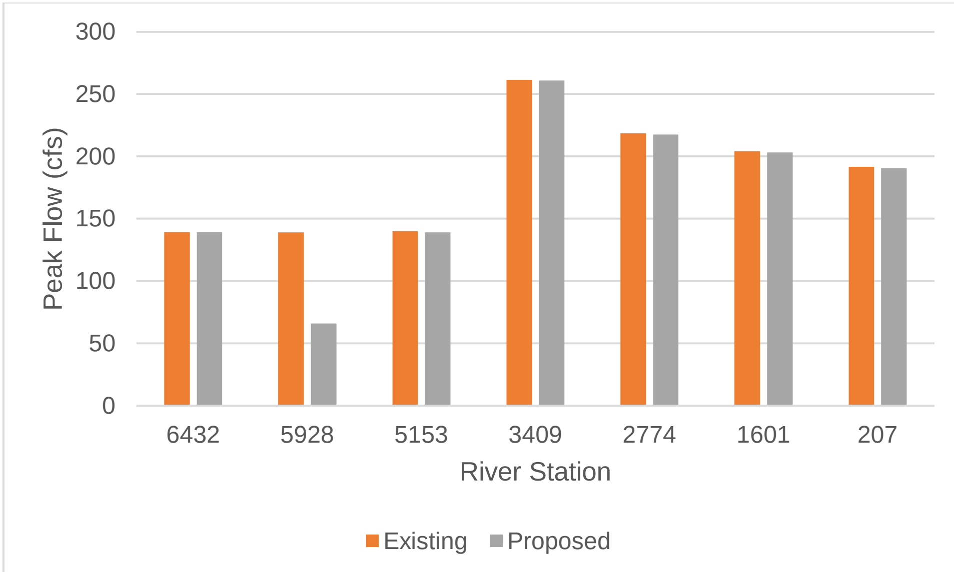



Figure #: 2-Year Peak Flows on K1

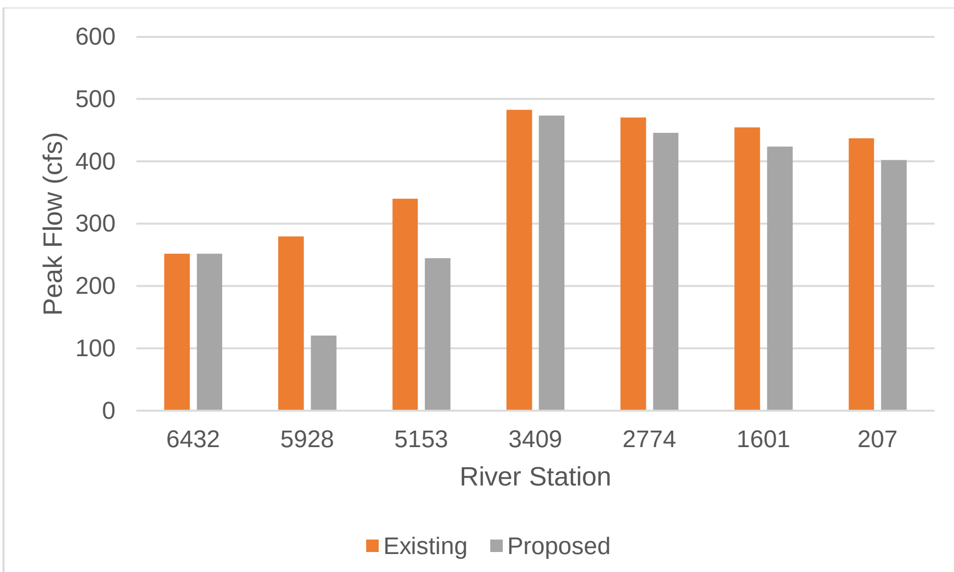



Figure #: 10-year Peak Flows on K1

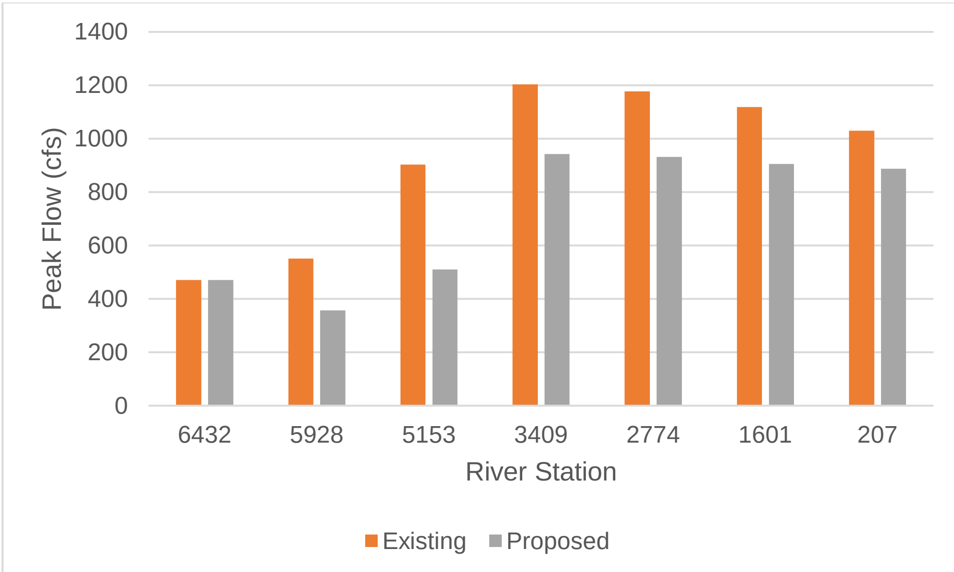



Figure #: 100-year Peak Flows on K1

For Figures # to #, the "River Station" denotes distance in feet from the confluence of K1 and Kinley Creek. Each River Station corresponds with the location of a HEC-HMS junction. The inlet and outlet for the K1 Offline Pond correspond with River Stations 6432 and 5928, respectively.

The revised peak flows for each event were added to the HEC-RAS existing condition model to determine whether the reductions would result in a lowering of the water surface along K1. Reductions were not achieved in more frequent storm events, but were up to 1' on the 100-yr return interval storm as shown in Figure #. This measure was carried forward for thorough cost-benefit analysis due to the potential reduction in water surface elevations for large storms.

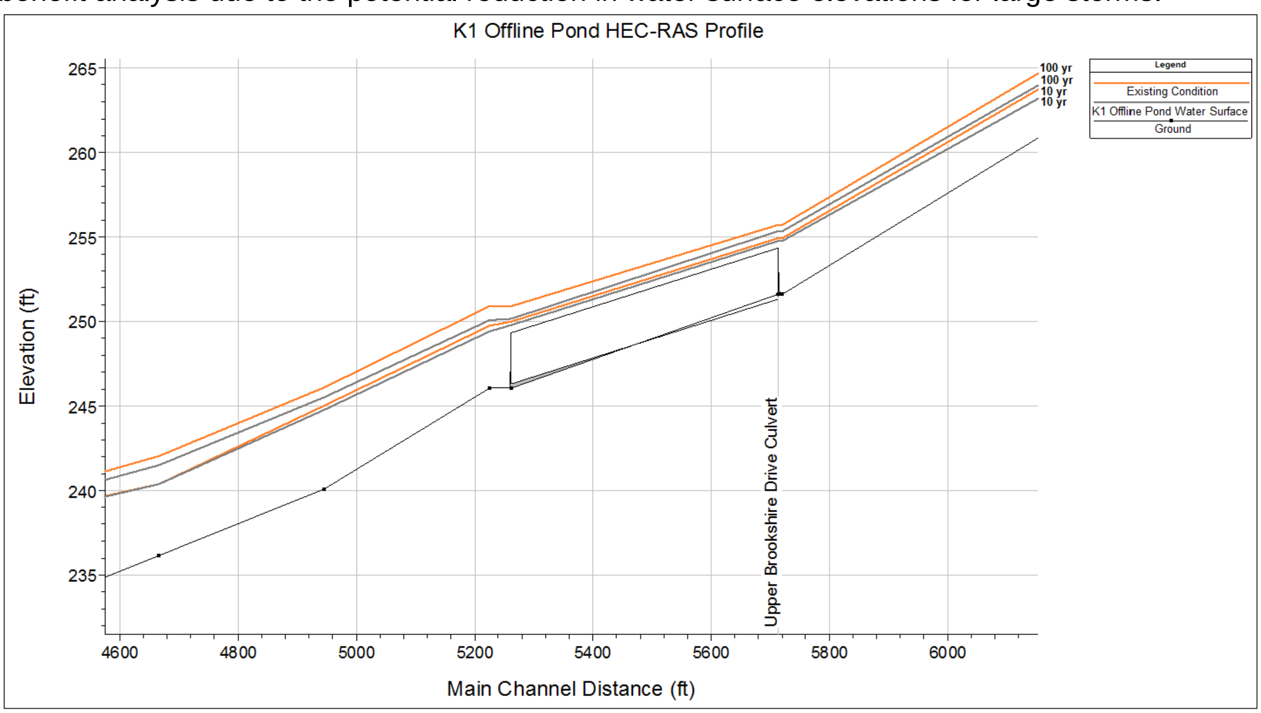


Figure #: 10-yr and 100-yr Water Surface Profile on Upper K1 with Offline Pond

## K2 Inline Pond

The impacts of both an offline and an inline pond were considered for K2. The results from the HEC-HMS model for the offline conditions were similar to the results to the offline pond on K1. However, the K2 offline pond was deemed ineffective based on the number of houses still inundated during higher-frequency events.

When modeled as an inline pond, improvements were observed during smaller events. However, the effectiveness decreased during the larger storm events. This option may be helpful in reducing flooding to homes immediately downstream of the pond. However, attenuation benefits are only realized approximately 1,500’ downstream. Beyond 1,500’ downstream of the K2 Inline Pond, reductions in flow rates associated with the pond become negligible. Initial model runs showed the pond overtopping during the larger events with the stage-storage curve created in AutoCAD. Outlet sizes were increased but this failed to prevent overtopping of the pond. It was determined that the banks of the pond would need to be raised an additional 4 feet to contain the 100-yr event. The raised banks were included as part of the final model and proposed design.

K2 Inline Pond Design:

- Bottom elevation = 226’.
- Top elevation = 234’.
- The lower outlet consists of two 6” diameter orifices at elevation 226.5’.
- The upper outlet consists of two 6” diameter orifices at elevation 228.5’.
  The emergency spillway is a 100’ long at elevation = 230.5’.

Table #: K2 Inline Pond Peak Flows

| Storm Return Interval | Peak Inflow (cfs) | Peak Outflow (cfs) | Reduction (%) |
|---|---|---|---|
| 2-year | 590.9 | 306.9 | 48 |
| 5-year | 837.1 | 626.7 | 25 |
| 10-year | 1050.3 | 891.6 | 15 |
| 25-year | 1366.9 | 1254.2 | 8 |
| 50-year | 1637.5 | 1541.7 | 6 |
| 100-year | 1934.5 | 1844.2 | 5 |

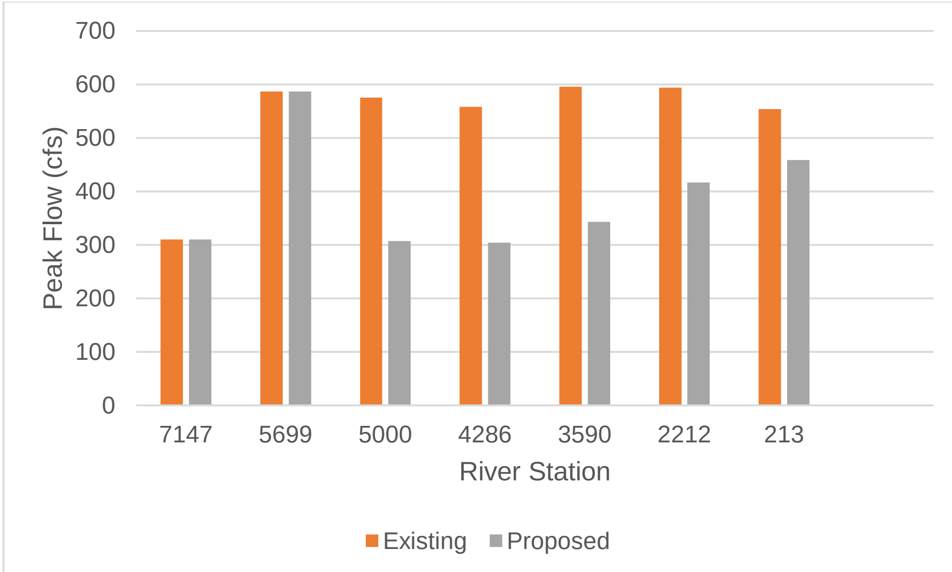



Figure #: 2-year Peak Flows on K2

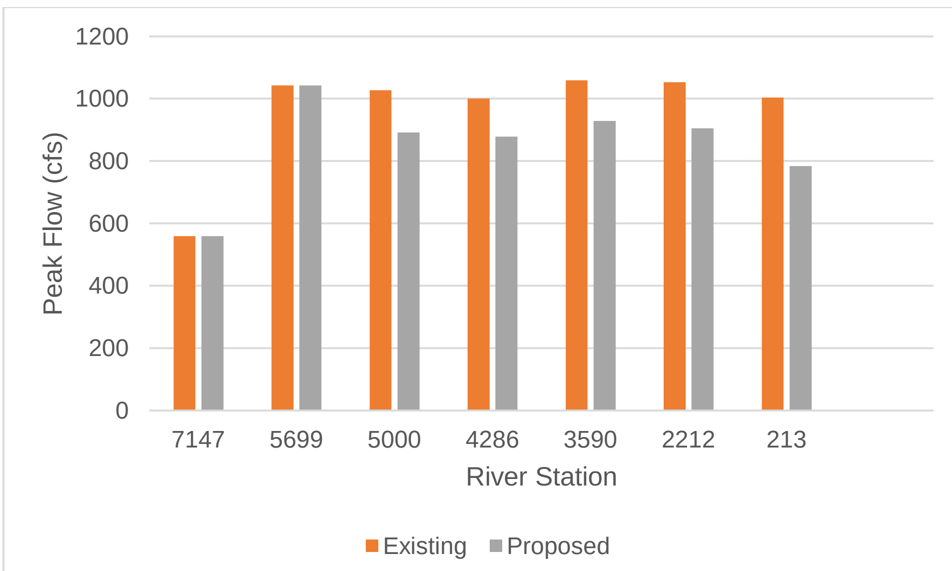



Figure #: 10-year Peak Flows on K2

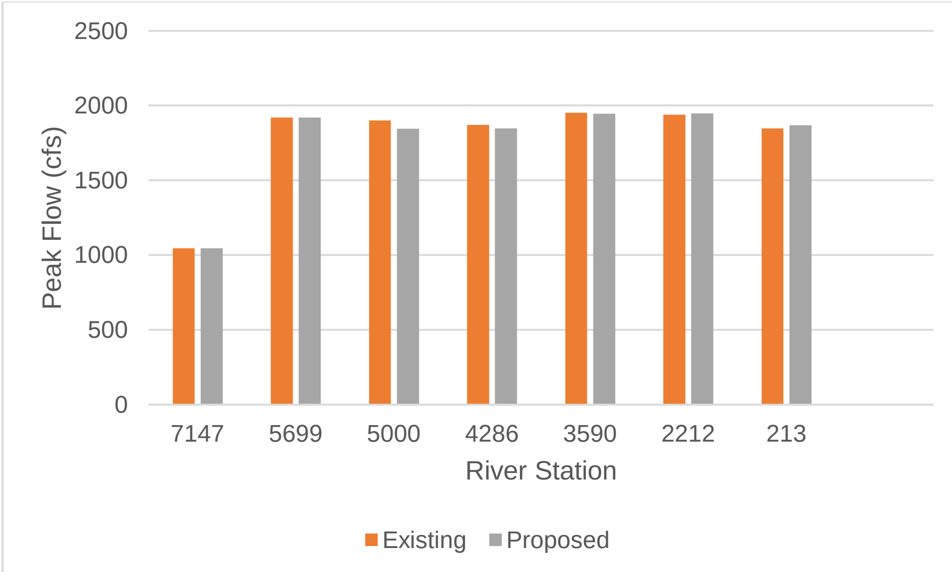


Figure #: 100-year Peak Flows on K2

For Figures # to #, the River Station denotes distance in feet from the confluence of K2 and Kinley Creek. Each River Station corresponds with the location of a HEC-HMS junction. The inlet and outlet for the K2 Inline Pond correspond with River Stations 5699 and 5000, respectively.

The revised peak flows for each event were added to the HEC-RAS existing condition model to determine whether the reductions would result in a lowering of the water surface along K2. Additionally, this pond was added into the HEC-RAS geometry with a rating curve (stage-flow relationship from HEC-HMS) at the downstream location, River Station 4500. Reductions were not achieved in the 100-yr return interval storm, but were observed in more frequent storm events as shown in Figure #. This measure was carried forward for thorough cost-benefit analysis due to the potential 0.5’ reduction in water surface elevations for frequent storms.

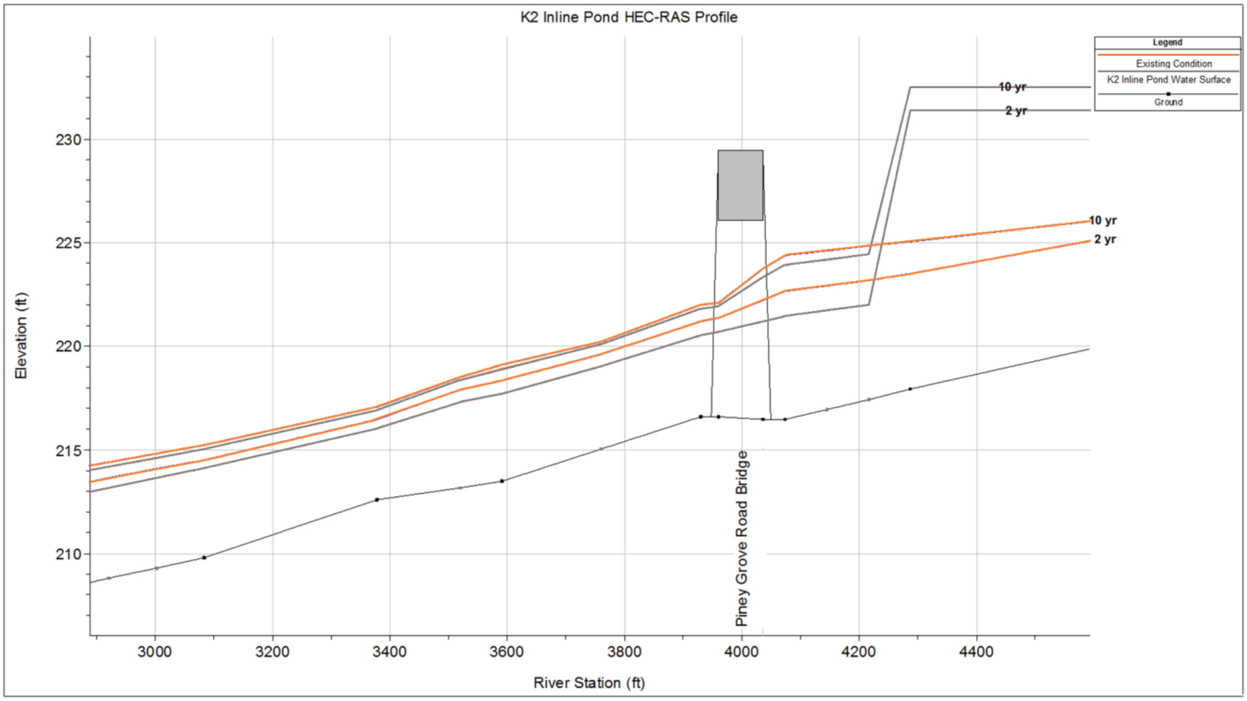



Figure #: 2-yr and 10-yr Water Surface Profile on K2 with Inline Pond

## K2 Tributary Inline Pond

In addition to the inline pond on K2, the construction of a pond along the unnamed tributary to K2 was also proposed. The K2 tributary pond would be located 150 feet northwest of the existing Shadow Brook pond. This facility would receive runoff primarily from I-26, secondary roads, and nearby parking lots. Stormwater discharge from the pond would be directed to the Shadow Brook pond before traveling through underground pipes and discharging into K2.

The K2 tributary pond was modeled as an inline pond in HEC-HMS. Like the K2 inline pond, peak reductions were more pronounced for smaller storm events. The results of the HEC-HMS showed peak reductions 97% and 75%, for the 5- and 100-yr events, respectively.
Despite achieving significant reductions along K2 tributary itself, the K2 tributary pond did not significantly reduce the peak flows in K2, as illustrated in Figures # -#. The K2 tributary has a drainage area of 0.17 square miles; by comparison, the drainage area of K2 upstream of the tributary is 1.05 square miles – nearly 10 times larger. Thus, the K2 tributary contributes only a small portion of the total flow into K2. As a result, the K2 tributary inline pond had minimal impact on the peak flows within K2.

The revised peak flows for each event were added to the HEC-RAS existing condition model to determine whether the reductions would result in a lowering of the water surface along K2. The largest reduction, only 0.15', was observed in a 2-yr event immediately upstream of Nottingham Road. After analyzing the model results, this flood mitigation measure was eliminated from consideration due to the minimal benefits achieved.

K2 Tributary Design:

- Bottom elevation = 240'.

- Top elevation = 246’.
- The outlet is a 1’ diameter orifice at elevation 241’.
- The emergency spillway is 50’ long at elevation 244.5’.

Table #: K2 Tributary Inline Pond Peak Flows

| Storm Return Interval | Peak Inflow (cfs) | Peak Outflow (cfs) | Reduction (%) |
|---|---|---|---|
| 2-year | 108.1 | 4.0 | 96 |
| 5-year | 154.2 | 5.3 | 97 |
| 10-year | 194.2 | 6.3 | 97 |
| 25-year | 253.6 | 13.3 | 95 |
| 50-year | 304.3 | 39.8 | 87 |
| 100-year | 359.9 | 93.1 | 74 |

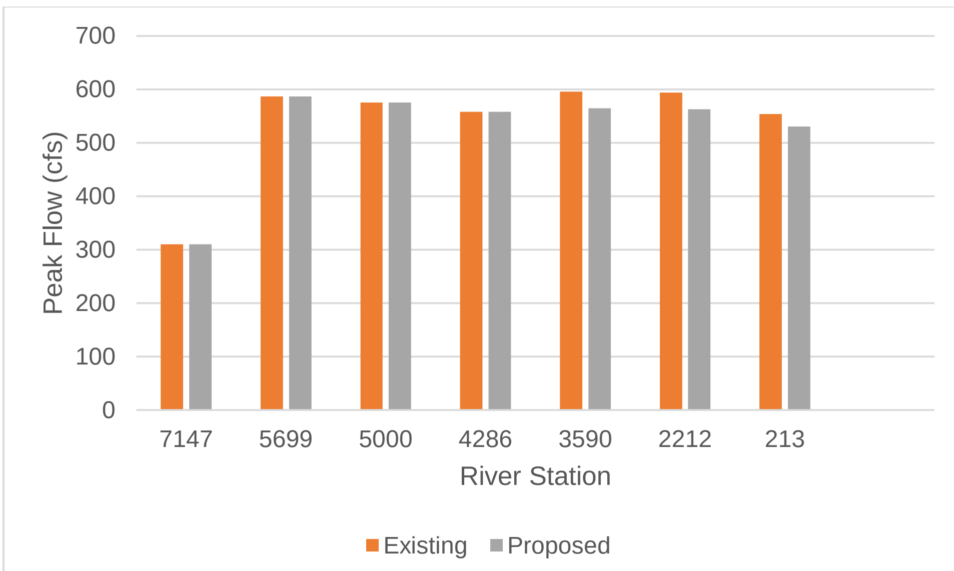



Figure #: 2-year Peak Flows on K2

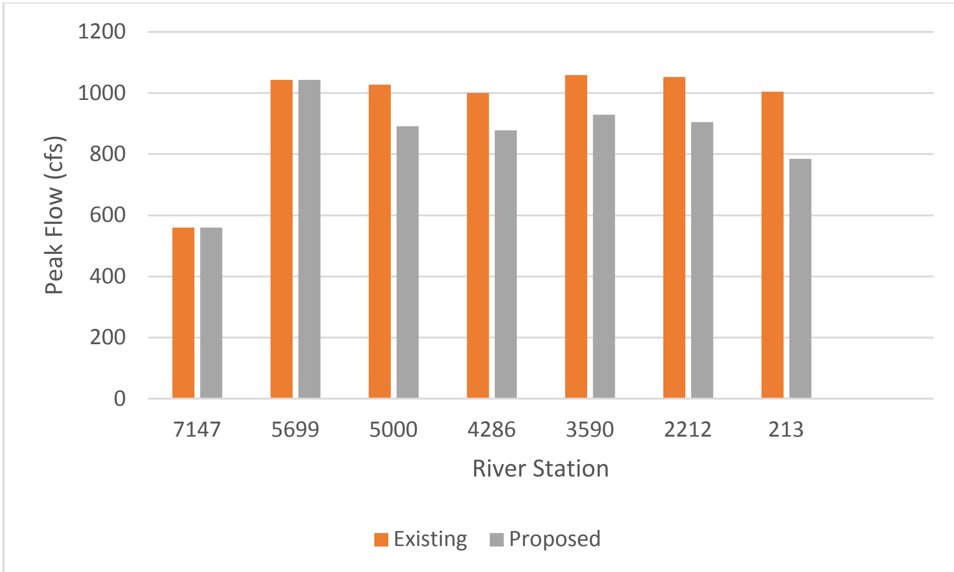



Figure #: 10-year Peak Flows on K2

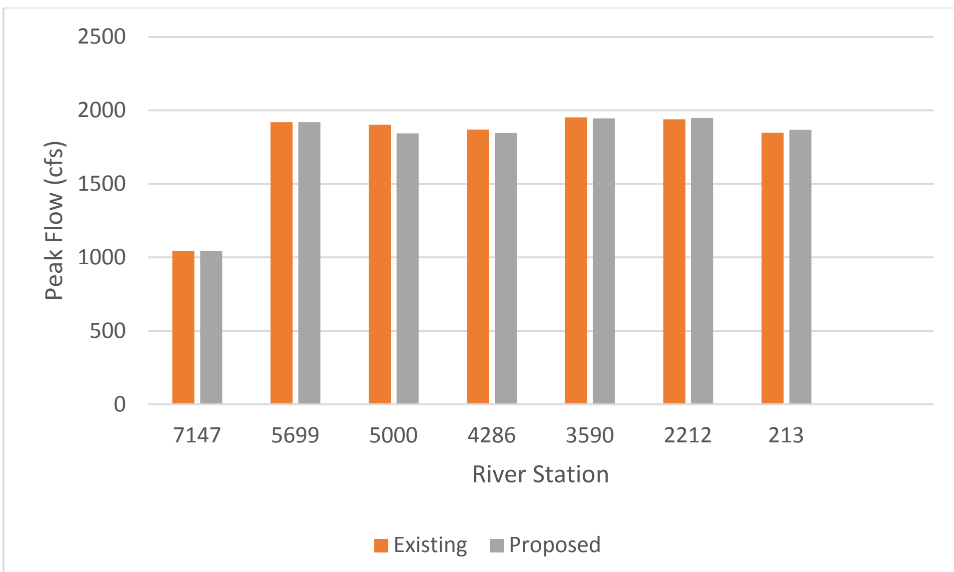



Figure #: 100-year Peak Flows on K2

For Figures # to #, the River Station denotes distance in feet from the confluence of K2 and Kinley. Each River Station corresponds with the location of a HEC-HMS junction. The inlet and outlet for the K2 Tributary Inline Pond correspond with River Stations 5699 and 5000, respectively.

## Offline Pond on Kinley Creek

The proposed pond on Kinley Creek was located at a decommissioned wastewater pond, 120 feet north of Piney Grove Road. Given the larger drainage area, peak flows along Kinley Creek are much higher than those in the tributaries. An inline pond on Kinley Creek would require a significantly larger volume than what is currently available. Therefore, the Kinley Creek pond was modeled as an offline structure.

The inlet to the pond was modeled as a 5’ lateral weir. This relatively short weir length was necessary to prevent overtopping of the pond at the higher return intervals. Through the use of HEC-HMS, it was determined that although reductions were high for flows diverted into the pond, only a small fraction of the total flows within Kinley Creek actually entered the facility through the lateral weir. As a result, the pond had minimal impact in reducing peak flows within Kinley Creek. This indicates that there is not enough storage available within the pond to significantly reduce peak flows within Kinley Creek. In addition, the proposed site is located downstream of the majority of the problem areas. Reductions to the floodplain extents downstream would only benefit a small number of homes. These factors led Amec Foster Wheeler to conclude that the construction of this pond would not be a viable option.

Kinley Creek Pond Design:

- Bottom elevation = 202’.
- Top elevation = 207’.
- The inlet is a lateral weir at elevation 202’ with a length of 5’.
- The outlet is a 2’ diameter orifice at elevation 202’.

Table #: Kinley Creek Offline Pond Peak Flows

| Storm Return Interval | Peak Inflow (cfs) | Peak Outflow (cfs) | Reduction (%) |
|---|---|---|---|
| 2-year | 33.2 | 2.1 | 94 |
| 5-year | 239.7 | 55.4 | 77 |
| 10-year | 284.6 | 70.1 | 75 |
| 25-year | 349.4 | 86.4 | 75 |
| 50-year | 163.8 | 33.3 | 80 |
| 100-year | 209.4 | 39.1 | 81 |

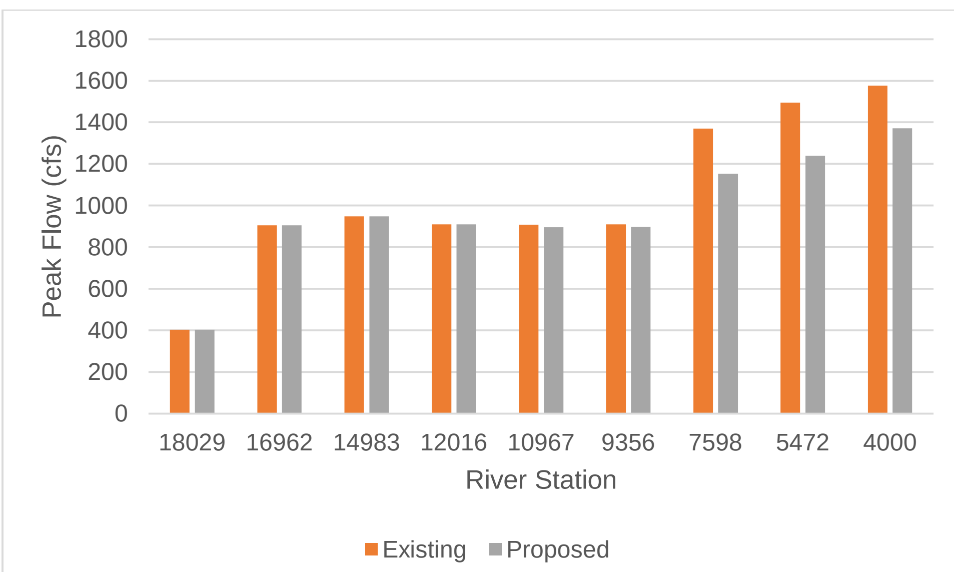



Figure #: 2-year Peak Flows on Kinley Main

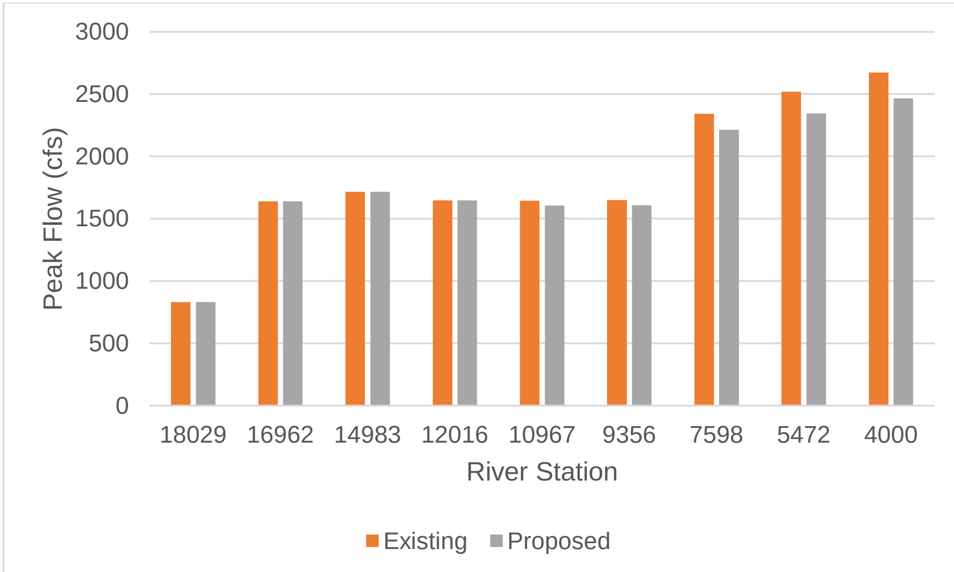



Figure #: 10-year Peak Flows on Kinley Main

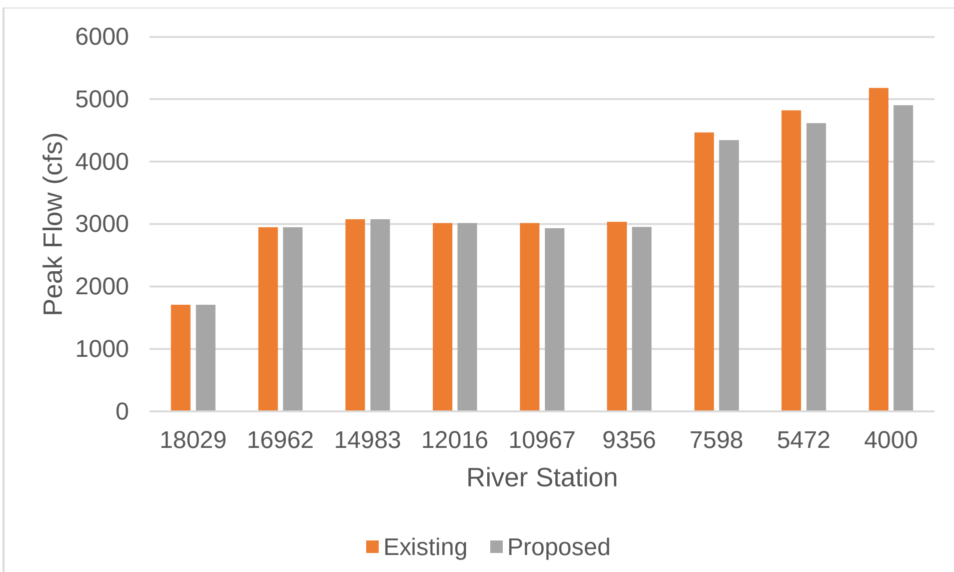



Figure #: 100-year Peak Flows on Kinley Main

## Retrofits to Existing Upstream Kinley Ponds

Two existing wet ponds located on Kinley Creek presented a possible opportunity for significant flow reductions. In the Original HEC-HMS model, the west and east ponds are identified as Beaverdam Road Dam and BAS605, respectively. Beaverdam Road Dam is located upstream of Beaverdam Road and BAS605 is located upstream of Archers Lane (see Figure Existing and Proposed Ponds Map). These ponds have available storage and treatment area to impact flooding. Therefore, lowering the normal pool and retrofitting the pond outlets provides additional storage for flood control storage. The Original HEC-HMS model included storage and outlet information for these ponds. Using those details, a new HEC-HMS model was created to determine the hydrologic impacts of lowering the normal pool elevations of each pond by one foot and adjusting the pond outlet to take advantage of additional storage.

The results of the model showed slight reductions in flows and minimal reductions in flooding. Building additional storage into these ponds is possible but may negatively impact recreational amenities in the area. Homes, docks, parks, and commercial properties exist along the pond shorelines. Modifications to the ponds would require community approval, and detailed analyses would need to be performed to ensure that any changes would not shift flooding problems elsewhere. Due to these restrictive factors, it was determined that utilizing the existing upstream Kinley ponds for new flood storage would not likely be viable.

Table #: BAS504 (East Pond) HEC-HMS Parameters

| | Existing | Proposed |
|---|---|---|
| Bottom Elevation (ft) | 245 | 244 |
| Orifice Outlet Elevation (ft) | 247 | 246 |
| Orifice Outlet Area ($ft^2$) | 96 | 48 |
| Dam Top Elevation (ft) | 259 | 259 |
| Dam Top Length (ft) | 800 | 800 |

Table #: Beaverdam Road Dam (East Pond) HEC-HMS Parameters

| | Existing | Proposed |
|---|---|---|
| Bottom Elevation (ft) | 244 | 243 |
| Spillway Elevation (ft) | 244 | 243 |
| Spillway Length (ft) | 35 | 25 |
| Dam Top Elevation (ft) | 250.5 | 250.5 |
| Dam Top Length (ft) | 350 | 350 |

Table #: BAS504 (East Pond) Peak Discharges

| Storm Return Interval | Existing Peak Outflow (cfs) | Proposed Peak Outflow (cfs) | Percent Difference (%) |
|---|---|---|---|
| 2-year | 467.7 | 425 | 9 |
| 5-year | 627.7 | 563.7 | 10 |
| 10-year | 731 | 667.1 | 9 |
| 25-year | 880.7 | 779.2 | 12 |
| 50-year | 1001.3 | 871.9 | 13 |
| 100-year | 1110.8 | 956.8 | 14 |

Table #: Beaverdam Road Dam (West Pond) Peak Discharges

| Storm Return Interval | Existing Peak Outflow (cfs) | Proposed Peak Outflow (cfs) | Percent Difference (%) |
|---|---|---|---|
| 2-year | 340.3 | 331.2 | 3 |
| 5-year | 525.1 | 494.3 | 6 |
| 10-year | 703.9 | 647.2 | 8 |
| 25-year | 959.6 | 876.9 | 9 |
| 50-year | 1185.9 | 1071.6 | 10 |
| 100-year | 1447.3 | 1299 | 10 |

## *Conclusions*

Of the proposed solutions, the construction of the K1 offline and K2 inline ponds were determined to be the most viable options. However, the results of the HEC-HMS models show that these facilities alone cannot completely eliminate flooding for many affected properties - they only reduce flooding on affected properties immediately downstream of the ponds. In order to further mitigate flooding in the Kinley Creek watershed, construction of these facilities must occur in conjunction with hydraulic improvements.

# Appendix E: Residential Flooding History Questionnaire

Submit Form

Lexington County

**Residential Flooding History Questionnaire**

Property Address: ______________________________________________________

1. Has your home or property ever been flooded or had a water problem? ☐ Yes ☐ No

   1f "yes," please complete this entire questionnaire.

   If "no", please complete questions 2 and 3.

2. Have you ever felt your home was in danger of flooding by rising water? ☐ Yes ☐ No

3. How long have you lived at this property? Since ____________________ (MM/YYYY)

4. How many times did your property flood since you moved there? ____________

   Please list any dates or years that flooding occurred: ______________________ ,

______________________, ______________________, ______________________ ,

______________________, ______________________, ______________________ ,

______________________, ______________________, ______________________ ,

5. Where did you get water and how deep was it (May select more than one)?

   ☐ In basement: _________________deep.

   ☐ In crawl space: __________________deep.

   ☐ In first floor: ________________deep.

   ☐ Water kept out of house by sandbagging, sewer valve or other protective measure.

   ☐ In yard only.

   ☐ In other structures on the property: ___________________ deep.

   Other comments on location of flooding: ____________________________________

   ______________________________________________________________________

6. What do you feel was the cause of the flooding (May select more than one)?

   ☐ Drain backup at street

   ☐ Drain backup inside house

   ☐ Overbank flooding from River/Creek from storm water

   ☐ Overbank flooding from Reservoir

   ☐ Urban runoff/storm water from street/surrounding land

   ☐ Other: ___________________________________________________________

7. Do you have any protective measures in place (i.e. sandbags, sump pumps, retaining walls, etc.)?

   ☐ Yes, I have _________________________________________________ (Describe)

   ☐ No

8. Which of these impacts to infrastructure affected you in times of flooding (May select more than one)?

- ☐ Road closures
- ☐ Loss of power
- ☐ Loss of water
- ☐ Loss of cell phone service
- ☐ Loss of home telephone service
- ☐ Other: ______________________________________________

9. Do you have any high water marks on structures, or photographs, video or other physical evidence of flooding impacts? ☐ Yes ☐ No

If "yes," we would appreciate any copies of documentation that you can provide along with this questionnaire in order to help with our investigation.

10. How many flooding events have resulted in needed repairs to your property? ____________

11. What was the breakdown of repairs for each major flooding incident (add additional sheets if needed)?

a. Date of flood: ______________________ Total cost of repairs: $___________

Repairs needed: ________________________________________________________

________________________________________________________________________

b. Date of flood: ______________________ Total cost of repairs: $___________

Repairs needed: ________________________________________________________

________________________________________________________________________

c. Date of flood: ______________________ Total cost of repairs: $___________

Repairs needed: ________________________________________________________

________________________________________________________________________

Grand Total (Cost of all repairs) $ ______________

12. Anything else you would like to mention about flooding at your property?

Signature _____________________________________________________ Date ____________

Contact Information (Optional): Phone ( ) -

Email ______________________________________________

**We appreciate your valuable contribution to this study!** Please return this form by email or mail to Chris Stone, CFM (CSTONE@lex-co.com), Floodplain Manager, County of Lexington, 212 S. Lake Drive, Lexington, SC 29072

# Appendix F:  Flood Damage Analysis

# Flood Damage Analysis

## *Introduction*

In order to quantitatively compare flood mitigation alternatives, Amec Foster Wheeler used GIS tools to assess potential flood-related losses (in $USD) associated with each alternative. Building footprint and first floor elevation (FFE) data was provided by Lexington County staff, and USACE provided HEC-RAS water surface profile data for each alternative. Using FFE data in tandem with HEC-RAS flood profile results, Amec Foster Wheeler was able to assess the effectiveness of each alternative. Structural and contents damages to buildings within the floodplain of each storm for each alternative were estimated using depth-damage curves. Please note that damage estimates in this section include multiple assumptions and are only intended to serve as a consistent basis for evaluating and comparing the alternatives, and do not take into account the levels of uncertainty in the various datasets.

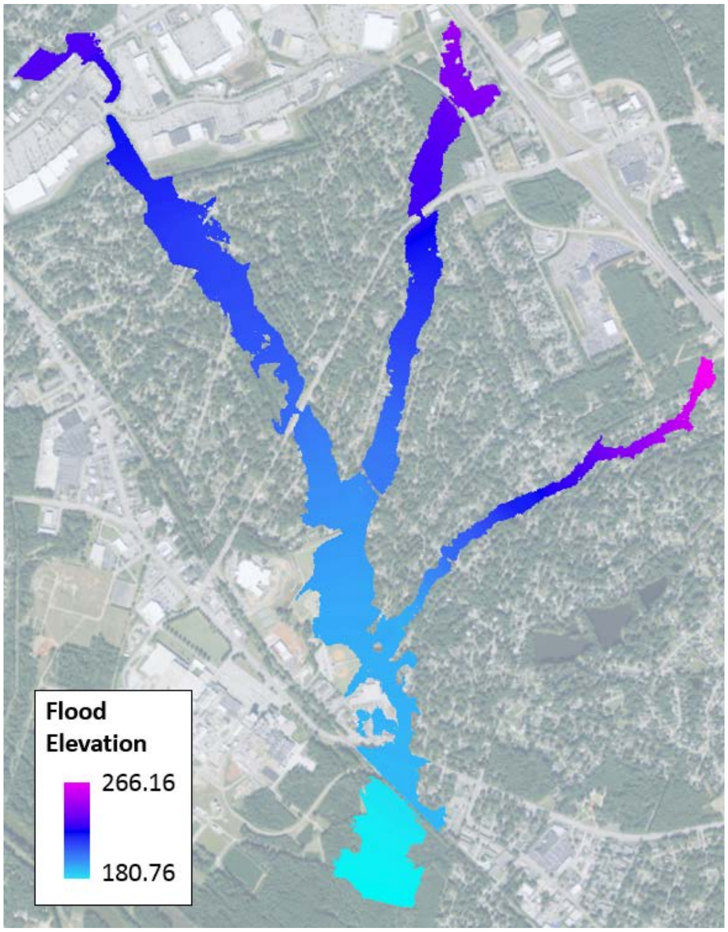
## *Process*

### First Floor Elevation (FFE) Survey

Draft existing conditions floodplain polygons were used to identify structures adjacent to K1, K2, and Kinley Creek with high potential for flooding. Buildings located within the 100-year floodplain were identified and the set of at-risk buildings was provided to Lexington County as a shapefile. Lexington County staff then performed first floor elevation (FFE) surveys at the identified buildings and populated the GIS layer with FFE data for each building. A total of 248 buildings were surveyed. The FFE data enabled Amec Foster Wheeler to compare actual building elevations to modeled flood elevations. Since it is possible for a building to fall within a mapped floodplain but remain perched above the flood elevation, FFE data is used to more accurately assess which buildings are likely to be damaged by different storm events.

### Water Surface Grid Generation

To compare flood elevations to individual building FFEs, Amec Foster Wheeler generated water surface grids for K1, K2, and Kinley Creek. USACE provided six (6) sets of HEC-RAS water surface profiles (2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr) for eight different alternatives (A, C, D, E, F, G, H, I). Alternatives B and J were not assessed for flood damages using this process since neither included any hydrologic or hydraulic modifications (alternative B includes acquisition only, and alternative J raises homes above the base flood elevation). A total of 48 water surface grids were generated using automated processes. An example water surface grid is shown below.




Water Surface Grid for Alternative A (Without Project), 100-yr Return Interval

## Flood Depths

Amec Foster Wheeler developed a GIS-based process to compare individual building first-floor elevations to adjacent flood elevations. This process was automated using the Python programming language in order to quickly calculate flood depths at all affected buildings for 48 different combinations of alternatives and storm events.

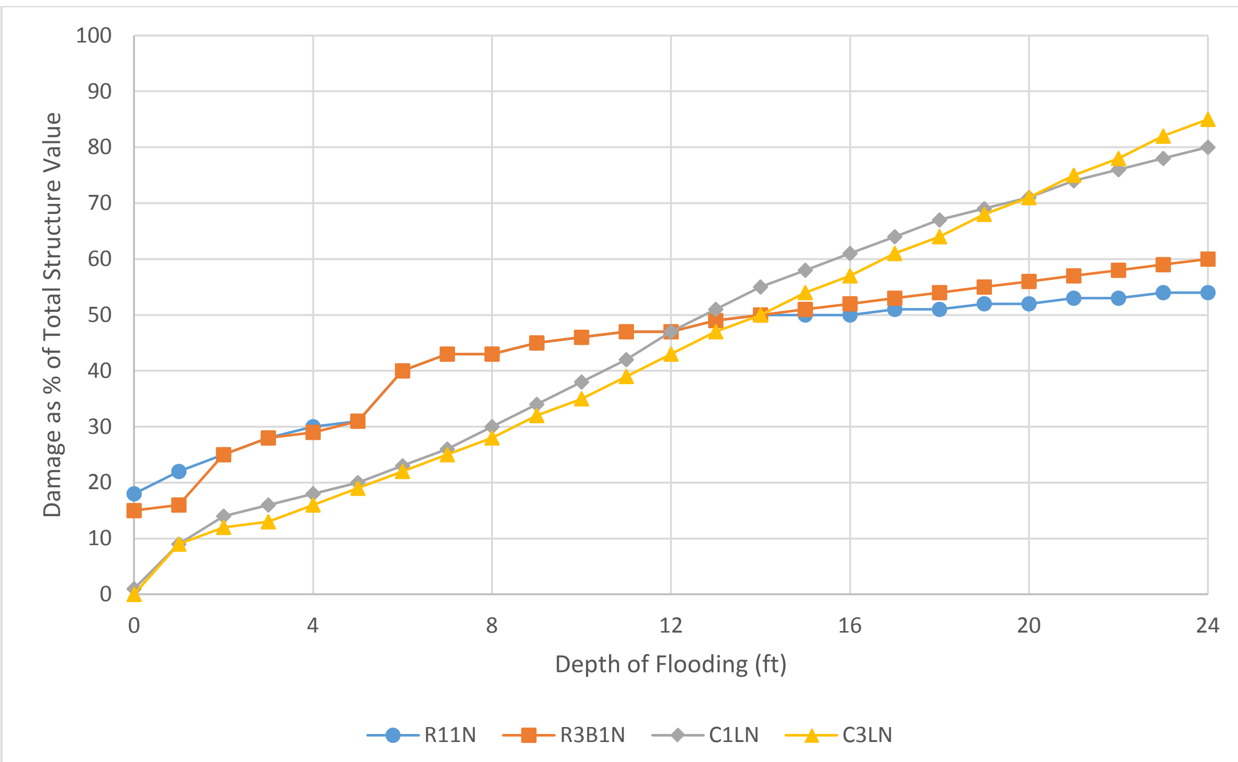
The adjacent flood elevation at each structure was determined by intersecting building polygon vertices with each water surface grid. To ensure conservative results the maximum flood elevation at each building was selected. Depth of flooding was calculated by subtracting the adjacent flood elevation from the FFE.

## Estimated Losses

To translate flood depths into estimated structural and contents losses ($USD), Amec Foster Wheeler used depth-damage curves. Structure and contents depth-damage curves were chosen for each building based on building type. The following structure and contents curves were used in this analysis, obtained from FEMA's Hazus-MH (Version 2.1) defaults.

**Depth-Damage Curves**

| *Hazus Occupancy ID* | *Description* |
|---|---|
| *R11N* | 1-story residential home, no basement |
| *R3B1N* | 1 to 2-story apartment building, at-grade |
| *C1LN* | Average retail building, at-grade, low rise |
| *C3LN* | Average personal & repair services (i.e. garage), at-grade, low rise |




Structure Depth-Damage Curves

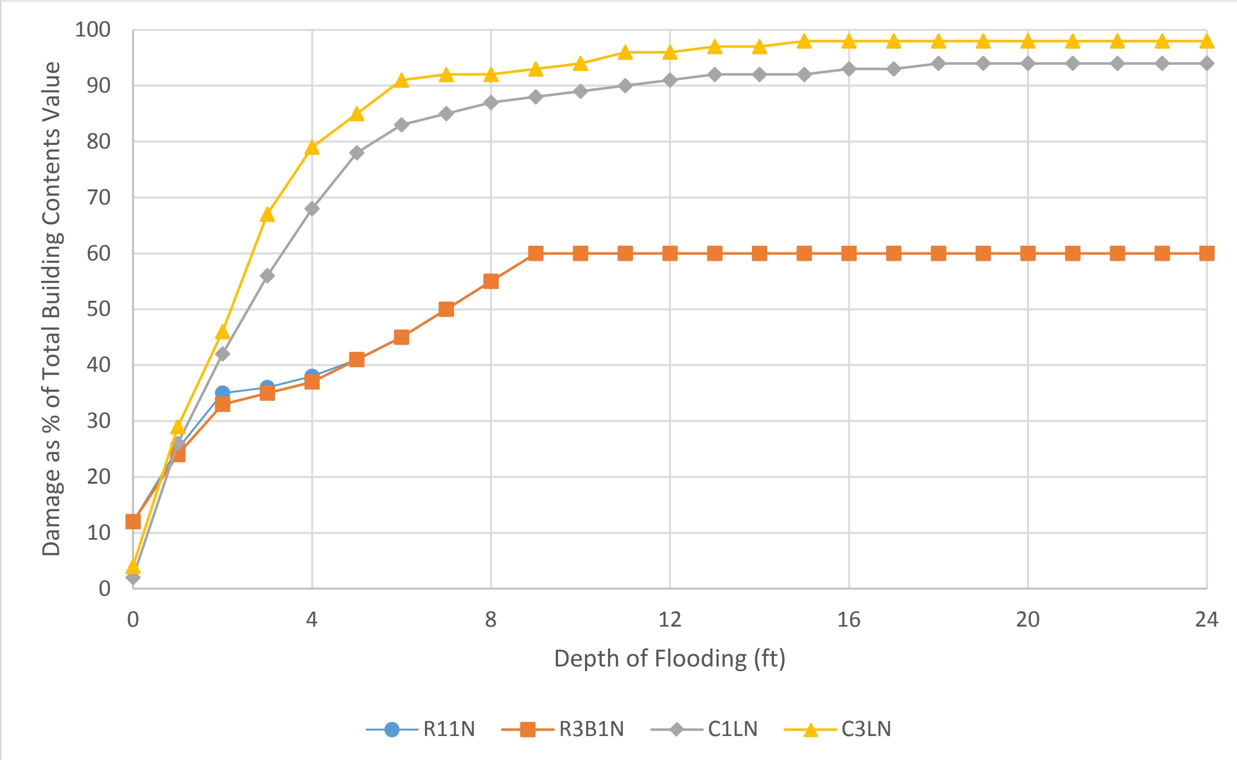



Figure #: Building Contents Depth-Damage Curves

All buildings were assumed to be constructed on crawlspaces or slab foundations without basements. All single-family homes were assumed to be single-story structures; modeled flood depths did not rise above 3.25 feet above the FFE for any given structure. Assessed structure values were provided by Lexington County as part of its parcel geodatabase. Building contents values were estimated as a ratio of assessed structure values, based on default ratios provided in FEMA's Hazus-MH (Version 2.1) documentation.

**Ratios Used to Estimate Building Contents Values**

| ***Occupancy Class*** | ***Contents Value as % of Structure Value*** |
|---|---|
| *Single Family Dwelling (RES1)* | 50 % |
| *Multi Family Dwelling (RES3)* | 50 % |
| *Retail Trade (COM1)* | 100 % |
| *Personal and Repair Services (COM3)* | 100 % |

At a given building, the total structure (Struct.) and contents (Cont.) losses can be calculated with the following equation:

$$Loss\ (\$) = [Struct.Value\ (\$) \times Struct.Damage\ (\%)] + [Cont.Value\ (\$) \times Cont.Damage\ (\%)]$$

Amec Foster Wheeler used Python functions to calculate flood-related losses for buildings adjacent to K1, K2, and Kinley Creek for the aforementioned 48 different combinations of alternatives and storm events. Average annualized losses were calculated based on the combined damages and probabilities of the modeled storm events. The following equation was used to calculate average annualized losses:

$$AAL\ (\$) = \left[(p_2 - p_5) * \frac{L_2 + L_5}{2}\right] + \left[(p_5 - p_{10}) * \frac{L_5 + L_{10}}{2}\right] + \left[(p_{10} - p_{25}) * \frac{L_{10} + L_{25}}{2}\right] + \left[(p_{25} - p_{50}) * \frac{L_{25} + L_{50}}{2}\right] + \left[(p_{50} - p_{100}) * \frac{L_{50} + L_{100}}{2}\right] + p_{100} * L_{100}$$

Where:

$p_n$ = Annual exceedance probability associated with an *n*-year storm event; $p_n = 1/n$

$L_n$ = Estimated losses ($) associated with *n*-year storm event

## Results

The table below summarizes total loss estimates for each alternative modeled in HEC-RAS by USACE, for each modeled storm event and for the Average Annualized Loss (AAL), the average cost per year of cumulative storm damages. Red cells indicate higher total losses and green cells indicate lower total losses.

**Total Estimated Building Losses (Structural and Contents), $USD**

| Alt. | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
|---|---|---|---|---|---|---|---|
| A[1] | $ 80,886 | $ 529,692 | $ 1,094,561 | $ 2,072,753 | $ 2,947,064 | $ 3,583,639 | $ 386,507 |
| C | $ 80,886 | $ 503,429 | $ 975,757 | $ 1,695,662 | $ 2,341,853 | $ 2,990,919 | $ 338,697 |
| D | $ - | $ 49,417 | $ 145,975 | $ 433,580 | $ 855,609 | $ 1,252,734 | $ 70,530 |
| E | $ 80,716 | $ 307,832 | $ 1,017,985 | $ 1,916,122 | $ 2,711,729 | $ 3,313,699 | $ 322,139 |
| F | $ - | $ 48,500 | $ 145,408 | $ 530,571 | $ 901,798 | $ 1,450,650 | $ 77,842 |
| G | $ - | $ 48,500 | $ 145,675 | $ 732,156 | $ 1,169,079 | $ 1,813,175 | $ 95,374 |
| H[2] | $ 80,886 | $ 507,011 | $ 1,046,138 | $ 2,000,220 | $ 2,848,431 | $ 3,515,886 | $ 372,700 |
| I | $ - | $ 48,282 | $ 196,957 | $ 355,735 | $ 575,755 | $ 844,612 | $ 60,948 |

[1] Alternative A represents existing or “without project” conditions.

[2] Alternative H only includes modifications to upper K2 but for comparison, this table includes the damages due to Kinley, K1 and K2 combined.

**Estimated Reductions in Building Losses Compared to "without project" Alternative A**

| Alt. | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
|---|---|---|---|---|---|---|---|
| C | 0.0% | 5.0% | 10.9% | 18.2% | 20.5% | 16.5% | 12.4% |
| D | 100.0% | 90.7% | 86.7% | 79.1% | 71.0% | 65.0% | 81.8% |
| E | 0.2% | 41.9% | 7.0% | 7.6% | 8.0% | 7.5% | 16.7% |
| F | 100.0% | 90.8% | 86.7% | 74.4% | 69.4% | 59.5% | 79.9% |
| G | 100.0% | 90.8% | 86.7% | 64.7% | 60.3% | 49.4% | 75.3% |
| H | 0.0% | 4.3% | 4.4% | 3.5% | 3.3% | 1.9% | 3.6% |
| I | 100.0% | 90.9% | 82.0% | 82.8% | 80.5% | 76.4% | 84.2% |

Alternatives D, F, G, and I were found to reduce estimated average annual losses most significantly ( > 75%) with respect to the "without project" scenario (alternative A), while alternatives C, E, and H reduced average annual losses only slightly (3.6% to 16.7%). Estimated damages caused by more frequent 2-year storms were entirely eliminated in alternatives D, F, G, and I, but remained almost completely unchanged in alternatives C, E, and H. Alternatives D, F, G, and I showed especially large reductions in estimated damages for larger storm events, with Alternative I reducing estimated 100-year damages by 76.4%.

It must be noted that the full economic impacts of flooding within the watershed may be higher than the estimates presented in the above table.  This flood damage analysis considered structural and contents damages to buildings adjacent to K1, K2, and Kinley Creek in order to draw comparisons between proposed alternatives. Other potential impacts not analyzed in this report include loss of personal income or business revenue, as well as damages to utilities or transportation infrastructure.

| | Total Estimated Building Damages (Structural and Contents) $USD | | | | | | |
|---|---|---|---|---|---|---|---|
| Alternative / Reach / Group | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
| Alternative A | $ 80,886 | $ 529,692 | $ 1,094,561 | $ 2,072,753 | $ 2,947,064 | $ 3,583,639 | $ 386,507 |
| K1 | $ 80,886 | $ 129,353 | $ 172,928 | $ 343,367 | $ 481,821 | $ 575,592 | $ 81,434 |
| Brookshire Dr to Kettering Dr | $ 49,879 | $ 90,232 | $ 92,630 | $ 133,122 | $ 179,153 | $ 200,321 | $ 43,956 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ 35,493 | $ 38,149 | $ 41,837 | $ 2,619 |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ 35,610 | $ 110,467 | $ 168,415 | $ 5,608 |
| Yarmouth Dr to Massingale Rd | $ 31,008 | $ 39,121 | $ 80,297 | $ 139,142 | $ 154,051 | $ 165,020 | $ 29,251 |
| K2 | $ - | $ 275,222 | $ 446,181 | $ 629,943 | $ 813,207 | $ 1,048,549 | $ 143,863 |
| Apartments | $ - | $ 51,958 | $ 165,719 | $ 280,853 | $ 292,114 | $ 342,751 | $ 44,406 |
| Bower Pkwy to Piney Grove Rd | $ - | $ 22,737 | $ 48,409 | $ 72,436 | $ 98,993 | $ 158,212 | $ 15,176 |
| Piney Grove Rd to Nottingham Rd | $ - | $ 200,527 | $ 232,053 | $ 276,654 | $ 422,100 | $ 547,586 | $ 84,281 |
| KinleyMain | $ - | $ 125,117 | $ 475,453 | $ 1,099,443 | $ 1,652,036 | $ 1,959,498 | $ 161,210 |
| Bower Pkwy to Piney Grove Rd | $ - | $ 99,140 | $ 318,306 | $ 566,427 | $ 868,429 | $ 1,012,368 | $ 96,162 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ 66,271 | $ 78,263 | $ 90,952 | $ 5,189 |
| K1 confluence | $ - | $ - | $ 66,613 | $ 82,806 | $ 94,069 | $ 132,234 | $ 12,036 |
| Piney Grove Rd to K2 confluence | $ - | $ 25,977 | $ 90,534 | $ 383,939 | $ 611,275 | $ 723,944 | $ 47,824 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative B-1 | $ - | $ - | $ - | $ 798,725 | $ 1,563,313 | $ 2,093,320 | $ 86,798 |
| K1 | $ - | $ - | $ - | $ 156,471 | $ 278,822 | $ 354,758 | $ 15,763 |
| Brookshire Dr to Kettering Dr | $ - | $ - | $ - | $ 37,084 | $ 74,532 | $ 83,239 | $ 3,850 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ 35,493 | $ 38,149 | $ 41,837 | $ 2,619 |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ 35,610 | $ 110,467 | $ 168,415 | $ 5,608 |
| Yarmouth Dr to Massingale Rd | $ - | $ - | $ - | $ 48,284 | $ 55,674 | $ 61,267 | $ 3,685 |
| K2 | $ - | $ - | $ - | $ 118,199 | $ 271,023 | $ 471,891 | $ 15,872 |
| Apartments | $ - | $ - | $ - | $ 68,691 | $ 73,275 | $ 115,421 | $ 5,578 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ 17,559 | $ 38,195 | $ 88,301 | $ 2,600 |
| Piney Grove Rd to Nottingham Rd | $ - | $ - | $ - | $ 31,949 | $ 159,554 | $ 268,170 | $ 7,694 |
| KinleyMain | $ - | $ - | $ - | $ 524,055 | $ 1,013,468 | $ 1,266,671 | $ 55,164 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ 185,576 | $ 448,559 | $ 559,000 | $ 22,536 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ 66,271 | $ 78,263 | $ 90,952 | $ 5,189 |
| K1 confluence | $ - | $ - | $ - | $ - | $ - | $ 28,903 | $ 434 |

| | Total Estimated Building Damages (Structural and Contents) $USD | | | | | | |
|---|---|---|---|---|---|---|---|
| Alternative / Reach / Group | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ 272,208 | $ 486,646 | $ 587,816 | $ 27,005 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative B-2 | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| K1 | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Brookshire Dr to Kettering Dr | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Yarmouth Dr to Massingale Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| K2 | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Apartments | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Piney Grove Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| KinleyMain | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Downstream of K1 confluence | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| K1 confluence | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative C | $ 80,886 | $ 503,429 | $ 975,757 | $ 1,695,662 | $ 2,341,853 | $ 2,990,919 | $ 338,697 |
| K1 | $ 80,886 | $ 129,353 | $ 172,928 | $ 343,367 | $ 481,821 | $ 575,592 | $ 81,434 |
| Brookshire Dr to Kettering Dr | $ 49,879 | $ 90,232 | $ 92,630 | $ 133,122 | $ 179,153 | $ 200,321 | $ 43,956 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ 35,493 | $ 38,149 | $ 41,837 | $ 2,619 |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ 35,610 | $ 110,467 | $ 168,415 | $ 5,608 |
| Yarmouth Dr to Massingale Rd | $ 31,008 | $ 39,121 | $ 80,297 | $ 139,142 | $ 154,051 | $ 165,020 | $ 29,251 |
| K2 | $ - | $ 275,037 | $ 446,565 | $ 669,797 | $ 822,594 | $ 1,055,137 | $ 145,690 |
| Apartments | $ - | $ 51,958 | $ 165,719 | $ 280,853 | $ 292,114 | $ 342,751 | $ 44,406 |
| Bower Pkwy to Piney Grove Rd | $ - | $ 22,737 | $ 48,409 | $ 72,436 | $ 98,993 | $ 158,212 | $ 15,176 |
| Piney Grove Rd to Nottingham Rd | $ - | $ 200,342 | $ 232,438 | $ 316,508 | $ 431,487 | $ 554,174 | $ 86,109 |
| KinleyMain | $ - | $ 99,039 | $ 356,264 | $ 682,498 | $ 1,037,438 | $ 1,360,190 | $ 111,573 |
| Bower Pkwy to Piney Grove Rd | $ - | $ 99,039 | $ 289,651 | $ 533,421 | $ 834,171 | $ 997,735 | $ 91,795 |

| | Total Estimated Building Damages (Structural and Contents) $USD | | | | | | |
|---|---|---|---|---|---|---|---|
| Alternative / Reach / Group | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
| Downstream of K1 confluence | $ - | $ - | $ - | $ 66,271 | $ 78,263 | $ 90,952 | $ 5,189 |
| K1 confluence | $ - | $ - | $ 66,613 | $ 82,806 | $ 94,069 | $ 132,234 | $ 12,036 |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ - | $ 30,934 | $ 139,270 | $ 2,553 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative D | $ - | $ 49,417 | $ 145,975 | $ 433,580 | $ 855,609 | $ 1,252,734 | $ 70,530 |
| K1 | $ - | $ - | $ - | $ - | $ 85,919 | $ 98,337 | $ 2,764 |
| Brookshire Dr to Kettering Dr | $ - | $ - | $ - | $ - | $ 49,764 | $ 57,559 | $ 1,610 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Yarmouth Dr to Massingale Rd | $ - | $ - | $ - | $ - | $ 36,155 | $ 40,778 | $ 1,154 |
| K2 | $ - | $ 49,417 | $ 128,475 | $ 278,855 | $ 370,388 | $ 507,695 | $ 44,487 |
| Apartments | $ - | $ 49,417 | $ 128,475 | $ 278,855 | $ 287,548 | $ 298,550 | $ 40,107 |
| Piney Grove Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ 82,840 | $ 209,145 | $ 4,380 |
| KinleyMain | $ - | $ - | $ 17,500 | $ 154,724 | $ 399,302 | $ 646,702 | $ 23,279 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ 17,500 | $ 154,724 | $ 368,177 | $ 580,036 | $ 21,812 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| K1 confluence | $ - | $ - | $ - | $ - | $ 31,126 | $ 36,093 | $ 1,008 |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ - | $ - | $ 30,573 | $ 459 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative E | $ 80,716 | $ 307,832 | $ 1,017,985 | $ 1,916,122 | $ 2,711,729 | $ 3,313,699 | $ 322,139 |
| K1 | $ 80,716 | $ 96,055 | $ 171,745 | $ 260,251 | $ 349,089 | $ 459,598 | $ 67,598 |
| Brookshire Dr to Kettering Dr | $ 49,582 | $ 57,125 | $ 93,009 | $ 94,650 | $ 96,417 | $ 139,741 | $ 33,631 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ - | $ 35,640 | $ 38,001 | $ 1,105 |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ 35,116 | $ 72,625 | $ 127,158 | $ 4,401 |
| Yarmouth Dr to Massingale Rd | $ 31,134 | $ 38,930 | $ 78,737 | $ 130,485 | $ 144,407 | $ 154,698 | $ 28,461 |
| K2 | $ - | $ 112,637 | $ 372,237 | $ 561,276 | $ 713,898 | $ 892,209 | $ 98,849 |
| Apartments | $ - | $ 52,723 | $ 166,500 | $ 280,853 | $ 292,341 | $ 343,057 | $ 44,630 |
| Piney Grove Rd to Nottingham Rd | $ - | $ 59,913 | $ 205,737 | $ 280,422 | $ 421,557 | $ 549,152 | $ 54,219 |
| KinleyMain | $ - | $ 99,140 | $ 474,002 | $ 1,094,595 | $ 1,648,742 | $ 1,961,892 | $ 155,692 |
| Bower Pkwy to Piney Grove Rd | $ - | $ 99,140 | $ 318,306 | $ 566,114 | $ 868,277 | $ 1,012,368 | $ 96,147 |

| Alternative / Reach / Group | Total Estimated Building Damages (Structural and Contents) $USD 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
|---|---|---|---|---|---|---|---|
| Downstream of K1 confluence | $ - | $ - | $ - | $ 65,458 | $ 77,806 | $ 91,364 | $ 5,156 |
| K1 confluence | $ - | $ - | $ 65,358 | $ 81,990 | $ 93,848 | $ 132,677 | $ 11,906 |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ 90,339 | $ 381,033 | $ 608,811 | $ 725,483 | $ 42,483 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative F | $ - | $ 48,500 | $ 145,408 | $ 530,571 | $ 901,798 | $ 1,450,650 | $ 77,842 |
| K1 | $ - | $ - | $ - | $ 76,779 | $ 133,753 | $ 248,030 | $ 8,798 |
| Brookshire Dr to Kettering Dr | $ - | $ - | $ - | $ 46,950 | $ 93,513 | $ 134,776 | $ 5,302 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ - | $ - | $ 29,155 | $ 437 |
| Yarmouth Dr to Massingale Rd | $ - | $ - | $ - | $ 29,829 | $ 40,240 | $ 84,100 | $ 3,058 |
| K2 | $ - | $ 48,500 | $ 127,907 | $ 299,068 | $ 368,457 | $ 556,241 | $ 45,766 |
| Apartments | $ - | $ 48,500 | $ 127,907 | $ 278,855 | $ 287,275 | $ 298,776 | $ 39,878 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ 20,213 | $ 23,017 | $ 50,557 | $ 1,912 |
| Piney Grove Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ 58,166 | $ 206,908 | $ 3,976 |
| KinleyMain | $ - | $ - | $ 17,500 | $ 154,725 | $ 399,588 | $ 646,378 | $ 23,279 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ 17,500 | $ 154,725 | $ 368,250 | $ 580,077 | $ 21,814 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| K1 confluence | $ - | $ - | $ - | $ - | $ 31,338 | $ 35,841 | $ 1,008 |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ - | $ - | $ 30,460 | $ 457 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative G | $ - | $ 48,500 | $ 145,675 | $ 732,156 | $ 1,169,079 | $ 1,813,175 | $ 95,374 |
| K1 | $ - | $ - | $ - | $ 106,423 | $ 170,310 | $ 293,536 | $ 11,215 |
| Brookshire Dr to Kettering Dr | $ - | $ - | $ - | $ 46,950 | $ 93,513 | $ 134,776 | $ 5,302 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ 29,644 | $ 36,558 | $ 74,661 | $ 2,854 |
| Yarmouth Dr to Massingale Rd | $ - | $ - | $ - | $ 29,829 | $ 40,240 | $ 84,100 | $ 3,058 |
| K2 | $ - | $ 48,500 | $ 127,907 | $ 299,068 | $ 368,457 | $ 556,241 | $ 45,766 |
| Apartments | $ - | $ 48,500 | $ 127,907 | $ 278,855 | $ 287,275 | $ 298,776 | $ 39,878 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ 20,213 | $ 23,017 | $ 50,557 | $ 1,912 |
| Piney Grove Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ 58,166 | $ 206,908 | $ 3,976 |

| | Total Estimated Building Damages (Structural and Contents) $USD | | | | | | |
|---|---|---|---|---|---|---|---|
| Alternative / Reach / Group | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
| KinleyMain | $ - | $ - | $ 17,767 | $ 326,665 | $ 630,312 | $ 963,398 | $ 38,394 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ 17,767 | $ 260,585 | $ 480,579 | $ 758,025 | $ 30,424 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ - | $ 69,103 | $ 81,821 | $ 2,264 |
| K1 confluence | $ - | $ - | $ - | $ 66,080 | $ 80,629 | $ 92,874 | $ 5,246 |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ - | $ - | $ 30,678 | $ 460 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative H | $ 80,886 | $ 507,011 | $ 1,046,138 | $ 2,000,220 | $ 2,848,431 | $ 3,515,886 | $ 372,700 |
| K1 | $ 80,886 | $ 129,353 | $ 172,928 | $ 343,367 | $ 481,821 | $ 575,592 | $ 81,434 |
| Brookshire Dr to Kettering Dr | $ 49,879 | $ 90,232 | $ 92,630 | $ 133,122 | $ 179,153 | $ 200,321 | $ 43,956 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ 35,493 | $ 38,149 | $ 41,837 | $ 2,619 |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ 35,610 | $ 110,467 | $ 168,415 | $ 5,608 |
| Yarmouth Dr to Massingale Rd | $ 31,008 | $ 39,121 | $ 80,297 | $ 139,142 | $ 154,051 | $ 165,020 | $ 29,251 |
| K2 | $ - | $ 252,541 | $ 397,758 | $ 557,410 | $ 714,574 | $ 980,795 | $ 130,056 |
| Apartments | $ - | $ 52,014 | $ 165,705 | $ 280,756 | $ 292,210 | $ 342,751 | $ 44,414 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ - | $ 264 | $ 90,458 | $ 1,361 |
| Piney Grove Rd to Nottingham Rd | $ - | $ 200,527 | $ 232,053 | $ 276,654 | $ 422,100 | $ 547,586 | $ 84,281 |
| KinleyMain | $ - | $ 125,117 | $ 475,453 | $ 1,099,443 | $ 1,652,036 | $ 1,959,498 | $ 161,210 |
| Bower Pkwy to Piney Grove Rd | $ - | $ 99,140 | $ 318,306 | $ 566,427 | $ 868,429 | $ 1,012,368 | $ 96,162 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ 66,271 | $ 78,263 | $ 90,952 | $ 5,189 |
| K1 confluence | $ - | $ - | $ 66,613 | $ 82,806 | $ 94,069 | $ 132,234 | $ 12,036 |
| Piney Grove Rd to K2 confluence | $ - | $ 25,977 | $ 90,534 | $ 383,939 | $ 611,275 | $ 723,944 | $ 47,824 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Alternative I | $ - | $ 48,282 | $ 196,957 | $ 355,735 | $ 575,755 | $ 844,612 | $ 60,948 |
| K1 | $ - | $ - | $ - | $ - | $ 81,292 | $ 132,979 | $ 3,214 |
| Brookshire Dr to Kettering Dr | $ - | $ - | $ - | $ - | $ 48,894 | $ 56,835 | $ 1,586 |
| Kettering Dr to Yarmouth Dr | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Massingale Rd to Nottingham Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Nottingham Rd to Sandhurst Rd | $ - | $ - | $ - | $ - | $ 32,398 | $ 38,073 | $ 1,057 |
| Yarmouth Dr to Massingale Rd | $ - | $ - | $ - | $ - | $ - | $ 38,071 | $ 571 |
| K2 | $ - | $ 48,282 | $ 196,957 | $ 355,735 | $ 371,669 | $ 450,314 | $ 51,972 |
| Apartments | $ - | $ 48,282 | $ 128,045 | $ 241,427 | $ 247,512 | $ 255,510 | $ 37,102 |

| Alternative / Reach / Group | Total Estimated Building Damages (Structural and Contents) $USD | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | AAL |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Piney Grove Rd to Nottingham Rd | $ - | $ - | $ 68,913 | $ 114,308 | $ 124,157 | $ 194,804 | $ 14,870 |
| KinleyMain | $ - | $ - | $ - | $ - | $ 122,794 | $ 261,319 | $ 5,762 |
| Bower Pkwy to Piney Grove Rd | $ - | $ - | $ - | $ - | $ 54,845 | $ 116,425 | $ 2,569 |
| Downstream of K1 confluence | $ - | $ - | $ - | $ - | $ 35,494 | $ 76,582 | $ 1,681 |
| K1 confluence | $ - | $ - | $ - | $ - | $ 32,455 | $ 39,029 | $ 1,072 |
| Piney Grove Rd to K2 confluence | $ - | $ - | $ - | $ - | $ - | $ 29,283 | $ 439 |
| Upstream of Harbison Blvd | $ - | $ - | $ - | $ - | $ - | $ - | $ - |

# Appendix G:  Cost Engineering Analysis

# COST ENGINEERING SUMMARY

## Table of Contents

# SECTION 1. COST ENGINEERING

## 1.1 Project Scope

The Kinley Creek watershed is a highly developed watershed approximately 4,480 acres in size. Kinley Creek starts north of SC Highway 60, and ends in the Saluda River. Elevations in watershed vary from 410 feet to 180 feet NGVD 29. Kinley Creek and its tributaries are typical of small Piedmont streams, exhibiting deeply incised channels with widely varying widths. Due to extensive residential and commercial development, the floodplain also varies greatly. The 14 acre Lake Quail Valley was created by impounding Kinley Creek above Harbison Boulevard (and outside of the project area). With the exception of a few isolated reaches, most of the floodplain within the project area has little or no unaltered floodplain remaining. It is not until Kinley Creek is below the CSX Railroad Bridge that the floodplain expands to natural conditions.

The study area is the Kinley Creek watershed located in Lexington County, South Carolina. Kinley Creek runs from just south of Lake Murray Boulevard, under Harbison Boulevard, and Piney Grove Road near the Town of Irmo. Flooding has been a longstanding problem within this watershed, with two tributaries K-1 and K-2, respectively, being of particular concern. The headwaters of Tributary K-1 are just southwest of Interstate 26 and flow through residential areas. Tributary K-2 starts northeast of Interstate 26 and is the larger of the two. This project involves evaluating and developing alternative solutions to address flood related impacts within the watershed.

## 1.2 Cost Methodology

The cost estimates for the various measures have been prepared at an equivalent price level of July 2015. The majority of the estimates have been prepared using the Parametric Cost Engineering System version 1.2 (PACES 1.2). The estimate for Measures 27 and 28, elevation of structures, was developed in the Micro-Computer Aided Cost Estimating System 2$^{nd}$ generation version 4.2 (MII version 4.2). The quantities used to generate the construction estimates were generated by SAC engineering personnel. Printouts of all cost estimates are contained at the end of this Appendix.

### 1.2.1 Cost Assumptions

The following assumptions were used in development of the total cost for each measure used in development of the alternatives:

1. For the installation of modified culverts, a box culvert of optimum size for flow improvement was used.
2. Where construction easements are required, a construction easement would be required for every 75' of construction.
3. The cost to buyout properties includes the property value, cost to relocate property owners and cost to demolish the structure.
4. Construction start would be in July 2017 resulting in escalation of approximately 8%.
5. Cost for elevating structures includes the construction work to elevate the structures and per diem costs for the average occupancy of 2 people per household for the project area.
6. Markups on construction items were based on the following:
   a. Prime/Sub arrangement with Prime performing 10% of work and Sub performing 90% of

work.
b. Sales tax of 7% on material costs.
c. Mobilization cost of 3%.
d. Field Overhead of 10%.
e. Home Office Overhead of 8%.
f. Profit of 10%.
g. Bond of 1.5%.
h. Design cost of 6%.
i. Construction Oversight of 5.7%.
j. Contingency of 20%.

7. All work was assumed to be performed during normal working hours without the need for overtime.

### 1.2.2 Benefit Cost Analysis

A simple benefit/cost analysis was performed to determine the viability of the various alternatives generated by SAC plan formulation and engineering. This analysis used the average annual reduction in flood damages that was generated by AMEC for each alternative versus the cost to construct the alternative. A 20 year period of analysis was selected and agreed upon during meetings with the study sponsor. The results are shown in Table 1-1.

| **Benefit - Cost Ratio for PAS Lexington County** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Alternative** | **Description** | **Measures** | **Average Annual Damages** | **Annual benefits (Δ from w/o project damages)** | **Benefits for 20 yr** | **Cost** | **B/C** |
| A | Without Project | N/A | $386,507 | $0 | $0 | $0 | 0.00 |
| B1 | Acquisition - 10 yr | 25 | $86,798 | $299,709 | $5,994,180 | $9,000,000 | 0.67 |
| B2 | Acquisition - 100 yr | 26 | $0 | $386,507 | $7,730,140 | $24,750,000 | 0.31 |
| C | Partially Modified Channel – Kinley/K-2 | 14, 19, 20 | $338,697 | $47,810 | $956,200 | $2,996,000 | 0.32 |
| D | Modified Channel, Bridges, Culverts, and New Ponds | 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 15, 17, 18, 19, 21 | $70,530 | $315,977 | $6,319,540 | $22,785,000 | 0.28 |
| E | K-1 and K-2 New Ponds | 6, 12 | $322,139 | $64,368 | $1,287,360 | $4,256,000 | 0.30 |
| F | Modified Channels, Bridges, and Culverts | 1, 2, 3, 4, 5, 8, 10, 11, 15, 17, 18, 19, 21 | $77,842 | $308,665 | $6,173,300 | $18,529,000 | 0.33 |
| G | Modified Channels, Limited Bridges, and Culverts | 1, 2, 3, 4, 5, 8, 10, 11, 15, 19, 22 | $95,374 | $291,133 | $5,822,660 | $15,629,000 | 0.37 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| H | Upper K-2 Floodplain Bench | 13 | $372,700 | $13,807 | $276,140 | $796,000 | 0.35 |
| I | Selective Acquisition with Modified Channel, Limited Bridges, and Culverts | 1, 2, 3, 4, 5, 7, 9, 10, 11, 16, 19, 23, 24 | $60,948 | $325,559 | $6,511,180 | $21,392,000 | 0.30 |
| J1 | Elevate Structures- 10 yr | 27 | $86,798 | $299,709 | $5,994,180 | $4,068,000 | 1.47 |
| J2 | Elevate Structures- 100 yr | 28 | $0 | $386,507 | $7,730,140 | $11,187,000 | 0.69 |

Table 1-1 Benefit/Cost Analysis

# ATTACHMENT A – COST ESTIMATES

# MEASURE 1 – NOTTINGHAM RD CULVERT MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 209.00 | CY | 21.76 | $4,548.41 | $0.00 | $0.00 | $0.00 | $4,548.41 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 5.00 | HR | 117.69 | $0.00 | $395.00 | $193.44 | $0.00 | $588.44 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 32.67 | CY | 1.71 | $0.00 | $23.43 | $32.54 | $0.00 | $55.97 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 16.00 | HR | 136.20 | $0.00 | $1,024.32 | $1,154.96 | $0.00 | $2,179.28 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 103.33 | CY | 1.57 | $0.00 | $70.13 | $92.61 | $0.00 | $162.74 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 12.93 | CY | 37.86 | $468.99 | $10.66 | $9.90 | $0.00 | $489.54 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 12.67 | SY | 1.42 | $0.00 | $13.21 | $4.73 | $0.00 | $17.94 |
| G1030050511 | Compact Soil W/Vibrating Plate | 566.48 | CY | 2.35 | $0.00 | $1,222.26 | $106.81 | $0.00 | $1,329.08 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 5.00 | DAY | 98.03 | $381.10 | $109.06 | $0.00 | $0.00 | $490.17 |
| **TOTAL** | | | | | **$5,398** | **$2,868** | **$1,595** | **$0** | **$9,862** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 1,968.00 | SF | 8.58 | $1,399.08 | $15,479.83 | $0.00 | $0.00 | $16,878.91 |
| **TOTAL** | | | | | **$1,399** | **$15,480** | **$0** | **$0** | **$16,879** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 73.00 | SF | 6.59 | $180.05 | $300.89 | $0.00 | $0.00 | $480.94 |
| G3030040411 | Cont Footing, Pour Concrete | 3.16 | CY | 163.82 | $444.71 | $71.16 | $1.81 | $0.00 | $517.68 |
| G3030040415 | CIP Wall Rebar | 4,111.11 | lb | 0.94 | $2,266.55 | $1,595.97 | $0.00 | $0.00 | $3,862.52 |

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 22.22 | CY | 214.56 | $3,353.38 | $1,106.37 | $307.70 | $0.00 | $4,767.45 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 112.00 | LF | 5.45 | $95.87 | $514.69 | $0.00 | $0.00 | $610.57 |
| G3030040420 | Slab On Grade, Rebar | 4,028.89 | lb | 1.06 | $2,221.22 | $2,040.10 | $0.00 | $0.00 | $4,261.32 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 21.78 | CY | 226.47 | $3,286.98 | $1,469.84 | $175.78 | $0.00 | $4,932.59 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 504.00 | SF | 9.36 | $241.30 | $4,477.83 | $0.00 | $0.00 | $4,719.14 |
| G3030040425 | Elevated Slab Rebar | 2,685.93 | lb | 0.85 | $1,402.87 | $868.92 | $0.00 | $0.00 | $2,271.80 |
| G3030040426 | Pour & Cure Top Slab Cover | 14.52 | CY | 278.31 | $2,270.74 | $1,605.87 | $164.51 | $0.00 | $4,041.12 |
| G3030040429 | Bush Hammer Finish | 144.00 | SF | 2.94 | $0.00 | $389.62 | $33.94 | $0.00 | $423.56 |
| **TOTAL** | | | | | **$15,764** | **$14,441** | **$684** | **$0** | **$30,889** |

**G90 OTHER SITE CONSTRUCTION**

G9090 OTHER SITE CONSTRUCTION

G909001 BRIDGES

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 193.18 | LF | 4.51 | $535.32 | $336.44 | $0.00 | $0.00 | $871.77 |
| G9090010146 | Footing, Rebar | 876.49 | lb | 1.11 | $483.23 | $486.16 | $0.00 | $0.00 | $969.39 |
| **TOTAL** | | | | | **$1,019** | **$823** | **$0** | **$0** | **$1,841** |

## EXCAVATION, TRENCH/CHANNEL

**G  BUILDING SITEWORK**

**G10 SITE PREPARATIONS**

G1020 SITE DEMOLITION & RELOCATIONS

G102007 SITE CLEANUP

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020070401 | Dump Charge | 92.59 | CY | 21.76 | $2,015.01 | $0.00 | $0.00 | $0.00 | $2,015.01 |

G1030 SITE EARTHWORK

G103002 COMMON EXCAVATION

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 2.00 | HR | 119.83 | $0.00 | $160.88 | $78.78 | $0.00 | $239.66 |
| G1030020251 | 0.38m3 (0.5 CY) Clamshell, W/12.19m (40') Boom | 3.00 | HR | 316.60 | $0.00 | $393.52 | $556.27 | $0.00 | $949.79 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 7.00 | HR | 132.99 | $0.00 | $471.88 | $459.02 | $0.00 | $930.90 |
| **TOTAL** | | | | | **$2,015** | **$1,026** | **$1,094** | **$0** | **$4,135** |

## RESURFACING ROADWAYS/PARKING LOTS

**G  BUILDING SITEWORK**

**G10 SITE PREPARATIONS**

G1020 SITE DEMOLITION & RELOCATIONS

G102007 SITE CLEANUP

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020070102 | Pavement Sweeping, Machine | 293.33 | SY | 0.03 | $0.00 | $8.65 | $0.00 | $0.00 | $8.65 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010103 | Rough Grading, 0.0014 T (14G), 1 Pass | 195.56 | SY | 0.00 | $0.00 | $0.07 | $0.06 | $0.00 | $0.13 |
| G1030010108 | Fine Grading, 0.013 T (130G), 2 Passes | 195.56 | SY | 1.03 | $0.00 | $123.03 | $78.72 | $0.00 | $201.75 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 195.56 | SY | 0.69 | $0.00 | $83.52 | $50.98 | $0.00 | $134.50 |
| **TOTAL** | | | | | **$0** | **$215** | **$130** | **$0** | **$345** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010104 | Asphalt, Intermediate Course (Line Item Incl 5% Waste) | 23.99 | TON | 103.09 | $2,265.86 | $153.08 | $54.20 | $0.00 | $2,473.14 |
| G201003 PAVED SURFACES | | | | | | | | | |
| G2010030311 | Tack Coat | 586.67 | SY | 1.75 | $587.31 | $262.47 | $177.43 | $0.00 | $1,027.20 |
| G2010030312 | Asphalt Wearing Course,1 Pass (Line Item Incl 5% Waste) | 15.89 | TON | 114.31 | $1,646.05 | $126.15 | $44.20 | $0.00 | $1,816.40 |
| G201004 MARKING & SIGNAGE | | | | | | | | | |
| G2010040401 | X Walk, Stop Lines, Per Lane, Intersection Painting | 1.00 | EA | 41.58 | $28.29 | $8.01 | $5.28 | $0.00 | $41.58 |
| G2010040402 | Turn Lane, Per Lane, Intersection Painting | 1.00 | EA | 26.82 | $18.28 | $5.15 | $3.39 | $0.00 | $26.82 |
| G2010040403 | Arrows, Per Lane, Intersection Painting | 1.00 | EA | 34.26 | $4.06 | $18.20 | $11.99 | $0.00 | $34.26 |
| G2010040405 | No Pass Stripe, Yellow | 36.67 | LF | 0.67 | $14.90 | $5.87 | $3.87 | $0.00 | $24.64 |
| G2010040406 | Centerline Stripe, White | 110.00 | LF | 1.79 | $134.06 | $37.76 | $24.88 | $0.00 | $196.69 |
| G2010040407 | Edge Stripe, Yellow | 220.00 | LF | 0.67 | $89.37 | $35.24 | $23.21 | $0.00 | $147.82 |
| **TOTAL** | | | | | **$4,788** | **$652** | **$348** | **$0** | **$5,789** |

| | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$30,383** | **$35,505** | **$3,851** | **$0** | **$69,739** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$69,739** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$69,739** |
| | Contingency | 20.00 % | $13,948 |
| | SIOH | 5.70 % | $4,770 |
| | Design | 6.00 % | $4,184 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $8,125 |
| **Total Project Cost:** | | | **$100,767** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Sep 2017

Area Cost Factor: 0.82
Escalation Rate: 7.49 %

# MEASURE 2 – OLD FRIARS RD CULVERT MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **DEMOLITION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102002 ABOVE GROUND SITE DEMOLITION | | | | | | | | | |
| G1020020207 | Demolish Rod Reinf Concrete To 152.40mm (6") Thk W/Air Equipment | 3.00 | CY | 322.75 | $0.00 | $925.80 | $42.43 | $0.00 | $968.24 |
| G102005 UTILITY RELOCATION | | | | | | | | | |
| G102005u2 | Selective demolition, water & sewer piping & fittings, concrete pipe, 42"-48", diameter, excludes excavation | 339.00 | LF | 38.00 | $0.00 | $8,081.61 | $4,800.71 | $0.00 | $12,882.32 |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 121.87 | CY | 21.90 | $2,669.30 | $0.00 | $0.00 | $0.00 | $2,669.30 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 3.00 | HR | 118.45 | $0.00 | $238.53 | $116.81 | $0.00 | $355.34 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 552.44 | CY | 2.80 | $0.00 | $903.24 | $644.65 | $0.00 | $1,547.90 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 9.00 | HR | 137.08 | $0.00 | $579.89 | $653.85 | $0.00 | $1,233.74 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 552.44 | CY | 2.31 | $0.00 | $619.96 | $654.05 | $0.00 | $1,274.01 |
| G1030040420 | Backfill Trench, Borrow Mat'l, Delivered & Dumped Only | 107.81 | CY | 38.45 | $3,935.57 | $102.59 | $107.38 | $0.00 | $4,145.54 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 552.44 | CY | 2.36 | $0.00 | $1,199.64 | $104.84 | $0.00 | $1,304.48 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 1.00 | DAY | 98.66 | $76.71 | $21.95 | $0.00 | $0.00 | $98.66 |
| **TOTAL** | | | | | **$6,682** | **$12,673** | **$7,125** | **$0** | **$26,480** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 984.00 | CY | 21.90 | $21,552.37 | $0.00 | $0.00 | $0.00 | $21,552.37 |
| G1030 SITE EARTHWORK | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 19.00 | HR | 125.61 | $0.00 | $1,510.68 | $875.84 | $0.00 | $2,386.52 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 146.67 | CY | 1.72 | $0.00 | $105.88 | $147.01 | $0.00 | $252.88 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 39.00 | HR | 150.01 | $0.00 | $2,512.85 | $3,337.56 | $0.00 | $5,850.41 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 462.67 | CY | 1.59 | $0.00 | $316.05 | $417.32 | $0.00 | $733.37 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 38.10 | $2,097.92 | $47.67 | $44.28 | $0.00 | $2,189.88 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.42 | $0.00 | $59.45 | $21.30 | $0.00 | $80.75 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,278.22 | CY | 2.36 | $0.00 | $4,947.23 | $432.34 | $0.00 | $5,379.57 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 98.66 | $1,534.23 | $439.06 | $0.00 | $0.00 | $1,973.30 |
| **TOTAL** | | | | | **$25,185** | **$9,939** | **$5,276** | **$0** | **$40,399** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 8,496.00 | SF | 8.63 | $6,078.82 | $67,257.76 | $0.00 | $0.00 | $73,336.58 |
| **TOTAL** | | | | | **$6,079** | **$67,258** | **$0** | **$0** | **$73,337** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.63 | $362.42 | $605.65 | $0.00 | $0.00 | $968.07 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 164.88 | $1,230.84 | $196.94 | $5.00 | $0.00 | $1,432.78 |
| G3030040415 | CIP Wall Rebar | 17,595.56 | lb | 0.95 | $9,763.27 | $6,874.74 | $0.00 | $0.00 | $16,638.01 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 95.11 | CY | 215.94 | $14,446.13 | $4,766.17 | $1,325.55 | $0.00 | $20,537.86 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.49 | $389.40 | $2,090.53 | $0.00 | $0.00 | $2,479.93 |
| G3030040420 | Slab On Grade, Rebar | 18,993.33 | lb | 1.06 | $10,538.85 | $9,679.54 | $0.00 | $0.00 | $20,218.39 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 102.67 | CY | 227.93 | $15,594.41 | $6,973.38 | $833.94 | $0.00 | $23,401.73 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.42 | $1,144.90 | $21,245.67 | $0.00 | $0.00 | $22,390.58 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.85 | $6,656.12 | $4,122.70 | $0.00 | $0.00 | $10,778.82 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 280.11 | $10,772.02 | $7,617.98 | $780.42 | $0.00 | $19,170.42 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.96 | $0.00 | $784.25 | $68.32 | $0.00 | $852.57 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$70,898** | **$64,958** | **$3,013** | **$0** | **$138,869** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 808.37 | LF | 4.54 | $2,254.51 | $1,416.92 | $0.00 | $0.00 | $3,671.43 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.11 | $1,337.66 | $1,345.77 | $0.00 | $0.00 | $2,683.43 |
| **TOTAL** | | | | | **$3,592** | **$2,763** | **$0** | **$0** | **$6,355** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 984.00 | CY | 21.90 | $21,552.37 | $0.00 | $0.00 | $0.00 | $21,552.37 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 19.00 | HR | 125.61 | $0.00 | $1,510.68 | $875.84 | $0.00 | $2,386.52 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 146.67 | CY | 1.72 | $0.00 | $105.88 | $147.01 | $0.00 | $252.88 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 39.00 | HR | 150.01 | $0.00 | $2,512.85 | $3,337.56 | $0.00 | $5,850.41 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 462.67 | CY | 1.59 | $0.00 | $316.05 | $417.32 | $0.00 | $733.37 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 38.10 | $2,097.92 | $47.67 | $44.28 | $0.00 | $2,189.88 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.42 | $0.00 | $59.45 | $21.30 | $0.00 | $80.75 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,278.22 | CY | 2.36 | $0.00 | $4,947.23 | $432.34 | $0.00 | $5,379.57 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 98.66 | $1,534.23 | $439.06 | $0.00 | $0.00 | $1,973.30 |
| **TOTAL** | | | | | **$25,185** | **$9,939** | **$5,276** | **$0** | **$40,399** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 8,496.00 | SF | 8.63 | $6,078.82 | $67,257.76 | $0.00 | $0.00 | $73,336.58 |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$6,079** | **$67,258** | **$0** | **$0** | **$73,337** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.63 | $362.42 | $605.65 | $0.00 | $0.00 | $968.07 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 164.88 | $1,230.84 | $196.94 | $5.00 | $0.00 | $1,432.78 |
| G3030040415 | CIP Wall Rebar | 17,595.56 | lb | 0.95 | $9,763.27 | $6,874.74 | $0.00 | $0.00 | $16,638.01 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 95.11 | CY | 215.94 | $14,446.13 | $4,766.17 | $1,325.55 | $0.00 | $20,537.86 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.49 | $389.40 | $2,090.53 | $0.00 | $0.00 | $2,479.93 |
| G3030040420 | Slab On Grade, Rebar | 18,993.33 | lb | 1.06 | $10,538.85 | $9,679.54 | $0.00 | $0.00 | $20,218.39 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 102.67 | CY | 227.93 | $15,594.41 | $6,973.38 | $833.94 | $0.00 | $23,401.73 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.42 | $1,144.90 | $21,245.67 | $0.00 | $0.00 | $22,390.58 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.85 | $6,656.12 | $4,122.70 | $0.00 | $0.00 | $10,778.82 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 280.11 | $10,772.02 | $7,617.98 | $780.42 | $0.00 | $19,170.42 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.96 | $0.00 | $784.25 | $68.32 | $0.00 | $852.57 |
| **TOTAL** | | | | | **$70,898** | **$64,958** | **$3,013** | **$0** | **$138,869** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 808.37 | LF | 4.54 | $2,254.51 | $1,416.92 | $0.00 | $0.00 | $3,671.43 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.11 | $1,337.66 | $1,345.77 | $0.00 | $0.00 | $2,683.43 |
| **TOTAL** | | | | | **$3,592** | **$2,763** | **$0** | **$0** | **$6,355** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 984.00 | CY | 21.90 | $21,552.37 | $0.00 | $0.00 | $0.00 | $21,552.37 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 19.00 | HR | 125.61 | $0.00 | $1,510.68 | $875.84 | $0.00 | $2,386.52 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 146.67 | CY | 1.72 | $0.00 | $105.88 | $147.01 | $0.00 | $252.88 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 39.00 | HR | 150.01 | $0.00 | $2,512.85 | $3,337.56 | $0.00 | $5,850.41 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 462.67 | CY | 1.59 | $0.00 | $316.05 | $417.32 | $0.00 | $733.37 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 38.10 | $2,097.92 | $47.67 | $44.28 | $0.00 | $2,189.88 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.42 | $0.00 | $59.45 | $21.30 | $0.00 | $80.75 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,278.22 | CY | 2.36 | $0.00 | $4,947.23 | $432.34 | $0.00 | $5,379.57 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 98.66 | $1,534.23 | $439.06 | $0.00 | $0.00 | $1,973.30 |
| **TOTAL** | | | | | **$25,185** | **$9,939** | **$5,276** | **$0** | **$40,399** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 8,496.00 | SF | 8.63 | $6,078.82 | $67,257.76 | $0.00 | $0.00 | $73,336.58 |
| **TOTAL** | | | | | **$6,079** | **$67,258** | **$0** | **$0** | **$73,337** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.63 | $362.42 | $605.65 | $0.00 | $0.00 | $968.07 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 164.88 | $1,230.84 | $196.94 | $5.00 | $0.00 | $1,432.78 |
| G3030040415 | CIP Wall Rebar | 17,595.56 | lb | 0.95 | $9,763.27 | $6,874.74 | $0.00 | $0.00 | $16,638.01 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 95.11 | CY | 215.94 | $14,446.13 | $4,766.17 | $1,325.55 | $0.00 | $20,537.86 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.49 | $389.40 | $2,090.53 | $0.00 | $0.00 | $2,479.93 |
| G3030040420 | Slab On Grade, Rebar | 18,993.33 | lb | 1.06 | $10,538.85 | $9,679.54 | $0.00 | $0.00 | $20,218.39 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 102.67 | CY | 227.93 | $15,594.41 | $6,973.38 | $833.94 | $0.00 | $23,401.73 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.42 | $1,144.90 | $21,245.67 | $0.00 | $0.00 | $22,390.58 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.85 | $6,656.12 | $4,122.70 | $0.00 | $0.00 | $10,778.82 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 280.11 | $10,772.02 | $7,617.98 | $780.42 | $0.00 | $19,170.42 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.96 | $0.00 | $784.25 | $68.32 | $0.00 | $852.57 |
| **TOTAL** | | | | | **$70,898** | **$64,958** | **$3,013** | **$0** | **$138,869** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 808.37 | LF | 4.54 | $2,254.51 | $1,416.92 | $0.00 | $0.00 | $3,671.43 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.11 | $1,337.66 | $1,345.77 | $0.00 | $0.00 | $2,683.43 |
| **TOTAL** | | | | | **$3,592** | **$2,763** | **$0** | **$0** | **$6,355** |

## EXCAVATION, TRENCH/CHANNEL

### G BUILDING SITEWORK

### G10 SITE PREPARATIONS

G1020 SITE DEMOLITION & RELOCATIONS

G102007 SITE CLEANUP

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020070401 | Dump Charge | 24.69 | CY | 21.90 | $540.78 | $0.00 | $0.00 | $0.00 | $540.78 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 118.45 | $0.00 | $79.51 | $38.94 | $0.00 | $118.45 |
| G1030020232 | Crawler Mounted, 1.53m3 (2 CY), 235 Hyd Excavator | 1.00 | HR | 206.20 | $0.00 | $89.07 | $117.13 | $0.00 | $206.20 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 2.00 | HR | 137.08 | $0.00 | $128.86 | $145.30 | $0.00 | $274.16 |
| **TOTAL** | | | | | **$541** | **$297** | **$301** | **$0** | **$1,140** |

## STRUCTURES-CULVERTS

### G BUILDING SITEWORK

### G10 SITE PREPARATIONS

G1030 SITE EARTHWORK

G103002 COMMON EXCAVATION

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 62.22 | CY | 1.72 | $0.00 | $44.91 | $62.36 | $0.00 | $107.28 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 167.11 | CY | 1.59 | $0.00 | $114.15 | $150.73 | $0.00 | $264.88 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 27.91 | CY | 38.10 | $1,018.85 | $23.15 | $21.51 | $0.00 | $1,063.50 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 27.11 | SY | 1.42 | $0.00 | $28.44 | $10.19 | $0.00 | $38.63 |
| G1030050511 | Compact Soil W/Vibrating Plate | 966.52 | CY | 2.36 | $0.00 | $2,098.83 | $183.42 | $0.00 | $2,282.25 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 9.00 | DAY | 98.66 | $690.41 | $197.58 | $0.00 | $0.00 | $887.98 |
| **TOTAL** | | | | | **$1,709** | **$2,507** | **$428** | **$0** | **$4,645** |

### G20 SITE IMPROVEMENTS

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 3,936.00 | SF | 8.63 | $2,816.18 | $31,158.96 | $0.00 | $0.00 | $33,975.14 |
| **TOTAL** | | | | | **$2,816** | **$31,159** | **$0** | **$0** | **$33,975** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.63 | $362.42 | $605.65 | $0.00 | $0.00 | $968.07 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 164.88 | $1,230.84 | $196.94 | $5.00 | $0.00 | $1,432.78 |
| G3030040415 | CIP Wall Rebar | 8,222.22 | lb | 0.95 | $4,562.27 | $3,212.50 | $0.00 | $0.00 | $7,774.77 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 44.44 | CY | 215.94 | $6,749.93 | $2,226.99 | $619.36 | $0.00 | $9,596.28 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 224.00 | LF | 5.49 | $192.98 | $1,036.01 | $0.00 | $0.00 | $1,228.99 |
| G3030040420 | Slab On Grade, Rebar | 8,057.78 | lb | 1.06 | $4,471.03 | $4,106.47 | $0.00 | $0.00 | $8,577.50 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 43.56 | CY | 227.93 | $6,616.27 | $2,958.61 | $353.82 | $0.00 | $9,928.70 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 1,008.00 | SF | 9.42 | $485.72 | $9,013.32 | $0.00 | $0.00 | $9,499.03 |
| G3030040425 | Elevated Slab Rebar | 5,371.85 | lb | 0.85 | $2,823.81 | $1,749.03 | $0.00 | $0.00 | $4,572.83 |
| G3030040426 | Pour & Cure Top Slab Cover | 29.04 | CY | 280.11 | $4,570.71 | $3,232.41 | $331.14 | $0.00 | $8,134.26 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.96 | $0.00 | $784.25 | $68.32 | $0.00 | $852.57 |
| **TOTAL** | | | | | **$32,066** | **$29,122** | **$1,378** | **$0** | **$62,566** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 405.57 | LF | 4.54 | $1,131.12 | $710.89 | $0.00 | $0.00 | $1,842.01 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.11 | $1,337.66 | $1,345.77 | $0.00 | $0.00 | $2,683.43 |
| **TOTAL** | | | | | **$2,469** | **$2,057** | **$0** | **$0** | **$4,525** |
| **RESURFACING ROADWAYS/PARKING LOTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070102 | Pavement Sweeping, Machine | 266.67 | SY | 0.03 | $0.00 | $7.37 | $0.00 | $0.00 | $7.37 |
| G1030 SITE EARTHWORK | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103001 GRADING | | | | | | | | | |
| G1030010103 | Rough Grading, 0.0014 T (14G), 1 Pass | 177.78 | SY | 1.15 | $0.00 | $117.12 | $86.86 | $0.00 | $203.98 |
| G1030010108 | Fine Grading, 0.013 T (130G), 2 Passes | 177.78 | SY | 0.65 | $0.00 | $69.39 | $46.77 | $0.00 | $116.16 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 177.78 | SY | 1.42 | $0.00 | $186.51 | $66.81 | $0.00 | $253.33 |
| **TOTAL** | | | | | **$0** | **$380** | **$200** | **$0** | **$581** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010104 | Asphalt, Intermediate Course (Line Item Incl 5% Waste) | 21.81 | TON | 107.89 | $2,173.54 | $130.11 | $49.35 | $0.00 | $2,352.99 |
| G201003 PAVED SURFACES | | | | | | | | | |
| G2010030311 | Tack Coat | 533.33 | SY | 0.55 | $165.64 | $100.43 | $29.65 | $0.00 | $295.72 |
| G2010030312 | Asphalt Wearing Course,1 Pass (Line Item Incl 5% Waste) | 14.44 | TON | 114.52 | $1,505.48 | $107.17 | $41.03 | $0.00 | $1,653.68 |
| G201004 MARKING & SIGNAGE | | | | | | | | | |
| G2010040401 | X Walk, Stop Lines, Per Lane, Intersection Painting | 1.00 | EA | 100.79 | $88.49 | $7.49 | $4.81 | $0.00 | $100.79 |
| G2010040402 | Turn Lane, Per Lane, Intersection Painting | 1.00 | EA | 64.42 | $56.51 | $4.82 | $3.09 | $0.00 | $64.42 |
| G2010040403 | Arrows, Per Lane, Intersection Painting | 1.00 | EA | 41.54 | $13.58 | $17.02 | $10.93 | $0.00 | $41.54 |
| G2010040405 | No Pass Stripe, Yellow | 33.33 | LF | 1.55 | $43.31 | $4.99 | $3.21 | $0.00 | $51.51 |
| G2010040406 | Centerline Stripe, White | 100.00 | LF | 4.29 | $376.73 | $32.10 | $20.62 | $0.00 | $429.44 |
| G2010040407 | Edge Stripe, Yellow | 200.00 | LF | 1.55 | $259.91 | $29.94 | $19.23 | $0.00 | $309.09 |
| **TOTAL** | | | | | **$4,683** | **$434** | **$182** | **$0** | **$5,299** |
| **Marked Up Cost:** | | | | | **$368,227** | **$513,381** | **$34,481** | **$0** | **$916,089** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$916,089** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$916,089** |
| | Contingency | 20.00 % | $183,218 |
| | SIOH | 5.70 % | $62,660 |
| | Design | 6.00 % | $54,965 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $40,625 |
| **Total Project Cost:** | | | **$1,257,558** |

# MEASURE 3 – YARMOUTH CULVERT MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **DEMOLITION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102002 ABOVE GROUND SITE DEMOLITION | | | | | | | | | |
| G1020020201 | Demolish Bituminous Road W/Power Equipment | 37.04 | CY | 28.98 | $0.00 | $755.39 | $317.89 | $0.00 | $1,073.28 |
| G1020020222 | Demolish Reinforced Concrete Curbs | 150.00 | LF | 5.82 | $0.00 | $750.38 | $122.20 | $0.00 | $872.58 |
| G102005 UTILITY RELOCATION | | | | | | | | | |
| G1020050606 | Remove 914.40mm (36") Dia Concrete Pipe, Not Incl Excavation | 339.00 | LF | 17.77 | $0.00 | $5,181.83 | $843.77 | $0.00 | $6,025.60 |
| G102005u1 | Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes excavation | 339.00 | LF | 14.67 | $0.00 | $3,792.24 | $1,180.73 | $0.00 | $4,972.97 |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 187.93 | CY | 21.44 | $4,029.18 | $0.00 | $0.00 | $0.00 | $4,029.18 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 5.00 | HR | 115.94 | $0.00 | $389.14 | $190.57 | $0.00 | $579.71 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 552.44 | CY | 2.74 | $0.00 | $884.15 | $631.03 | $0.00 | $1,515.17 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 14.00 | HR | 134.18 | $0.00 | $882.98 | $995.59 | $0.00 | $1,878.57 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 552.44 | CY | 2.26 | $0.00 | $606.85 | $640.22 | $0.00 | $1,247.08 |
| G1030040420 | Backfill Trench, Borrow Mat'l, Delivered & Dumped Only | 107.81 | CY | 37.64 | $3,852.37 | $100.42 | $105.11 | $0.00 | $4,057.90 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 552.44 | CY | 2.31 | $0.00 | $1,174.28 | $102.62 | $0.00 | $1,276.90 |
| **TOTAL** | | | | | **$7,882** | **$14,518** | **$5,130** | **$0** | **$27,529** |
| **EXCAVATION, TRENCH/CHANNEL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 12.35 | CY | 21.44 | $264.78 | $0.00 | $0.00 | $0.00 | $264.78 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 115.94 | $0.00 | $77.83 | $38.11 | $0.00 | $115.94 |
| G1030020232 | Crawler Mounted, 1.53m3 (2 CY), 235 Hyd Excavator | 1.00 | HR | 201.84 | $0.00 | $87.19 | $114.65 | $0.00 | $201.84 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 2.00 | HR | 134.18 | $0.00 | $126.14 | $142.23 | $0.00 | $268.37 |
| **TOTAL** | | | | | **$265** | **$291** | **$295** | **$0** | **$851** |

## STRUCTURES-CULVERTS

### G BUILDING SITEWORK

### G10 SITE PREPARATIONS

G1020 SITE DEMOLITION & RELOCATIONS

G102007 SITE CLEANUP

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1020070401 | Dump Charge | 856.00 | CY | 21.44 | $18,352.46 | $0.00 | $0.00 | $0.00 | $18,352.46 |

G1030 SITE EARTHWORK

G103002 COMMON EXCAVATION

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 16.00 | HR | 122.95 | $0.00 | $1,245.26 | $721.95 | $0.00 | $1,967.21 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 139.33 | CY | 1.69 | $0.00 | $98.45 | $136.70 | $0.00 | $235.15 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 34.00 | HR | 146.84 | $0.00 | $2,144.38 | $2,848.16 | $0.00 | $4,992.54 |

G103004 FILL & BORROW

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 466.67 | CY | 1.55 | $0.00 | $312.04 | $412.03 | $0.00 | $724.07 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 37.30 | $2,053.57 | $46.66 | $43.35 | $0.00 | $2,143.58 |

G103005 COMPACTION

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.39 | $0.00 | $58.20 | $20.85 | $0.00 | $79.04 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,010.56 | CY | 2.31 | $0.00 | $4,273.70 | $373.48 | $0.00 | $4,647.18 |

G103010 TEMPORARY DEWATERING

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 96.58 | $1,501.80 | $429.78 | $0.00 | $0.00 | $1,931.58 |
| **TOTAL** | | | | | **$21,908** | **$8,608** | **$4,557** | **$0** | **$35,073** |

### G20 SITE IMPROVEMENTS

G2040 SITE DEVELOPMENT

G204002 RETAINING WALLS AND FREESTANDING WALLS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 7,308.00 | SF | 8.45 | $5,118.28 | $56,630.05 | $0.00 | $0.00 | $61,748.33 |
| **TOTAL** | | | | | **$5,118** | **$56,630** | **$0** | **$0** | **$61,748** |

### G30 SITE CIVIL/MECHANICAL UTILITIES

G3030 STORM SEWER

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.49 | $354.76 | $592.84 | $0.00 | $0.00 | $947.60 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 161.39 | $1,204.82 | $192.78 | $4.90 | $0.00 | $1,402.49 |
| G3030040415 | CIP Wall Rebar | 14,882.22 | lb | 0.93 | $8,083.15 | $5,691.70 | $0.00 | $0.00 | $13,774.84 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 80.44 | CY | 211.37 | $11,959.64 | $3,945.81 | $1,097.39 | $0.00 | $17,002.84 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.37 | $381.17 | $2,046.33 | $0.00 | $0.00 | $2,427.50 |
| G3030040420 | Slab On Grade, Rebar | 18,993.33 | lb | 1.04 | $10,316.06 | $9,474.92 | $0.00 | $0.00 | $19,790.98 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 102.67 | CY | 223.11 | $15,264.75 | $6,825.96 | $816.31 | $0.00 | $22,907.02 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.22 | $1,120.70 | $20,796.54 | $0.00 | $0.00 | $21,917.24 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.83 | $6,515.41 | $4,035.55 | $0.00 | $0.00 | $10,550.95 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 274.18 | $10,544.30 | $7,456.93 | $763.92 | $0.00 | $18,765.15 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.90 | $0.00 | $767.67 | $66.87 | $0.00 | $834.54 |
| **TOTAL** | | | | | **$65,745** | **$61,827** | **$2,749** | **$0** | **$130,321** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 762.37 | LF | 4.45 | $2,081.27 | $1,308.04 | $0.00 | $0.00 | $3,389.31 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.09 | $1,309.38 | $1,317.32 | $0.00 | $0.00 | $2,626.70 |
| **TOTAL** | | | | | **$3,391** | **$2,625** | **$0** | **$0** | **$6,016** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 856.00 | CY | 21.44 | $18,352.46 | $0.00 | $0.00 | $0.00 | $18,352.46 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 16.00 | HR | 122.95 | $0.00 | $1,245.26 | $721.95 | $0.00 | $1,967.21 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 139.33 | CY | 1.69 | $0.00 | $98.45 | $136.70 | $0.00 | $235.15 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 34.00 | HR | 146.84 | $0.00 | $2,144.38 | $2,848.16 | $0.00 | $4,992.54 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 466.67 | CY | 1.55 | $0.00 | $312.04 | $412.03 | $0.00 | $724.07 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 37.30 | $2,053.57 | $46.66 | $43.35 | $0.00 | $2,143.58 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.39 | $0.00 | $58.20 | $20.85 | $0.00 | $79.04 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,010.56 | CY | 2.31 | $0.00 | $4,273.70 | $373.48 | $0.00 | $4,647.18 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 96.58 | $1,501.80 | $429.78 | $0.00 | $0.00 | $1,931.58 |
| **TOTAL** | | | | | **$21,908** | **$8,608** | **$4,557** | **$0** | **$35,073** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 7,308.00 | SF | 8.45 | $5,118.28 | $56,630.05 | $0.00 | $0.00 | $61,748.33 |
| **TOTAL** | | | | | **$5,118** | **$56,630** | **$0** | **$0** | **$61,748** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.49 | $354.76 | $592.84 | $0.00 | $0.00 | $947.60 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 161.39 | $1,204.82 | $192.78 | $4.90 | $0.00 | $1,402.49 |
| G3030040415 | CIP Wall Rebar | 14,882.22 | lb | 0.93 | $8,083.15 | $5,691.70 | $0.00 | $0.00 | $13,774.84 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 80.44 | CY | 211.37 | $11,959.64 | $3,945.81 | $1,097.39 | $0.00 | $17,002.84 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.37 | $381.17 | $2,046.33 | $0.00 | $0.00 | $2,427.50 |
| G3030040420 | Slab On Grade, Rebar | 18,993.33 | lb | 1.04 | $10,316.06 | $9,474.92 | $0.00 | $0.00 | $19,790.98 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 102.67 | CY | 223.11 | $15,264.75 | $6,825.96 | $816.31 | $0.00 | $22,907.02 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.22 | $1,120.70 | $20,796.54 | $0.00 | $0.00 | $21,917.24 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.83 | $6,515.41 | $4,035.55 | $0.00 | $0.00 | $10,550.95 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 274.18 | $10,544.30 | $7,456.93 | $763.92 | $0.00 | $18,765.15 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.90 | $0.00 | $767.67 | $66.87 | $0.00 | $834.54 |
| **TOTAL** | | | | | **$65,745** | **$61,827** | **$2,749** | **$0** | **$130,321** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 762.37 | LF | 4.45 | $2,081.27 | $1,308.04 | $0.00 | $0.00 | $3,389.31 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.09 | $1,309.38 | $1,317.32 | $0.00 | $0.00 | $2,626.70 |
| **TOTAL** | | | | | **$3,391** | **$2,625** | **$0** | **$0** | **$6,016** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 856.00 | CY | 21.44 | $18,352.46 | $0.00 | $0.00 | $0.00 | $18,352.46 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 16.00 | HR | 122.95 | $0.00 | $1,245.26 | $721.95 | $0.00 | $1,967.21 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 139.33 | CY | 1.69 | $0.00 | $98.45 | $136.70 | $0.00 | $235.15 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 34.00 | HR | 146.84 | $0.00 | $2,144.38 | $2,848.16 | $0.00 | $4,992.54 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 466.67 | CY | 1.55 | $0.00 | $312.04 | $412.03 | $0.00 | $724.07 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 37.30 | $2,053.57 | $46.66 | $43.35 | $0.00 | $2,143.58 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.39 | $0.00 | $58.20 | $20.85 | $0.00 | $79.04 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,010.56 | CY | 2.31 | $0.00 | $4,273.70 | $373.48 | $0.00 | $4,647.18 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 96.58 | $1,501.80 | $429.78 | $0.00 | $0.00 | $1,931.58 |
| **TOTAL** | | | | | **$21,908** | **$8,608** | **$4,557** | **$0** | **$35,073** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 7,308.00 | SF | 8.45 | $5,118.28 | $56,630.05 | $0.00 | $0.00 | $61,748.33 |
| **TOTAL** | | | | | **$5,118** | **$56,630** | **$0** | **$0** | **$61,748** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.49 | $354.76 | $592.84 | $0.00 | $0.00 | $947.60 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 161.39 | $1,204.82 | $192.78 | $4.90 | $0.00 | $1,402.49 |
| G3030040415 | CIP Wall Rebar | 14,882.22 | lb | 0.93 | $8,083.15 | $5,691.70 | $0.00 | $0.00 | $13,774.84 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 80.44 | CY | 211.37 | $11,959.64 | $3,945.81 | $1,097.39 | $0.00 | $17,002.84 |

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.37 | $381.17 | $2,046.33 | $0.00 | $0.00 | $2,427.50 |
| G3030040420 | Slab On Grade, Rebar | 18,993.33 | lb | 1.04 | $10,316.06 | $9,474.92 | $0.00 | $0.00 | $19,790.98 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 102.67 | CY | 223.11 | $15,264.75 | $6,825.96 | $816.31 | $0.00 | $22,907.02 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.22 | $1,120.70 | $20,796.54 | $0.00 | $0.00 | $21,917.24 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.83 | $6,515.41 | $4,035.55 | $0.00 | $0.00 | $10,550.95 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 274.18 | $10,544.30 | $7,456.93 | $763.92 | $0.00 | $18,765.15 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.90 | $0.00 | $767.67 | $66.87 | $0.00 | $834.54 |
| **TOTAL** | | | | | **$65,745** | **$61,827** | **$2,749** | **$0** | **$130,321** |

### G90 OTHER SITE CONSTRUCTION
G9090 OTHER SITE CONSTRUCTION
G909001 BRIDGES

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 762.37 | LF | 4.45 | $2,081.27 | $1,308.04 | $0.00 | $0.00 | $3,389.31 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.09 | $1,309.38 | $1,317.32 | $0.00 | $0.00 | $2,626.70 |
| **TOTAL** | | | | | **$3,391** | **$2,625** | **$0** | **$0** | **$6,016** |

## STRUCTURES-CULVERTS

### G BUILDING SITEWORK
### G10 SITE PREPARATIONS
G1030 SITE EARTHWORK
G103002 COMMON EXCAVATION

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020268 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand, Trenching | 529.48 | CY | 1.07 | $0.00 | $267.60 | $298.10 | $0.00 | $565.70 |

G103004 FILL & BORROW

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 852.96 | CY | 1.55 | $0.00 | $570.33 | $753.09 | $0.00 | $1,323.42 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 27.91 | CY | 37.30 | $997.31 | $22.66 | $21.05 | $0.00 | $1,041.02 |

G103005 COMPACTION

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030050510 | Dry Roll Gravel, Steel Roller | 27.11 | SY | 1.39 | $0.00 | $27.84 | $9.97 | $0.00 | $37.81 |
| G1030050511 | Compact Soil W/Vibrating Plate | 852.96 | CY | 2.31 | $0.00 | $1,813.07 | $158.45 | $0.00 | $1,971.52 |
| **TOTAL** | | | | | **$997** | **$2,702** | **$1,241** | **$0** | **$4,939** |

### G20 SITE IMPROVEMENTS
G2040 SITE DEVELOPMENT
G204002 RETAINING WALLS AND FREESTANDING WALLS

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 3,432.00 | SF | 8.45 | $2,403.66 | $26,594.74 | $0.00 | $0.00 | $28,998.39 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$2,404** | **$26,595** | **$0** | **$0** | **$28,998** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.49 | $354.76 | $592.84 | $0.00 | $0.00 | $947.60 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 161.39 | $1,204.82 | $192.78 | $4.90 | $0.00 | $1,402.49 |
| G3030040415 | CIP Wall Rebar | 7,071.11 | lb | 0.93 | $3,840.61 | $2,704.34 | $0.00 | $0.00 | $6,544.95 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 38.22 | CY | 211.37 | $5,682.46 | $1,874.80 | $521.41 | $0.00 | $8,078.68 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 224.00 | LF | 5.37 | $188.90 | $1,014.11 | $0.00 | $0.00 | $1,203.01 |
| G3030040420 | Slab On Grade, Rebar | 8,057.78 | lb | 1.04 | $4,376.51 | $4,019.66 | $0.00 | $0.00 | $8,396.18 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 43.56 | CY | 223.11 | $6,476.40 | $2,896.06 | $346.34 | $0.00 | $9,718.81 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 1,008.00 | SF | 9.22 | $475.45 | $8,822.77 | $0.00 | $0.00 | $9,298.22 |
| G3030040425 | Elevated Slab Rebar | 5,371.85 | lb | 0.83 | $2,764.11 | $1,712.05 | $0.00 | $0.00 | $4,476.16 |
| G3030040426 | Pour & Cure Top Slab Cover | 29.04 | CY | 274.18 | $4,474.09 | $3,164.08 | $324.14 | $0.00 | $7,962.30 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.90 | $0.00 | $767.67 | $66.87 | $0.00 | $834.54 |
| **TOTAL** | | | | | **$29,838** | **$27,761** | **$1,264** | **$0** | **$58,863** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 382.37 | LF | 4.45 | $1,043.87 | $656.05 | $0.00 | $0.00 | $1,699.92 |
| G9090010146 | Footing, Rebar | 2,410.76 | lb | 1.09 | $1,309.38 | $1,317.32 | $0.00 | $0.00 | $2,626.70 |
| **TOTAL** | | | | | **$2,353** | **$1,973** | **$0** | **$0** | **$4,327** |
| **RESURFACING ROADWAYS/PARKING LOTS** | | | | | | | | | |
| **G  BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070102 | Pavement Sweeping, Machine | 266.67 | SY | 0.03 | $0.00 | $7.22 | $0.00 | $0.00 | $7.22 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010103 | Rough Grading, 0.0014 T (14G), 1 Pass | 177.78 | SY | 1.12 | $0.00 | $114.64 | $85.02 | $0.00 | $199.67 |
| G1030010108 | Fine Grading, 0.013 T (130G), 2 Passes | 177.78 | SY | 0.64 | $0.00 | $67.93 | $45.78 | $0.00 | $113.71 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 177.78 | SY | 1.39 | $0.00 | $182.57 | $65.40 | $0.00 | $247.97 |
| **TOTAL** | | | | | **$0** | **$372** | **$196** | **$0** | **$569** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010104 | Asphalt, Intermediate Course (Line Item Incl 5% Waste) | 21.81 | TON | 105.61 | $2,127.59 | $127.36 | $48.30 | $0.00 | $2,303.25 |
| G201003 PAVED SURFACES | | | | | | | | | |
| G2010030311 | Tack Coat | 533.33 | SY | 0.54 | $162.14 | $98.31 | $29.02 | $0.00 | $289.47 |
| G2010030312 | Asphalt Wearing Course,1 Pass (Line Item Incl 5% Waste) | 14.44 | TON | 112.10 | $1,473.65 | $104.91 | $40.16 | $0.00 | $1,618.72 |
| G201004 MARKING & SIGNAGE | | | | | | | | | |
| G2010040401 | X Walk, Stop Lines, Per Lane, Intersection Painting | 1.00 | EA | 98.66 | $86.62 | $7.33 | $4.71 | $0.00 | $98.66 |
| G2010040402 | Turn Lane, Per Lane, Intersection Painting | 1.00 | EA | 63.06 | $55.31 | $4.71 | $3.03 | $0.00 | $63.06 |
| G2010040403 | Arrows, Per Lane, Intersection Painting | 1.00 | EA | 40.66 | $13.29 | $16.66 | $10.70 | $0.00 | $40.66 |
| G2010040405 | No Pass Stripe, Yellow | 33.33 | LF | 1.51 | $42.40 | $4.88 | $3.14 | $0.00 | $50.42 |
| G2010040406 | Centerline Stripe, White | 100.00 | LF | 4.20 | $368.76 | $31.42 | $20.18 | $0.00 | $420.37 |
| G2010040407 | Edge Stripe, Yellow | 200.00 | LF | 1.51 | $254.42 | $29.31 | $18.83 | $0.00 | $302.56 |
| **TOTAL** | | | | | **$4,584** | **$425** | **$178** | **$0** | **$5,187** |

| | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$336,807** | **$463,710** | **$30,221** | **$0** | **$830,738** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$830,738** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$830,738** |
| | Contingency | 20.00 % | $166,148 |
| | SIOH | 5.70 % | $56,822 |
| | Design | 6.00 % | $49,844 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $40,625 |
| **Total Project Cost:** | | | **$1,144,177** |

# MEASURE 4 – KETTERING CULVERT MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **DEMOLITION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102002 ABOVE GROUND SITE DEMOLITION | | | | | | | | | |
| G1020020201 | Demolish Bituminous Road W/Power Equipment | 37.04 | CY | 29.41 | $0.00 | $766.77 | $322.68 | $0.00 | $1,089.44 |
| G102005 UTILITY RELOCATION | | | | | | | | | |
| G1020050606 | Remove 914.40mm (36") Dia Concrete Pipe, Not Incl Excavation | 38.00 | LF | 18.04 | $0.00 | $589.60 | $96.01 | $0.00 | $685.61 |
| G102005u2 | Selective demolition, water & sewer piping & fittings, concrete pipe, 42"-48", diameter, excludes excavation | 38.00 | LF | 37.76 | $0.00 | $900.11 | $534.69 | $0.00 | $1,434.80 |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 69.22 | CY | 21.76 | $1,506.41 | $0.00 | $0.00 | $0.00 | $1,506.41 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 2.00 | HR | 117.69 | $0.00 | $158.00 | $77.38 | $0.00 | $235.38 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 61.93 | CY | 2.78 | $0.00 | $100.61 | $71.81 | $0.00 | $172.41 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 6.00 | HR | 136.20 | $0.00 | $384.12 | $433.11 | $0.00 | $817.23 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 61.93 | CY | 2.29 | $0.00 | $69.05 | $72.85 | $0.00 | $141.91 |
| G1030040420 | Backfill Trench, Borrow Mat'l, Delivered & Dumped Only | 12.09 | CY | 38.21 | $438.52 | $11.43 | $11.96 | $0.00 | $461.91 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 61.93 | CY | 2.35 | $0.00 | $133.62 | $11.68 | $0.00 | $145.30 |
| **TOTAL** | | | | | **$1,945** | **$3,113** | **$1,632** | **$0** | **$6,690** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 279.00 | CY | 21.76 | $6,071.80 | $0.00 | $0.00 | $0.00 | $6,071.80 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 7.00 | HR | 117.69 | $0.00 | $553.01 | $270.81 | $0.00 | $823.82 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020268 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand, Trenching | 360.30 | CY | 1.08 | $0.00 | $184.84 | $205.91 | $0.00 | $390.74 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 21.00 | HR | 136.20 | $0.00 | $1,344.42 | $1,515.88 | $0.00 | $2,860.30 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 154.37 | CY | 1.57 | $0.00 | $104.77 | $138.35 | $0.00 | $243.12 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 24.81 | CY | 37.86 | $899.89 | $20.45 | $18.99 | $0.00 | $939.33 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 24.15 | SY | 1.42 | $0.00 | $25.17 | $9.02 | $0.00 | $34.19 |
| G1030050511 | Compact Soil W/Vibrating Plate | 677.43 | CY | 2.35 | $0.00 | $1,461.65 | $127.73 | $0.00 | $1,589.39 |
| **TOTAL** | | | | | **$6,972** | **$3,694** | **$2,287** | **$0** | **$12,953** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 2,704.00 | SF | 8.58 | $1,922.31 | $21,269.03 | $0.00 | $0.00 | $23,191.34 |
| **TOTAL** | | | | | **$1,922** | **$21,269** | **$0** | **$0** | **$23,191** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 146.00 | SF | 6.59 | $360.10 | $601.77 | $0.00 | $0.00 | $961.87 |
| G3030040411 | Cont Footing, Pour Concrete | 7.50 | CY | 163.82 | $1,055.49 | $168.89 | $4.29 | $0.00 | $1,228.67 |
| G3030040415 | CIP Wall Rebar | 5,481.48 | lb | 0.94 | $3,022.06 | $2,127.96 | $0.00 | $0.00 | $5,150.02 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 29.63 | CY | 214.56 | $4,471.67 | $1,475.33 | $410.31 | $0.00 | $6,357.31 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 208.00 | LF | 5.45 | $178.05 | $955.86 | $0.00 | $0.00 | $1,133.91 |
| G3030040420 | Slab On Grade, Rebar | 7,290.37 | lb | 1.06 | $4,019.34 | $3,691.61 | $0.00 | $0.00 | $7,710.96 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 39.41 | CY | 226.47 | $5,947.64 | $2,659.62 | $318.06 | $0.00 | $8,925.32 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 912.00 | SF | 9.36 | $436.65 | $8,102.74 | $0.00 | $0.00 | $8,539.39 |
| G3030040425 | Elevated Slab Rebar | 4,860.25 | lb | 0.85 | $2,538.53 | $1,572.33 | $0.00 | $0.00 | $4,110.86 |
| G3030040426 | Pour & Cure Top Slab Cover | 26.27 | CY | 278.31 | $4,108.28 | $2,905.38 | $297.64 | $0.00 | $7,311.30 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.94 | $0.00 | $779.23 | $67.88 | $0.00 | $847.11 |
| **TOTAL** | | | | | **$26,138** | **$25,041** | **$1,098** | **$0** | **$52,277** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 324.50 | LF | 4.51 | $899.23 | $565.15 | $0.00 | $0.00 | $1,464.38 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010146 | Footing, Rebar | 2,081.87 | lb | 1.11 | $1,147.78 | $1,154.74 | $0.00 | $0.00 | $2,302.52 |
| **TOTAL** | | | | | **$2,047** | **$1,720** | **$0** | **$0** | **$3,767** |
| **EXCAVATION, TRENCH/CHANNEL** | | | | | | | | | |
| **G  BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 12.35 | CY | 21.76 | $268.77 | $0.00 | $0.00 | $0.00 | $268.77 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 117.69 | $0.00 | $79.00 | $38.69 | $0.00 | $117.69 |
| G1030020232 | Crawler Mounted, 1.53m3 (2 CY), 235 Hyd Excavator | 1.00 | HR | 204.88 | $0.00 | $88.50 | $116.38 | $0.00 | $204.88 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 2.00 | HR | 136.20 | $0.00 | $128.04 | $144.37 | $0.00 | $272.41 |
| **TOTAL** | | | | | **$269** | **$296** | **$299** | **$0** | **$864** |
| **RESURFACING ROADWAYS/PARKING LOTS** | | | | | | | | | |
| **G  BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070102 | Pavement Sweeping, Machine | 266.67 | SY | 0.03 | $0.00 | $7.32 | $0.00 | $0.00 | $7.32 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010103 | Rough Grading, 0.0014 T (14G), 1 Pass | 177.78 | SY | 1.14 | $0.00 | $116.37 | $86.30 | $0.00 | $202.67 |
| G1030010108 | Fine Grading, 0.013 T (130G), 2 Passes | 177.78 | SY | 0.65 | $0.00 | $68.95 | $46.47 | $0.00 | $115.42 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 177.78 | SY | 1.42 | $0.00 | $185.32 | $66.39 | $0.00 | $251.71 |
| **TOTAL** | | | | | **$0** | **$378** | **$199** | **$0** | **$577** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010104 | Asphalt, Intermediate Course (Line Item Incl 5% Waste) | 21.81 | TON | 107.20 | $2,159.63 | $129.28 | $49.03 | $0.00 | $2,337.94 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G201003 PAVED SURFACES | | | | | | | | | |
| G2010030311 | Tack Coat | 533.33 | SY | 0.55 | $164.58 | $99.79 | $29.46 | $0.00 | $293.83 |
| G2010030312 | Asphalt Wearing Course,1 Pass (Line Item Incl 5% Waste) | 14.44 | TON | 113.79 | $1,495.85 | $106.49 | $40.77 | $0.00 | $1,643.10 |
| G201004 MARKING & SIGNAGE | | | | | | | | | |
| G2010040401 | X Walk, Stop Lines, Per Lane, Intersection Painting | 1.00 | EA | 100.14 | $87.92 | $7.44 | $4.78 | $0.00 | $100.14 |
| G2010040402 | Turn Lane, Per Lane, Intersection Painting | 1.00 | EA | 64.00 | $56.15 | $4.78 | $3.07 | $0.00 | $64.00 |
| G2010040403 | Arrows, Per Lane, Intersection Painting | 1.00 | EA | 41.27 | $13.49 | $16.91 | $10.86 | $0.00 | $41.27 |
| G2010040405 | No Pass Stripe, Yellow | 33.33 | LF | 1.54 | $43.04 | $4.96 | $3.18 | $0.00 | $51.18 |
| G2010040406 | Centerline Stripe, White | 100.00 | LF | 4.27 | $374.32 | $31.89 | $20.49 | $0.00 | $426.70 |
| G2010040407 | Edge Stripe, Yellow | 200.00 | LF | 1.54 | $258.25 | $29.75 | $19.11 | $0.00 | $307.11 |
| **TOTAL** | | | | | **$4,653** | **$431** | **$181** | **$0** | **$5,265** |

| | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$43,946** | **$55,942** | **$5,696** | **$0** | **$105,584** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$105,584** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$105,584** |
| | Contingency | 20.00 % | $21,117 |
| | SIOH | 5.70 % | $7,222 |
| | Design | 6.00 % | $6,335 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $8,125 |
| **Total Project Cost:** | | | **$148,383** |

Note: All Costs Include ACF, Markups and Escalation

Project Location: Columbia, South Carolina
Project Midpoint: Sep 2017

Area Cost Factor: 0.82
Escalation Rate: 7.49 %

# Measure 5 – Lower Brookshire Culvert Modification

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **DEMOLITION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102002 ABOVE GROUND SITE DEMOLITION | | | | | | | | | |
| G1020020201 | Demolish Bituminous Road W/Power Equipment | 37.04 | CY | 29.41 | $0.00 | $766.77 | $322.68 | $0.00 | $1,089.44 |
| **TOTAL** | | | | | **$0** | **$767** | **$323** | **$0** | **$1,089** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3095 SITE UTILITY RENOVATION | | | | | | | | | |
| G309501 PIPE DEMOLITION | | | | | | | | | |
| G3095010138 | Demo pipe, CMP, steel, 48"-60", diameter, excludes excavation | 71.00 | LF | 18.69 | $0.00 | $1,120.04 | $207.09 | $0.00 | $1,327.13 |
| **TOTAL** | | | | | **$0** | **$1,120** | **$207** | **$0** | **$1,327** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 261.00 | CY | 21.76 | $5,680.07 | $0.00 | $0.00 | $0.00 | $5,680.07 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 6.00 | HR | 117.69 | $0.00 | $474.01 | $232.13 | $0.00 | $706.13 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 47.33 | CY | 1.71 | $0.00 | $33.95 | $47.14 | $0.00 | $81.08 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 20.00 | HR | 136.20 | $0.00 | $1,280.40 | $1,443.70 | $0.00 | $2,724.10 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 162.74 | CY | 1.57 | $0.00 | $110.46 | $145.85 | $0.00 | $256.31 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 20.45 | CY | 37.86 | $741.75 | $16.85 | $15.66 | $0.00 | $774.26 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 20.19 | SY | 1.42 | $0.00 | $21.05 | $7.54 | $0.00 | $28.59 |
| G1030050511 | Compact Soil W/Vibrating Plate | 632.86 | CY | 2.35 | $0.00 | $1,365.49 | $119.33 | $0.00 | $1,484.82 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 8.00 | DAY | 98.03 | $609.77 | $174.50 | $0.00 | $0.00 | $784.27 |
| **TOTAL** | | | | | **$7,032** | **$3,477** | **$2,011** | **$0** | **$12,520** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 2,276.00 | SF | 8.58 | $1,618.04 | $17,902.48 | $0.00 | $0.00 | $19,520.52 |
| **TOTAL** | | | | | **$1,618** | **$17,902** | **$0** | **$0** | **$19,521** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 73.00 | SF | 6.59 | $180.05 | $300.89 | $0.00 | $0.00 | $480.94 |
| G3030040411 | Cont Footing, Pour Concrete | 3.16 | CY | 163.82 | $444.71 | $71.16 | $1.81 | $0.00 | $517.68 |
| G3030040415 | CIP Wall Rebar | 4,549.63 | lb | 0.94 | $2,508.31 | $1,766.21 | $0.00 | $0.00 | $4,274.52 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 24.59 | CY | 214.56 | $3,711.05 | $1,224.38 | $340.52 | $0.00 | $5,275.95 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 170.00 | LF | 5.45 | $145.52 | $781.23 | $0.00 | $0.00 | $926.75 |
| G3030040420 | Slab On Grade, Rebar | 6,810.74 | lb | 1.06 | $3,754.91 | $3,448.75 | $0.00 | $0.00 | $7,203.66 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 36.81 | CY | 226.47 | $5,555.26 | $2,484.15 | $297.08 | $0.00 | $8,336.49 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 852.00 | SF | 9.36 | $407.92 | $7,569.67 | $0.00 | $0.00 | $7,977.59 |
| G3030040425 | Elevated Slab Rebar | 4,540.49 | lb | 0.85 | $2,371.52 | $1,468.89 | $0.00 | $0.00 | $3,840.41 |
| G3030040426 | Pour & Cure Top Slab Cover | 24.54 | CY | 278.31 | $3,837.73 | $2,714.05 | $278.04 | $0.00 | $6,829.82 |
| G3030040429 | Bush Hammer Finish | 144.00 | SF | 2.94 | $0.00 | $389.62 | $33.94 | $0.00 | $423.56 |
| **TOTAL** | | | | | **$22,917** | **$22,219** | **$951** | **$0** | **$46,087** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 260.85 | LF | 4.51 | $722.85 | $454.30 | $0.00 | $0.00 | $1,177.14 |
| G9090010146 | Footing, Rebar | 876.49 | lb | 1.11 | $483.23 | $486.16 | $0.00 | $0.00 | $969.39 |
| **TOTAL** | | | | | **$1,206** | **$940** | **$0** | **$0** | **$2,147** |

## STRUCTURES-CULVERTS

**G BUILDING SITEWORK**

**G10 SITE PREPARATIONS**

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 307.00 | CY | 21.76 | $6,681.15 | $0.00 | $0.00 | $0.00 | $6,681.15 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 7.00 | HR | 117.69 | $0.00 | $553.01 | $270.81 | $0.00 | $823.82 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 49.96 | CY | 1.71 | $0.00 | $35.83 | $49.75 | $0.00 | $85.59 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 23.00 | HR | 136.20 | $0.00 | $1,472.46 | $1,660.25 | $0.00 | $3,132.71 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 160.74 | CY | 1.57 | $0.00 | $109.10 | $144.06 | $0.00 | $253.16 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 20.45 | CY | 37.86 | $741.75 | $16.85 | $15.66 | $0.00 | $774.26 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 20.19 | SY | 1.42 | $0.00 | $21.05 | $7.54 | $0.00 | $28.59 |
| G1030050511 | Compact Soil W/Vibrating Plate | 720.96 | CY | 2.35 | $0.00 | $1,555.57 | $135.94 | $0.00 | $1,691.52 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 8.00 | DAY | 98.03 | $609.77 | $174.50 | $0.00 | $0.00 | $784.27 |
| **TOTAL** | | | | | **$8,033** | **$3,938** | **$2,284** | **$0** | **$14,255** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 2,702.00 | SF | 8.58 | $1,920.89 | $21,253.30 | $0.00 | $0.00 | $23,174.19 |
| **TOTAL** | | | | | **$1,921** | **$21,253** | **$0** | **$0** | **$23,174** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 73.00 | SF | 6.59 | $180.05 | $300.89 | $0.00 | $0.00 | $480.94 |
| G3030040411 | Cont Footing, Pour Concrete | 3.16 | CY | 163.82 | $444.71 | $71.16 | $1.81 | $0.00 | $517.68 |
| G3030040415 | CIP Wall Rebar | 5,522.59 | lb | 0.94 | $3,044.73 | $2,143.92 | $0.00 | $0.00 | $5,188.65 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 29.85 | CY | 214.56 | $4,504.88 | $1,486.28 | $413.36 | $0.00 | $6,404.52 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 170.00 | LF | 5.45 | $145.52 | $781.23 | $0.00 | $0.00 | $926.75 |
| G3030040420 | Slab On Grade, Rebar | 6,810.74 | lb | 1.06 | $3,754.91 | $3,448.75 | $0.00 | $0.00 | $7,203.66 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 36.81 | CY | 226.47 | $5,555.26 | $2,484.15 | $297.08 | $0.00 | $8,336.49 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 852.00 | SF | 9.36 | $407.92 | $7,569.67 | $0.00 | $0.00 | $7,977.59 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G3030040425 | Elevated Slab Rebar | 4,540.49 | lb | 0.85 | $2,371.52 | $1,468.89 | $0.00 | $0.00 | $3,840.41 |
| G3030040426 | Pour & Cure Top Slab Cover | 24.54 | CY | 278.31 | $3,837.73 | $2,714.05 | $278.04 | $0.00 | $6,829.82 |
| G3030040429 | Bush Hammer Finish | 144.00 | SF | 2.94 | $0.00 | $389.62 | $33.94 | $0.00 | $423.56 |
| **TOTAL** | | | | | **$24,247** | **$22,859** | **$1,024** | **$0** | **$48,130** |

**G90 OTHER SITE CONSTRUCTION**

G9090 OTHER SITE CONSTRUCTION

G909001 BRIDGES

| | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 278.25 | LF | 4.51 | $771.06 | $484.60 | $0.00 | $0.00 | $1,255.66 |
| G9090010146 | Footing, Rebar | 876.49 | lb | 1.11 | $483.23 | $486.16 | $0.00 | $0.00 | $969.39 |
| **TOTAL** | | | | | **$1,254** | **$971** | **$0** | **$0** | **$2,225** |

| | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$68,228** | **$95,446** | **$6,801** | **$0** | **$170,475** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$170,475** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$170,475** |
| | Contingency | 20.00 % | $34,095 |
| | SIOH | 5.70 % | $11,660 |
| | Design | 6.00 % | $10,228 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easesment | | | $8,125 |
| **Total Project Cost:** | | | **$234,584** |

Note: All Costs Include ACF, Markups and Escalation

Project Location: Columbia, South Carolina
Project Midpoint: Sep 2017

Area Cost Factor: 0.82
Escalation Rate: 7.49 %

# MEASURE 6 – OFFLINE POND, JAMIL ROAD

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 1,269.00 | CY | 21.90 | $27,794.67 | $0.00 | $0.00 | $0.00 | $27,794.67 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020208 | D5 W/A Blade Bulldozer | 29.00 | HR | 128.03 | $0.00 | $2,305.77 | $1,407.10 | $0.00 | $3,712.88 |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 20.00 | HR | 118.45 | $0.00 | $1,590.19 | $778.74 | $0.00 | $2,368.93 |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 24.00 | HR | 125.61 | $0.00 | $1,908.23 | $1,106.32 | $0.00 | $3,014.55 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 50.00 | HR | 150.01 | $0.00 | $3,221.61 | $4,278.92 | $0.00 | $7,500.53 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050517 | Spread/Compact Lg Areas, 152.40mm (6") Lifts, D8 & Towed Sheepsft | 2,357.00 | CY | 1.15 | $0.00 | $1,407.15 | $1,307.85 | $0.00 | $2,715.00 |
| **TOTAL** | | | | | **$27,795** | **$10,433** | **$8,879** | **$0** | **$47,107** |
| **SPILLWAY** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010105 | Fine Grading, Hand | 800.00 | SY | 8.20 | $0.00 | $6,559.01 | $0.00 | $0.00 | $6,559.01 |
| G1030010107 | Fine Grading, 0.012 T (120G), 2 Passes | 200.00 | SY | 0.65 | $0.00 | $78.07 | $52.62 | $0.00 | $130.68 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020257 | Cat 215, 0.76m3 (1 CY), Soil, Shallow, Trenching | 472.22 | CY | 3.98 | $0.00 | $1,158.08 | $722.58 | $0.00 | $1,880.66 |
| G1030020282 | Soil, 8.05km (5 Mi), Dump Truck, Load/Haul off Spoil From Trench | 276.48 | CY | 4.79 | $0.00 | $985.85 | $339.11 | $0.00 | $1,324.96 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 251.04 | CY | 2.31 | $0.00 | $281.72 | $297.21 | $0.00 | $578.94 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050516 | Compact W/50% Pogosticks, 50% Hand Roller | 251.04 | CY | 7.74 | $0.00 | $1,716.93 | $225.82 | $0.00 | $1,942.75 |
| **TOTAL** | | | | | **$0** | **$10,780** | **$1,637** | **$0** | **$12,417** |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020201 | Cont. Footing, Edge Form, 4 Uses | 600.00 | SF | 6.63 | $1,489.39 | $2,488.96 | $0.00 | $0.00 | $3,978.35 |
| G2040020202 | Footing, Rebar | 9,453.33 | lb | 1.06 | $5,245.38 | $4,817.69 | $0.00 | $0.00 | $10,063.07 |
| G2040020203 | Pour & Cure Concrete, Cont. Footing | 210.07 | CY | 228.80 | $30,830.60 | $12,377.22 | $4,856.41 | $0.00 | $48,064.23 |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 5,400.00 | SF | 8.63 | $3,863.66 | $42,748.57 | $0.00 | $0.00 | $46,612.23 |
| G2040020206 | Reinf Steel, Retaining Wall | 11,375.00 | lb | 0.95 | $6,311.66 | $4,444.31 | $0.00 | $0.00 | $10,755.98 |
| G2040020207 | Pour & Cure Concrete, Retaining Wall | 108.33 | CY | 215.94 | $16,454.10 | $5,428.66 | $1,509.80 | $0.00 | $23,392.56 |
| G2040020208 | Bush Hammer Finish | 2,500.00 | SF | 2.96 | $0.00 | $6,807.72 | $593.03 | $0.00 | $7,400.76 |
| G2040020210 | Keyway | 100.00 | LF | 1.18 | $18.98 | $99.22 | $0.00 | $0.00 | $118.20 |
| **TOTAL** | | | | | **$64,214** | **$79,212** | **$6,959** | **$0** | **$150,385** |

## CLEAR AND GRUB

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1010 SITE CLEARING | | | | | | | | | |
| G101001 CLEARING | | | | | | | | | |
| G1010010102 | Medium Brush W/O Grub, Clearing | 1.00 | ACRE | 280.03 | $0.00 | $121.96 | $158.07 | $0.00 | $280.03 |
| G1010010111 | Medium, W/O Grub D7LGP, Wet Clearing | 1.00 | ACRE | 2,301.42 | $0.00 | $2,146.19 | $155.23 | $0.00 | $2,301.42 |
| G101002 TREE REMOVAL | | | | | | | | | |
| G1010020211 | Clear Trees To 304.80mm (12") Dia W/D8 Cat | 200.00 | EA | 14.72 | $0.00 | $1,011.39 | $1,932.66 | $0.00 | $2,944.05 |
| G1010020212 | Clear Trees To 609.60mm (24") Dia W/D8 Cat | 10.00 | EA | 22.08 | $0.00 | $75.85 | $144.95 | $0.00 | $220.80 |
| G101003 STUMP REMOVAL | | | | | | | | | |
| G1010030311 | > 152.40mm (6") < 304.80mm (12") Stump Removal, W/LGP D7 | 100.00 | EA | 155.08 | $0.00 | $7,604.76 | $7,903.72 | $0.00 | $15,508.49 |
| G1010030312 | > 304.80mm (12") < 609.60 (24") Stump Removal, W/LGP D7 | 5.00 | EA | 206.78 | $0.00 | $506.98 | $526.91 | $0.00 | $1,033.90 |
| G1010030315 | > 152.40mm (6") and <= 304.80mm (12") Stump Removal, W/D8 | 100.00 | EA | 12.57 | $0.00 | $486.70 | $769.94 | $0.00 | $1,256.64 |
| G1010030316 | > 304.80mm (12") and <= 609.60mm (24") Stump Removal, W/D8 | 5.00 | EA | 125.66 | $0.00 | $243.35 | $384.97 | $0.00 | $628.32 |
| G101004 GRUBBING | | | | | | | | | |
| G1010040501 | Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 121.00 | CY | 7.28 | $0.00 | $588.90 | $292.29 | $0.00 | $881.19 |
| G1010040510 | Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 80.67 | CY | 7.28 | $0.00 | $392.62 | $194.86 | $0.00 | $587.48 |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 937.90 | CY | 21.90 | $20,542.65 | $0.00 | $0.00 | $0.00 | $20,542.65 |
| G1030 SITE EARTHWORK | | | | | | | | | |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 18.00 | HR | 125.61 | $0.00 | $1,431.17 | $829.74 | $0.00 | $2,260.91 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 37.00 | HR | 150.01 | $0.00 | $2,383.99 | $3,166.40 | $0.00 | $5,550.39 |
| **TOTAL** | | | | | **$20,543** | **$16,994** | **$16,460** | **$0** | **$53,996** |
| **Marked Up Cost:** | | | | | **$112,551** | **$117,419** | **$33,935** | **$0** | **$263,905** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$263,905** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$263,905** |
| | Contingency | 20.00 % | $52,781 |
| | SIOH | 5.70 % | $18,051 |
| | Design | 6.00 % | $15,834 |
| | Other | 0.00 % | $0 |
| **Total Project Cost:** | | | **$350,572** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Jan 2018

Area Cost Factor: 0.82
Escalation Rate: 8.18 %

# MEASURE 7 – UPPER BROOKSHIRE CULVERT MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **STORM SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 954.75 | CY | 21.44 | $20,469.63 | $0.00 | $0.00 | $0.00 | $20,469.63 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 18.00 | HR | 125.19 | $0.00 | $1,426.41 | $826.98 | $0.00 | $2,253.39 |
| G1030020265 | Cat 245, 2.29m3 (3 CY), Soil/Sand, Trenching | 2,398.61 | CY | 2.24 | $0.00 | $2,295.98 | $3,081.37 | $0.00 | $5,377.35 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 38.00 | HR | 149.51 | $0.00 | $2,440.28 | $3,241.17 | $0.00 | $5,681.45 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 1,634.81 | CY | 2.32 | $0.00 | $1,452.05 | $2,337.06 | $0.00 | $3,789.11 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 386.63 | CY | 71.16 | $9,394.50 | $16,754.05 | $1,363.34 | $0.00 | $27,511.89 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 1,634.81 | CY | 2.46 | $0.00 | $3,741.89 | $275.55 | $0.00 | $4,017.45 |
| G1030050515 | Compact With Pogosticks | 386.63 | CY | 13.83 | $0.00 | $4,687.21 | $659.79 | $0.00 | $5,347.00 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 3.00 | DAY | 100.49 | $260.90 | $40.56 | $0.00 | $0.00 | $301.46 |
| **TOTAL** | | | | | **$30,125** | **$32,838** | **$11,785** | **$0** | **$74,749** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2020 PARKING LOTS | | | | | | | | | |
| G202002 CURBS & GUTTERS | | | | | | | | | |
| G2020020204 | 1.22m x 1.22m (4' x 4'), 1.83m (6') Deep Cast in Place Deep Precast Area Drain W/Grate | 4.00 | EA | 5,725.88 | $10,394.01 | $12,016.45 | $493.07 | $0.00 | $22,903.53 |
| **TOTAL** | | | | | **$10,394** | **$12,016** | **$493** | **$0** | **$22,904** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303001 STORM SEWER PIPING | | | | | | | | | |
| G3030010170 | 914.40mm (36") RCP, Class 3, With Gaskets | 1,200.00 | LF | 140.94 | $103,071.85 | $55,760.90 | $10,296.38 | $0.00 | $169,129.13 |
| G303090 OTHER STORM SEWER | | | | | | | | | |
| G3030909935 | 914.40mm (36") Flared End RCP, Class 3 | 2.00 | EA | 389.82 | $537.42 | $204.46 | $37.75 | $0.00 | $779.63 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | **$103,609** | **$55,965** | **$10,334** | **$0** | **$169,909** |
| **DEMOLITION** | | | | | | | | |
| **G  BUILDING SITEWORK** | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | |
| G102001 BUILDING MASS DEMOLITION | | | | | | | | |
| G1020010103 Multi-Level, Masonry, Non-Explosive, Bldg Demolition | 44,000.00 | CF | 0.35 | $0.00 | $8,885.32 | $6,431.64 | $0.00 | $15,316.96 |
| **TOTAL** | | | | **$0** | **$8,885** | **$6,432** | **$0** | **$15,317** |
| **Marked Up Cost:** | | | | **$144,128** | **$109,706** | **$29,044** | **$0** | **$282,878** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$282,878** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$282,878** |
| | Contingency | 20.00 % | $56,576 |
| | SIOH | 5.70 % | $19,349 |
| | Design | 6.00 % | $16,973 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Real Estate Cost | | | $234,432 |
| Construction Easesment | | | $24,375 |
| **Total Project Cost:** | | | **$634,582** |

# MEASURE 8 – MODIFY CHANNEL 20' WIDTH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 5,940.00 | CY | 21.98 | $130,532.04 | $0.00 | $0.00 | $0.00 | $130,532.04 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020224 | 966, 3.06m3 (4 CY), Wheel Loader | 35.00 | HR | 198.31 | $0.00 | $2,842.83 | $4,097.91 | $0.00 | $6,940.73 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 87.00 | HR | 342.21 | $0.00 | $7,916.43 | $21,855.52 | $0.00 | $29,771.96 |
| G1030020288 | 19.88m3 (26 CY), Semi Dump | 142.00 | HR | 143.68 | $0.00 | $9,346.62 | $11,056.59 | $0.00 | $20,403.21 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030310 | D8 W/U Blade & Single Shank Ripper, Bulldozer | 8.00 | HR | 239.01 | $0.00 | $682.89 | $1,229.23 | $0.00 | $1,912.11 |
| **TOTAL** | | | | | **$130,532** | **$20,789** | **$38,239** | **$0** | **$189,560** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 790.58 | CY | 21.98 | $17,373.07 | $0.00 | $0.00 | $0.00 | $17,373.07 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 15.00 | HR | 128.31 | $0.00 | $1,218.36 | $706.36 | $0.00 | $1,924.71 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 3,815.64 | CY | 2.99 | $0.00 | $6,738.57 | $4,664.73 | $0.00 | $11,403.30 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 31.00 | HR | 153.24 | $0.00 | $2,040.46 | $2,710.13 | $0.00 | $4,750.59 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 3,183.18 | CY | 2.38 | $0.00 | $2,897.91 | $4,664.17 | $0.00 | $7,562.08 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 605.02 | CY | 62.85 | $32,352.07 | $2,429.55 | $3,241.74 | $0.00 | $38,023.36 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 3,183.18 | CY | 2.52 | $0.00 | $7,467.85 | $549.93 | $0.00 | $8,017.78 |
| G1030050515 | Compact With Pogosticks | 605.02 | CY | 14.18 | $0.00 | $7,517.94 | $1,058.26 | $0.00 | $8,576.20 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 13.00 | DAY | 103.00 | $1,158.81 | $180.15 | $0.00 | $0.00 | $1,338.95 |
| **TOTAL** | | | | | **$50,884** | **$30,491** | **$17,595** | **$0** | **$98,970** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 6,500.00 | LF | 96.13 | $371,379.03 | $253,475.32 | $0.00 | $0.00 | $624,854.34 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 22.00 | EA | 2,195.00 | $31,703.49 | $14,403.03 | $2,183.45 | $0.00 | $48,289.97 |
| **TOTAL** | | | | | **$403,083** | **$267,878** | **$2,183** | **$0** | **$673,144** |
| **Marked Up Cost:** | | | | | **$584,498** | **$319,158** | **$58,018** | **$0** | **$961,674** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$961,674** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$961,674** |
| | Contingency | 20.00 % | $192,335 |
| | SIOH | 5.70 % | $65,779 |
| | Design | 6.00 % | $57,700 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $706,875 |
| **Total Project Cost:** | | | **$1,984,363** |

# MEASURE 9 – MODIFY CHANNEL 35’ WIDTH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 12,500.00 | CY | 21.98 | $274,688.63 | $0.00 | $0.00 | $0.00 | $274,688.63 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020224 | 966, 3.06m3 (4 CY), Wheel Loader | 74.00 | HR | 198.31 | $0.00 | $6,010.55 | $8,664.14 | $0.00 | $14,674.70 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 183.00 | HR | 342.21 | $0.00 | $16,651.81 | $45,971.96 | $0.00 | $62,623.77 |
| G1030020288 | 19.88m3 (26 CY), Semi Dump | 299.00 | HR | 143.68 | $0.00 | $19,680.56 | $23,281.13 | $0.00 | $42,961.70 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030311 | D9 W/U Blade & Single Shank Ripper, Bulldozer | 13.00 | HR | 295.26 | $0.00 | $1,109.69 | $2,728.71 | $0.00 | $3,838.40 |
| **TOTAL** | | | | | **$274,689** | **$43,453** | **$80,646** | **$0** | **$398,787** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 778.41 | CY | 21.98 | $17,105.63 | $0.00 | $0.00 | $0.00 | $17,105.63 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 15.00 | HR | 128.31 | $0.00 | $1,218.36 | $706.36 | $0.00 | $1,924.71 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 3,756.94 | CY | 2.99 | $0.00 | $6,634.91 | $4,592.97 | $0.00 | $11,227.87 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 31.00 | HR | 153.24 | $0.00 | $2,040.46 | $2,710.13 | $0.00 | $4,750.59 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 3,134.21 | CY | 2.38 | $0.00 | $2,853.33 | $4,592.42 | $0.00 | $7,445.75 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 595.71 | CY | 62.85 | $31,854.23 | $2,392.17 | $3,191.86 | $0.00 | $37,438.26 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 3,134.21 | CY | 2.52 | $0.00 | $7,352.96 | $541.47 | $0.00 | $7,894.44 |
| G1030050515 | Compact With Pogosticks | 595.71 | CY | 14.18 | $0.00 | $7,402.26 | $1,041.98 | $0.00 | $8,444.23 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 13.00 | DAY | 103.00 | $1,158.81 | $180.15 | $0.00 | $0.00 | $1,338.95 |
| **TOTAL** | | | | | **$50,119** | **$30,075** | **$17,377** | **$0** | **$97,570** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 6,400.00 | LF | 96.13 | $365,665.50 | $249,575.70 | $0.00 | $0.00 | $615,241.20 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 22.00 | EA | 2,195.00 | $31,703.49 | $14,403.03 | $2,183.45 | $0.00 | $48,289.97 |
| **TOTAL** | | | | | **$397,369** | **$263,979** | **$2,183** | **$0** | **$663,531** |
| **Marked Up Cost:** | | | | | **$722,176** | **$337,506** | **$100,207** | **$0** | **$1,159,889** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$1,159,889** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$1,159,889** |
| | Contingency | 20.00 % | $231,978 |
| | SIOH | 5.70 % | $79,336 |
| | Design | 6.00 % | $69,593 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $698,750 |
| **Total Project Cost:** | | | **$2,239,546** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Mar 2018

Area Cost Factor: 0.82
Escalation Rate: 8.54 %

# MEASURE 10 – PINEY GROVE RD BRIDGE MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **REMOVE 540 CY SOIL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 666.67 | CY | 21.72 | $14,477.53 | $0.00 | $0.00 | $0.00 | $14,477.53 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 13.00 | HR | 127.49 | $0.00 | $1,052.44 | $604.96 | $0.00 | $1,657.40 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 5.00 | HR | 338.95 | $0.00 | $453.47 | $1,241.27 | $0.00 | $1,694.74 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 26.00 | HR | 152.00 | $0.00 | $1,705.72 | $2,246.23 | $0.00 | $3,951.96 |
| **TOTAL** | | | | | **$14,478** | **$3,212** | **$4,092** | **$0** | **$21,782** |
| **REMOVE 510 CY RIP RAP** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 629.63 | CY | 21.72 | $13,673.16 | $0.00 | $0.00 | $0.00 | $13,673.16 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020221 | 916, 1.15m3 (1.5 CY), Wheel Loader | 11.00 | HR | 127.49 | $0.00 | $890.52 | $511.89 | $0.00 | $1,402.41 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 5.00 | HR | 338.95 | $0.00 | $453.47 | $1,241.27 | $0.00 | $1,694.74 |
| G1030020285 | 9.17m3 (12 CY), Dump Truck | 35.00 | HR | 143.23 | $0.00 | $2,433.54 | $2,579.57 | $0.00 | $5,013.11 |
| **TOTAL** | | | | | **$13,673** | **$3,778** | **$4,333** | **$0** | **$21,783** |
| **INSTALL RIP RAP** | | | | | | | | | |
| **A SUBSTRUCTURE** | | | | | | | | | |
| **A10 FOUNDATIONS** | | | | | | | | | |
| A1030 SLAB ON GRADE | | | | | | | | | |
| A103005 FOUNDATION DRAINAGE | | | | | | | | | |
| A1030050601 | Drainage | 417.00 | LF | 22.45 | $4,852.62 | $4,164.66 | $345.33 | $0.00 | $9,362.61 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$4,853** | **$4,165** | **$345** | **$0** | **$9,363** |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070101 | General Area Cleanup | 0.31 | ACRE | 3,979.48 | $0.00 | $696.60 | $537.04 | $0.00 | $1,233.64 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010105 | Fine Grading, Hand | 608.36 | SY | 8.82 | $0.00 | $5,368.38 | $0.00 | $0.00 | $5,368.38 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020212 | Hand Excavation, Sand/Gravel | 89.20 | CY | 99.07 | $0.00 | $8,836.92 | $0.00 | $0.00 | $8,836.92 |
| G1030020298 | 0.38m3 (1/2 CY) Crawler Mounted, Hydraulic Excavator | 0.00 | CY | 0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 0.00 | CY | 0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 178.39 | CY | 2.51 | $0.00 | $417.13 | $30.46 | $0.00 | $447.59 |
| G1030050514 | Compact Soil By Machine W/Roller | 1,605.55 | CY | 1.34 | $0.00 | $1,008.57 | $1,139.21 | $0.00 | $2,147.78 |
| **TOTAL** | | | | | **$0** | **$16,328** | **$1,707** | **$0** | **$18,034** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2020 PARKING LOTS | | | | | | | | | |
| G202095 PARKING GARAGE SITEWORK | | | | | | | | | |
| G2020950108 | Retaining Wall Pour & Cure Concrete | 8.33 | CY | 173.48 | $845.15 | $481.01 | $118.89 | $0.00 | $1,445.05 |
| G2050 LANDSCAPING | | | | | | | | | |
| G205002 EROSION CONTROL MEASURES | | | | | | | | | |
| G2050020201 | Sediment Fence, Temporary | 425.00 | LF | 10.89 | $1,757.70 | $2,244.53 | $626.60 | $0.00 | $4,628.83 |
| G2050020203 | Rock Cover, Rip-Rap, Medium 4.54 To 90.72 kg (10 To 200 Lb) Pieces | 110.00 | CY | 60.75 | $6,081.44 | $268.26 | $332.77 | $0.00 | $6,682.46 |
| G205003 TOPSOIL & PLANTING BEDS | | | | | | | | | |
| G2050030301 | Topsoil, 152.40mm (6") Lifts, Off-Site | 178.39 | CY | 55.46 | $8,367.73 | $1,066.00 | $460.48 | $0.00 | $9,894.21 |
| **TOTAL** | | | | | **$17,052** | **$4,060** | **$1,539** | **$0** | **$22,651** |

Note: All Costs Include ACF, Markups and Escalation

| | | | | | |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$50,055** | **$31,541** | **$12,016** | **$0** | **$93,613** |

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$93,613** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$93,613** |
| | Contingency | 20.00 % | $18,723 |
| | SIOH | 5.70 % | $6,403 |
| | Design | 6.00 % | $5,617 |
| | Other | 0.00 % | $0 |
| **Total Project Cost:** | | | **$124,355** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Jan 2018

Area Cost Factor: 0.82
Escalation Rate: 8.18 %

# MEASURE 11 – NOTTINGHAM RD CULVERT MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **DEMOLITION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102002 ABOVE GROUND SITE DEMOLITION | | | | | | | | | |
| G1020020207 | Demolish Rod Reinf Concrete To 152.40mm (6") Thk W/Air Equipment | 3.00 | CY | 322.75 | $0.00 | $925.80 | $42.43 | $0.00 | $968.24 |
| G102005 UTILITY RELOCATION | | | | | | | | | |
| G102005u2 | Selective demolition, water & sewer piping & fittings, concrete pipe, 42"-48", diameter, excludes excavation | 339.00 | LF | 38.00 | $0.00 | $8,081.61 | $4,800.71 | $0.00 | $12,882.32 |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 121.87 | CY | 21.90 | $2,669.30 | $0.00 | $0.00 | $0.00 | $2,669.30 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 3.00 | HR | 118.45 | $0.00 | $238.53 | $116.81 | $0.00 | $355.34 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 552.44 | CY | 2.80 | $0.00 | $903.24 | $644.65 | $0.00 | $1,547.90 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 9.00 | HR | 137.08 | $0.00 | $579.89 | $653.85 | $0.00 | $1,233.74 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 552.44 | CY | 2.31 | $0.00 | $619.96 | $654.05 | $0.00 | $1,274.01 |
| G1030040420 | Backfill Trench, Borrow Mat'l, Delivered & Dumped Only | 107.81 | CY | 38.45 | $3,935.57 | $102.59 | $107.38 | $0.00 | $4,145.54 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 552.44 | CY | 2.36 | $0.00 | $1,199.64 | $104.84 | $0.00 | $1,304.48 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 1.00 | DAY | 98.66 | $76.71 | $21.95 | $0.00 | $0.00 | $98.66 |
| **TOTAL** | | | | | **$6,682** | **$12,673** | **$7,125** | **$0** | **$26,480** |
| **TEMPORARY CULVERT** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 941.00 | CY | 21.90 | $20,610.55 | $0.00 | $0.00 | $0.00 | $20,610.55 |
| G1030 SITE EARTHWORK | | | | | | | | | |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 18.00 | HR | 125.61 | $0.00 | $1,431.17 | $829.74 | $0.00 | $2,260.91 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 144.22 | CY | 1.72 | $0.00 | $104.11 | $144.55 | $0.00 | $248.66 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 37.00 | HR | 150.01 | $0.00 | $2,383.99 | $3,166.40 | $0.00 | $5,550.39 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 464.00 | CY | 1.59 | $0.00 | $316.95 | $418.52 | $0.00 | $735.48 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 57.47 | CY | 38.10 | $2,097.92 | $47.67 | $44.28 | $0.00 | $2,189.88 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 56.67 | SY | 1.42 | $0.00 | $59.45 | $21.30 | $0.00 | $80.75 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,186.56 | CY | 2.36 | $0.00 | $4,748.19 | $414.95 | $0.00 | $5,163.13 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 98.66 | $1,534.23 | $439.06 | $0.00 | $0.00 | $1,973.30 |
| **TOTAL** | | | | | **$24,243** | **$9,531** | **$5,040** | **$0** | **$38,813** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 8,496.00 | SF | 8.63 | $6,078.82 | $67,257.76 | $0.00 | $0.00 | $73,336.58 |
| **TOTAL** | | | | | **$6,079** | **$67,258** | **$0** | **$0** | **$73,337** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 130.67 | SF | 6.63 | $324.36 | $542.05 | $0.00 | $0.00 | $866.42 |
| G3030040411 | Cont Footing, Pour Concrete | 8.69 | CY | 164.88 | $1,230.84 | $196.94 | $5.00 | $0.00 | $1,432.78 |
| G3030040415 | CIP Wall Rebar | 17,595.56 | lb | 0.95 | $9,763.27 | $6,874.74 | $0.00 | $0.00 | $16,638.01 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 95.11 | CY | 215.94 | $14,446.13 | $4,766.17 | $1,325.55 | $0.00 | $20,537.86 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.49 | $389.40 | $2,090.53 | $0.00 | $0.00 | $2,479.93 |
| G3030040420 | Slab On Grade, Rebar | 12,662.22 | lb | 1.06 | $7,025.90 | $6,453.03 | $0.00 | $0.00 | $13,478.93 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 68.44 | CY | 227.93 | $10,395.26 | $4,648.46 | $555.91 | $0.00 | $15,599.64 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.42 | $1,144.90 | $21,245.67 | $0.00 | $0.00 | $22,390.58 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.85 | $6,656.12 | $4,122.70 | $0.00 | $0.00 | $10,778.82 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 280.11 | $10,772.02 | $7,617.98 | $780.42 | $0.00 | $19,170.42 |
| G3030040429 | Bush Hammer Finish | 288.00 | SF | 2.96 | $0.00 | $784.25 | $68.32 | $0.00 | $852.57 |

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$62,148** | **$59,343** | **$2,735** | **$0** | **$124,226** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 692.51 | LF | 4.54 | $1,931.38 | $1,213.84 | $0.00 | $0.00 | $3,145.22 |
| G9090010146 | Footing, Rebar | 1,607.17 | lb | 1.11 | $891.77 | $897.18 | $0.00 | $0.00 | $1,788.95 |
| **TOTAL** | | | | | **$2,823** | **$2,111** | **$0** | **$0** | **$4,934** |
| **STRUCTURES-CULVERTS** | | | | | | | | | |
| **G  BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 941.00 | CY | 21.90 | $20,610.55 | $0.00 | $0.00 | $0.00 | $20,610.55 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 18.00 | HR | 125.61 | $0.00 | $1,431.17 | $829.74 | $0.00 | $2,260.91 |
| G1030020270 | Koehring 1166, 2.68m3 (3-1/2 CY), Soil/Sand W/Boulders, Trenching | 110.00 | CY | 1.72 | $0.00 | $79.41 | $110.25 | $0.00 | $189.66 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 37.00 | HR | 150.01 | $0.00 | $2,383.99 | $3,166.40 | $0.00 | $5,550.39 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040402 | 966, 3.06m3 (4 CY), Backfill W/Excavated Material | 291.33 | CY | 1.59 | $0.00 | $199.01 | $262.78 | $0.00 | $461.78 |
| G1030040406 | 966, 3.06m3 (4 CY), Delivered & Dumped, Backfill W/Sand | 53.89 | CY | 38.10 | $1,967.24 | $44.70 | $41.52 | $0.00 | $2,053.46 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050510 | Dry Roll Gravel, Steel Roller | 53.56 | SY | 1.42 | $0.00 | $56.19 | $20.13 | $0.00 | $76.32 |
| G1030050511 | Compact Soil W/Vibrating Plate | 2,186.56 | CY | 2.36 | $0.00 | $4,748.19 | $414.95 | $0.00 | $5,163.13 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 20.00 | DAY | 98.66 | $1,534.23 | $439.06 | $0.00 | $0.00 | $1,973.30 |
| **TOTAL** | | | | | **$24,112** | **$9,382** | **$4,846** | **$0** | **$38,339** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 8,160.00 | SF | 8.63 | $5,838.41 | $64,597.85 | $0.00 | $0.00 | $70,436.26 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$5,838** | **$64,598** | **$0** | **$0** | **$70,436** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040410 | Cont Footing, Edge Form, 4 Uses | 56.00 | SF | 6.63 | $139.01 | $232.30 | $0.00 | $0.00 | $371.31 |
| G3030040411 | Cont Footing, Pour Concrete | 3.62 | CY | 164.88 | $512.73 | $82.04 | $2.08 | $0.00 | $596.85 |
| G3030040415 | CIP Wall Rebar | 16,828.15 | lb | 0.95 | $9,337.46 | $6,574.91 | $0.00 | $0.00 | $15,912.37 |
| G3030040416 | Pour & Finish Conc (1-Side), Ret Wall | 90.96 | CY | 215.94 | $13,815.80 | $4,558.21 | $1,267.71 | $0.00 | $19,641.72 |
| G3030040419 | Slab On Grade, Edge Form, 4 Uses | 452.00 | LF | 5.49 | $389.40 | $2,090.53 | $0.00 | $0.00 | $2,479.93 |
| G3030040420 | Slab On Grade, Rebar | 12,662.22 | lb | 1.06 | $7,025.90 | $6,453.03 | $0.00 | $0.00 | $13,478.93 |
| G3030040421 | Pour & Cure Conc, Slab On Grade | 68.44 | CY | 227.93 | $10,395.26 | $4,648.46 | $555.91 | $0.00 | $15,599.64 |
| G3030040424 | Top Slab Cover, Form & Strip, 4 Uses | 2,376.00 | SF | 9.42 | $1,144.90 | $21,245.67 | $0.00 | $0.00 | $22,390.58 |
| G3030040425 | Elevated Slab Rebar | 12,662.22 | lb | 0.85 | $6,656.12 | $4,122.70 | $0.00 | $0.00 | $10,778.82 |
| G3030040426 | Pour & Cure Top Slab Cover | 68.44 | CY | 280.11 | $10,772.02 | $7,617.98 | $780.42 | $0.00 | $19,170.42 |
| G3030040429 | Bush Hammer Finish | 120.00 | SF | 2.96 | $0.00 | $326.77 | $28.47 | $0.00 | $355.24 |
| **TOTAL** | | | | | **$60,189** | **$57,953** | **$2,635** | **$0** | **$120,776** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010129 | 25.40mm (1") Bituminous Fiber Expansion Joint | 642.75 | LF | 4.54 | $1,792.60 | $1,126.62 | $0.00 | $0.00 | $2,919.22 |
| G9090010146 | Footing, Rebar | 669.65 | lb | 1.11 | $371.57 | $373.82 | $0.00 | $0.00 | $745.39 |
| **TOTAL** | | | | | **$2,164** | **$1,500** | **$0** | **$0** | **$3,665** |
| **EXCAVATION, TRENCH/CHANNEL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 24.69 | CY | 21.90 | $540.78 | $0.00 | $0.00 | $0.00 | $540.78 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 118.45 | $0.00 | $79.51 | $38.94 | $0.00 | $118.45 |
| G1030020232 | Crawler Mounted, 1.53m3 (2 CY), 235 Hyd Excavator | 1.00 | HR | 206.20 | $0.00 | $89.07 | $117.13 | $0.00 | $206.20 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 2.00 | HR | 137.08 | $0.00 | $128.86 | $145.30 | $0.00 | $274.16 |
| **TOTAL** | | | | | **$541** | **$297** | **$301** | **$0** | **$1,140** |

## BRIDGE MODIFICATION

### G BUILDING SITEWORK

### G10 SITE PREPARATIONS

G1020 SITE DEMOLITION & RELOCATIONS

G102007 SITE CLEANUP

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020070101 | General Area Cleanup | 0.86 | ACRE | 3,994.37 | $0.00 | $1,932.50 | $1,502.66 | $0.00 | $3,435.16 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010102 | Rough Grading, 0.0012 T (12G), 1 Pass | 101,359.00 | SY | 0.00 | $0.00 | $18.80 | $14.48 | $0.00 | $33.29 |
| G1030010107 | Fine Grading, 0.012 T (120G), 2 Passes | 4,147.00 | SY | 1.04 | $0.00 | $2,625.82 | $1,680.04 | $0.00 | $4,305.86 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020201 | Excavation, Spoil To Side | 82.00 | CY | 1.06 | $0.00 | $30.44 | $56.51 | $0.00 | $86.96 |
| G1030020282 | Soil, 8.05km (5 Mi), Dump Truck, Load/Haul off Spoil From Trench | 21.00 | CY | 4.76 | $0.00 | $43.18 | $56.85 | $0.00 | $100.02 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 4.00 | CY | 62.64 | $213.19 | $16.01 | $21.36 | $0.00 | $250.56 |
| G1030040416 | Backfill, Lrg Spot Footing Excav Material, 950, 2.29m3 (3 CY) | 65.00 | CY | 3.12 | $0.00 | $143.46 | $59.27 | $0.00 | $202.73 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050508 | Compact, Ftg Excav, Excav Material Backfill | 65.00 | CY | 8.17 | $0.00 | $512.00 | $19.29 | $0.00 | $531.29 |
| G1030050511 | Compact Soil W/Vibrating Plate | 20.00 | CY | 2.51 | $0.00 | $46.77 | $3.44 | $0.00 | $50.21 |
| G1030050513 | Spread Dumped Borrow & Compact W/Roller | 13,975.00 | CY | 2.71 | $0.00 | $35,327.69 | $2,602.12 | $0.00 | $37,929.82 |
| **TOTAL** | | | | | **$213** | **$40,697** | **$6,016** | **$0** | **$46,926** |

### G20 SITE IMPROVEMENTS

G2010 ROADWAYS

G201001 BASES & SUBBASES

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2010010101 | Cement Stabilized Base | 252.00 | CY | 78.41 | $15,399.43 | $2,872.51 | $1,487.10 | $0.00 | $19,759.04 |
| G201005 GUARDRAILS & BARRIERS | | | | | | | | | |
| G2010050501 | Guardrail, Single Rail, Wood Posts | 700.00 | LF | 48.91 | $31,175.00 | $2,531.20 | $532.46 | $0.00 | $34,238.67 |
| G2010050502 | Guardrail, Single Rail, Wood Posts, Ends | 4.00 | EA | 178.39 | $513.99 | $164.89 | $34.68 | $0.00 | $713.55 |
| G2050 LANDSCAPING | | | | | | | | | |
| G205002 EROSION CONTROL MEASURES | | | | | | | | | |
| G2050020201 | Sediment Fence, Temporary | 1,392.00 | LF | 10.94 | $5,806.47 | $7,351.50 | $2,069.93 | $0.00 | $15,227.90 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G205004 SEEDING, SPRIGGING AND SODDING | | | | | | | | | |
| G2050040402 | Seeding, Vegetative Cover | 0.60 | ACRE | 6,941.15 | $2,968.27 | $1,019.41 | $177.01 | $0.00 | $4,164.69 |
| G2050040408 | Fertilizer, Hydr Spread | 0.60 | ACRE | 231.26 | $2.89 | $135.87 | $0.00 | $0.00 | $138.76 |
| **TOTAL** | | | | | **$55,866** | **$14,075** | **$4,301** | **$0** | **$74,243** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909001 BRIDGES | | | | | | | | | |
| G9090010105 | Form, Beam Bracing Diaphragms | 281.00 | SF | 10.26 | $406.21 | $2,475.89 | $0.00 | $0.00 | $2,882.10 |
| G9090010106 | Rebar, Bracing Diaphragms | 138.00 | lb | 1.55 | $98.74 | $115.41 | $0.00 | $0.00 | $214.15 |
| G9090010107 | Pour & Cure, Bracing Diaphragms | 4.00 | CY | 257.00 | $652.70 | $295.56 | $79.73 | $0.00 | $1,027.99 |
| G9090010108 | Form Deck, 3 Uses | 1,681.00 | SF | 6.44 | $417.28 | $10,402.16 | $0.00 | $0.00 | $10,819.44 |
| G9090010109 | Rebar, Bridge Deck | 1,761.00 | lb | 1.01 | $1,131.41 | $654.71 | $0.00 | $0.00 | $1,786.13 |
| G9090010110 | Pour & Cure, Deck | 40.00 | CY | 248.21 | $6,308.01 | $3,149.20 | $471.12 | $0.00 | $9,928.33 |
| G9090010111 | Bush Hammer Finish | 1,760.00 | SF | 3.20 | $0.00 | $5,158.66 | $474.34 | $0.00 | $5,633.00 |
| G9090010112 | Armor Joints | 47.00 | LF | 562.44 | $21,618.08 | $4,710.89 | $105.94 | $0.00 | $26,434.90 |
| G9090010113 | Beam Bearing Pads (Elastomeric) | 4.00 | SF | 92.99 | $148.94 | $223.02 | $0.00 | $0.00 | $371.96 |
| G9090010120 | Precast I Beam, Type I, 406.40mm x 711.20mm (1'-4" X 2'-4") Deep | 167.00 | LF | 179.91 | $0.00 | $0.00 | $0.00 | $30,045.78 | $30,045.78 |
| G9090010145 | Large Spot Footing, Edge Form & Strip, 4 Uses | 240.00 | SF | 6.14 | $217.28 | $1,255.57 | $0.00 | $0.00 | $1,472.84 |
| G9090010146 | Footing, Rebar | 570.00 | lb | 1.32 | $387.02 | $363.24 | $0.00 | $0.00 | $750.27 |
| G9090010147 | Large Spot Footing, Pour & Cure Concrete | 14.00 | CY | 245.73 | $2,161.81 | $885.64 | $392.81 | $0.00 | $3,440.25 |
| G9090010148 | Column Forms, Fiber, 609.60mm (24") Round | 171.00 | LF | 29.44 | $2,184.81 | $2,848.93 | $0.00 | $0.00 | $5,033.74 |
| G9090010149 | Columns, Rebar, Spiral | 3,414.00 | lb | 1.60 | $3,489.56 | $1,986.25 | $0.00 | $0.00 | $5,475.81 |
| G9090010150 | Columns, Pour & Finish Concrete | 20.00 | CY | 378.38 | $3,136.48 | $4,170.58 | $260.54 | $0.00 | $7,567.59 |
| G9090010151 | Form, Bentcap Bottom | 109.00 | SF | 13.09 | $178.26 | $1,248.52 | $0.00 | $0.00 | $1,426.78 |
| G9090010152 | Form, Bentcap Sides | 349.00 | SF | 9.54 | $601.33 | $2,727.73 | $0.00 | $0.00 | $3,329.07 |
| G9090010153 | Bentcap, Rebar | 747.00 | lb | 1.01 | $479.93 | $277.72 | $0.00 | $0.00 | $757.66 |
| G9090010154 | Bentcap, Pour & Cure | 8.00 | CY | 244.03 | $1,230.06 | $562.72 | $159.46 | $0.00 | $1,952.23 |
| G9090010155 | Edgeforms, 254.00mm (10") Approach Slab, 2 Uses | 812.00 | LF | 11.71 | $628.41 | $8,882.26 | $0.00 | $0.00 | $9,510.66 |
| G9090010156 | Welded Wire Mesh, Approach Slab, 6 X 6 X 4/4, 58#/SQ | 82.00 | SQ | 102.63 | $4,148.83 | $4,267.16 | $0.00 | $0.00 | $8,415.99 |
| G9090010157 | Pour & Cure, Approach Slab | 252.00 | CY | 226.19 | $39,298.90 | $15,449.74 | $2,251.61 | $0.00 | $57,000.25 |
| G9090010158 | Parapet, Form | 566.00 | SF | 7.78 | $677.70 | $3,722.97 | $0.00 | $0.00 | $4,400.67 |
| G9090010159 | Parapet, Rebar | 201.00 | lb | 1.12 | $136.48 | $89.64 | $0.00 | $0.00 | $226.12 |
| G9090010160 | Parapet, Pour & Cure | 9.00 | CY | 245.24 | $1,500.12 | $561.26 | $145.75 | $0.00 | $2,207.14 |
| **TOTAL** | | | | | **$91,238** | **$76,485** | **$4,341** | **$30,046** | **$202,111** |

Note: All Costs Include ACF, Markups and Escalation

| | | | | | |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$342,136** | **$415,903** | **$37,340** | **$30,046** | **$825,424** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$825,424** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$825,424** |
| | Contingency | 20.00 % | $165,085 |
| | SIOH | 5.70 % | $56,459 |
| | Design | 6.00 % | $49,525 |
| | Other | 0.00 % | $0 |
| **Total Project Cost:** | | | **$1,096,494** |

# MEASURE 12 – INLINE POND, BOWER RD

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 55,125.00 | CY | 21.98 | $1,211,376.86 | $0.00 | $0.00 | $0.00 | $1,211,376.86 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020223 | 950, 2.29m3 (3.0 CY), Wheel Loader | 118.00 | HR | 163.45 | $0.00 | $9,413.08 | $9,873.50 | $0.00 | $19,286.58 |
| G1030020226 | 988, 5.35m3 (7 CY), Wheel Loader | 207.00 | HR | 276.39 | $0.00 | $17,353.88 | $39,858.92 | $0.00 | $57,212.80 |
| G1030020289 | 24.47m3 (32 CY), Semi Dump | 1,038.00 | HR | 147.85 | $0.00 | $67,101.23 | $86,364.17 | $0.00 | $153,465.40 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 52.00 | HR | 348.43 | $0.00 | $4,359.43 | $13,758.99 | $0.00 | $18,118.42 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050517 | Spread/Compact Lg Areas, 152.40mm (6") Lifts, D8 & Towed Sheepsft | 18,375.00 | CY | 1.16 | $0.00 | $11,006.25 | $10,229.57 | $0.00 | $21,235.82 |
| **TOTAL** | | | | | **$1,211,377** | **$109,234** | **$160,085** | **$0** | **$1,480,696** |
| **SPILLWAY** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010105 | Fine Grading, Hand | 1,777.78 | SY | 8.85 | $0.00 | $15,739.52 | $0.00 | $0.00 | $15,739.52 |
| G1030010107 | Fine Grading, 0.012 T (120G), 2 Passes | 444.44 | SY | 1.04 | $0.00 | $282.34 | $180.65 | $0.00 | $462.99 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020257 | Cat 215, 0.76m3 (1 CY), Soil, Shallow, Trenching | 2,974.07 | CY | 4.11 | $0.00 | $7,878.49 | $4,333.04 | $0.00 | $12,211.53 |
| G1030020282 | Soil, 8.05km (5 Mi), Dump Truck, Load/Haul off Spoil From Trench | 1,448.80 | CY | 4.78 | $0.00 | $2,988.49 | $3,934.98 | $0.00 | $6,923.48 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 1,815.04 | CY | 2.38 | $0.00 | $1,652.38 | $2,659.50 | $0.00 | $4,311.88 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050516 | Compact W/50% Pogosticks, 50% Hand Roller | 1,815.04 | CY | 8.35 | $0.00 | $13,405.86 | $1,744.29 | $0.00 | $15,150.15 |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$0** | **$41,947** | **$12,852** | **$0** | **$54,800** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2040 SITE DEVELOPMENT | | | | | | | | | |
| G204002 RETAINING WALLS AND FREESTANDING WALLS | | | | | | | | | |
| G2040020201 | Cont. Footing, Edge Form, 4 Uses | 2,400.00 | SF | 7.31 | $6,785.91 | $10,753.04 | $0.00 | $0.00 | $17,538.95 |
| G2040020202 | Footing, Rebar | 40,906.67 | lb | 1.26 | $27,866.76 | $23,877.89 | $0.00 | $0.00 | $51,744.66 |
| G2040020203 | Pour & Cure Concrete, Cont. Footing | 909.04 | CY | 247.15 | $141,231.99 | $57,846.04 | $25,589.72 | $0.00 | $224,667.75 |
| G2040020205 | CIP Walls Form & Strip (4 Uses) | 12,000.00 | SF | 9.28 | $8,790.04 | $102,544.98 | $0.00 | $0.00 | $111,335.01 |
| G2040020206 | Reinf Steel, Retaining Wall | 113,750.00 | lb | 1.13 | $77,489.66 | $50,899.29 | $0.00 | $0.00 | $128,388.95 |
| G2040020207 | Pour & Cure Concrete, Retaining Wall | 1,083.33 | CY | 229.87 | $174,738.06 | $58,635.43 | $15,646.33 | $0.00 | $249,019.82 |
| G2040020208 | Bush Hammer Finish | 5,000.00 | SF | 3.21 | $0.00 | $14,703.66 | $1,351.99 | $0.00 | $16,055.65 |
| G2040020210 | Keyway | 200.00 | LF | 1.34 | $52.74 | $214.31 | $0.00 | $0.00 | $267.05 |
| **TOTAL** | | | | | **$436,955** | **$319,475** | **$42,588** | **$0** | **$799,018** |
| **CLEAR AND GRUB** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1010 SITE CLEARING | | | | | | | | | |
| G101001 CLEARING | | | | | | | | | |
| G1010010104 | Heavy Brush W/O Grub, Clearing | 16.00 | ACRE | 370.73 | $0.00 | $2,634.91 | $3,296.81 | $0.00 | $5,931.73 |
| G1010010112 | Heavy, W/O Grub D7LGP, Wet Clearing | 4.00 | ACRE | 2,214.49 | $0.00 | $7,955.52 | $902.44 | $0.00 | $8,857.96 |
| G101002 TREE REMOVAL | | | | | | | | | |
| G1010020210 | Clear Trees To 152.40mm (6") Dia W/D8 Cat | 2,500.00 | EA | 8.36 | $0.00 | $7,315.53 | $13,582.30 | $0.00 | $20,897.83 |
| G1010020212 | Clear Trees To 609.60mm (24") Dia W/D8 Cat | 1,000.00 | EA | 23.41 | $0.00 | $8,193.62 | $15,212.29 | $0.00 | $23,405.91 |
| G1010020213 | Clear Trees To914.40mm (36") Dia W/D8 Cat | 200.00 | EA | 46.81 | $0.00 | $3,277.45 | $6,084.91 | $0.00 | $9,362.36 |
| G101003 STUMP REMOVAL | | | | | | | | | |
| G1010030310 | < 152.40mm (6") Stump Removal, W/LGP D7 | 500.00 | EA | 5.85 | $0.00 | $1,024.20 | $1,901.54 | $0.00 | $2,925.74 |
| G1010030312 | > 304.80mm (12") < 609.60 (24") Stump Removal, W/LGP D7 | 200.00 | EA | 9.00 | $0.00 | $630.29 | $1,170.17 | $0.00 | $1,800.46 |
| G1010030313 | > 609.60mm (24") < 914.40mm (36") Stump Removal, W/LGP D7 | 40.00 | EA | 12.00 | $0.00 | $168.07 | $312.05 | $0.00 | $480.12 |
| G1010030314 | <= 152.40mm (6") Stump Removal, W/D8 | 2,000.00 | EA | 5.85 | $0.00 | $4,096.81 | $7,606.14 | $0.00 | $11,702.95 |
| G1010030316 | > 304.80mm (12") and <= 609.60mm (24") Stump Removal, W/D8 | 800.00 | EA | 9.00 | $0.00 | $2,521.15 | $4,680.68 | $0.00 | $7,201.83 |
| G1010030317 | > 609.60mm (24") and <= 914.40mm (36") Stump Removal, W/D8 | 160.00 | EA | 12.00 | $0.00 | $672.29 | $1,248.18 | $0.00 | $1,920.47 |
| G101004 GRUBBING | | | | | | | | | |
| G1010040501 | Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 3,226.67 | CY | 0.98 | $0.00 | $1,101.49 | $2,045.21 | $0.00 | $3,146.70 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1010040510 | Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 322.67 | CY | 0.98 | $0.00 | $110.15 | $204.52 | $0.00 | $314.67 |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 19,065.00 | CY | 21.98 | $418,955.10 | $0.00 | $0.00 | $0.00 | $418,955.10 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020224 | 966, 3.06m3 (4 CY), Wheel Loader | 114.00 | HR | 198.31 | $0.00 | $9,259.50 | $13,347.46 | $0.00 | $22,606.96 |
| G1030020288 | 19.88m3 (26 CY), Semi Dump | 455.00 | HR | 143.68 | $0.00 | $29,948.68 | $35,427.81 | $0.00 | $65,376.50 |
| **TOTAL** | | | | | **$418,955** | **$78,910** | **$107,023** | **$0** | **$604,887** |
| **Marked Up Cost:** | | | | | **$2,067,287** | **$549,565** | **$322,548** | **$0** | **$2,939,401** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$2,939,401** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$2,939,401** |
| | Contingency | 20.00 % | $587,880 |
| | SIOH | 5.70 % | $201,055 |
| | Design | 6.00 % | $176,364 |
| | Other | 0.00 % | $0 |
| **Total Project Cost:** | | | **$3,904,700** |

# MEASURE 13 – UPPER K-2 BENCH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 14,486.00 | CY | 21.44 | $310,576.71 | $0.00 | $0.00 | $0.00 | $310,576.71 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020224 | 966, 3.06m3 (4 CY), Wheel Loader | 86.00 | HR | 193.48 | $0.00 | $6,815.08 | $9,823.86 | $0.00 | $16,638.94 |
| G1030020235 | Crawler Mounted, 4.21m3 (5.5 CY), Koehring 1266, Hyd Excavator | 112.00 | HR | 341.25 | $0.00 | $9,943.02 | $28,276.96 | $0.00 | $38,219.98 |
| G1030020288 | 19.88m3 (26 CY), Semi Dump | 346.00 | HR | 140.18 | $0.00 | $22,219.39 | $26,284.44 | $0.00 | $48,503.84 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 12.00 | HR | 346.13 | $0.00 | $999.38 | $3,154.19 | $0.00 | $4,153.57 |
| **TOTAL** | | | | | **$310,577** | **$39,977** | **$67,539** | **$0** | **$418,093** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 85.14 | CY | 21.44 | $1,825.38 | $0.00 | $0.00 | $0.00 | $1,825.38 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 2.00 | HR | 118.05 | $0.00 | $158.49 | $77.61 | $0.00 | $236.11 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 410.92 | CY | 2.92 | $0.00 | $708.02 | $490.12 | $0.00 | $1,198.15 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 7.00 | HR | 131.01 | $0.00 | $464.88 | $452.21 | $0.00 | $917.09 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 342.80 | CY | 2.32 | $0.00 | $304.48 | $490.05 | $0.00 | $794.53 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 65.16 | CY | 61.32 | $3,399.41 | $255.29 | $340.63 | $0.00 | $3,995.32 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 342.80 | CY | 2.46 | $0.00 | $784.63 | $57.78 | $0.00 | $842.41 |
| G1030050515 | Compact With Pogosticks | 65.16 | CY | 13.83 | $0.00 | $789.95 | $111.20 | $0.00 | $901.15 |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 2.00 | DAY | 100.49 | $173.94 | $27.04 | $0.00 | $0.00 | $200.97 |
| **TOTAL** | | | | | **$5,399** | **$3,493** | **$2,020** | **$0** | **$10,911** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 700.00 | LF | 93.79 | $39,020.41 | $26,632.39 | $0.00 | $0.00 | $65,652.79 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 3.00 | EA | 2,141.53 | $4,217.89 | $1,916.21 | $290.49 | $0.00 | $6,424.59 |
| **TOTAL** | | | | | **$43,238** | **$28,549** | **$290** | **$0** | **$72,077** |
| **REROUTE WATER DISTRIBUTION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 70.61 | CY | 21.44 | $1,513.86 | $0.00 | $0.00 | $0.00 | $1,513.86 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 2.00 | HR | 118.05 | $0.00 | $158.49 | $77.61 | $0.00 | $236.11 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 382.56 | CY | 2.92 | $0.00 | $659.16 | $456.30 | $0.00 | $1,115.46 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 6.00 | HR | 131.01 | $0.00 | $398.47 | $387.61 | $0.00 | $786.07 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 326.08 | CY | 2.32 | $0.00 | $289.63 | $466.15 | $0.00 | $755.78 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 56.99 | CY | 61.32 | $2,973.18 | $223.28 | $297.92 | $0.00 | $3,494.37 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 326.08 | CY | 2.46 | $0.00 | $746.36 | $54.96 | $0.00 | $801.32 |
| G1030050515 | Compact With Pogosticks | 56.99 | CY | 13.83 | $0.00 | $690.90 | $97.25 | $0.00 | $788.16 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 2.00 | DAY | 100.49 | $173.94 | $27.04 | $0.00 | $0.00 | $200.97 |
| **TOTAL** | | | | | **$4,661** | **$3,193** | **$1,838** | **$0** | **$9,692** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |

# Assembly Detail Report



| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| G3010 WATER SUPPLY | | | | | | | | |
| G301002 POTABLE WATER DISTRIBUTION | | | | | | | | |
| G3010020221 152.40mm (6"), Class 50, Mechanical Joint, DIP | 700.00 | LF | 42.68 | $14,757.72 | $11,911.65 | $3,208.59 | $0.00 | $29,877.95 |
| **TOTAL** | | | | **$14,758** | **$11,912** | **$3,209** | **$0** | **$29,878** |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | |
| G4090 OTHER SITE ELECTRICAL UTILITIES | | | | | | | | |
| G409001 SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM | | | | | | | | |
| G4090010101 3-4.08kg (9 Lb) Magnesium Anodes, Cathodic Protection Point | 3.00 | EA | 1,150.82 | $612.96 | $2,700.60 | $138.89 | $0.00 | $3,452.46 |
| **TOTAL** | | | | **$613** | **$2,701** | **$139** | **$0** | **$3,452** |
| **Marked Up Cost:** | | | | **$379,245** | **$89,824** | **$75,035** | **$0** | **$544,104** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$544,104** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$544,104** |
| | Contingency | 20.00 % | $108,821 |
| | SIOH | 5.70 % | $37,217 |
| | Design | 6.00 % | $32,646 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $73,125 |
| **Total Project Cost:** | | | **$795,913** |

# MEASURE 14 – MODIFY CHANNEL DOWNSTREAM OF NOTTINGHAM

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 2,700.00 | CY | 21.37 | $57,692.27 | $0.00 | $0.00 | $0.00 | $57,692.27 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 52.00 | HR | 124.77 | $0.00 | $4,106.85 | $2,381.00 | $0.00 | $6,487.85 |
| G1030020231 | Crawler Mounted, 0.96m3 (1.25 CY), 225 Hyd Excavator | 145.00 | HR | 166.73 | $0.00 | $12,829.26 | $11,346.12 | $0.00 | $24,175.38 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 106.00 | HR | 149.01 | $0.00 | $6,784.15 | $9,010.67 | $0.00 | $15,794.82 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030310 | D8 W/U Blade & Single Shank Ripper, Bulldozer | 5.00 | HR | 232.41 | $0.00 | $415.00 | $747.03 | $0.00 | $1,162.03 |
| **TOTAL** | | | | | **$57,692** | **$24,135** | **$23,485** | **$0** | **$105,312** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 72.98 | CY | 21.37 | $1,559.40 | $0.00 | $0.00 | $0.00 | $1,559.40 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 2.00 | HR | 117.65 | $0.00 | $157.96 | $77.35 | $0.00 | $235.31 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 352.21 | CY | 2.91 | $0.00 | $604.82 | $418.68 | $0.00 | $1,023.50 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 6.00 | HR | 130.57 | $0.00 | $397.12 | $386.30 | $0.00 | $783.42 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 293.83 | CY | 2.31 | $0.00 | $260.10 | $418.63 | $0.00 | $678.73 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 55.85 | CY | 61.11 | $2,903.88 | $218.07 | $290.97 | $0.00 | $3,412.93 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 293.83 | CY | 2.45 | $0.00 | $670.28 | $49.36 | $0.00 | $719.64 |
| G1030050515 | Compact With Pogosticks | 55.85 | CY | 13.78 | $0.00 | $674.80 | $94.99 | $0.00 | $769.79 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 2.00 | DAY | 100.15 | $173.35 | $26.95 | $0.00 | $0.00 | $200.30 |
| **TOTAL** | | | | | **$4,637** | **$3,010** | **$1,736** | **$0** | **$9,383** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 600.00 | LF | 93.47 | $33,333.31 | $22,750.80 | $0.00 | $0.00 | $56,084.11 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 2.00 | EA | 2,134.31 | $2,802.45 | $1,273.16 | $193.01 | $0.00 | $4,268.62 |
| **TOTAL** | | | | | **$36,136** | **$24,024** | **$193** | **$0** | **$60,353** |
| **REROUTE WATER DISTRIBUTION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 25.22 | CY | 21.37 | $538.89 | $0.00 | $0.00 | $0.00 | $538.89 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 117.65 | $0.00 | $78.98 | $38.68 | $0.00 | $117.65 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 136.63 | CY | 2.91 | $0.00 | $234.62 | $162.42 | $0.00 | $397.04 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 3.00 | HR | 130.57 | $0.00 | $198.56 | $193.15 | $0.00 | $391.71 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 116.46 | CY | 2.31 | $0.00 | $103.09 | $165.93 | $0.00 | $269.02 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 20.35 | CY | 61.11 | $1,058.08 | $79.46 | $106.02 | $0.00 | $1,243.56 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 116.46 | CY | 2.45 | $0.00 | $265.66 | $19.56 | $0.00 | $285.23 |
| G1030050515 | Compact With Pogosticks | 20.35 | CY | 13.78 | $0.00 | $245.88 | $34.61 | $0.00 | $280.49 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 1.00 | DAY | 100.15 | $86.67 | $13.47 | $0.00 | $0.00 | $100.15 |
| **TOTAL** | | | | | **$1,684** | **$1,220** | **$720** | **$0** | **$3,624** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3010 WATER SUPPLY | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| G301002 POTABLE WATER DISTRIBUTION | | | | | | | | |
| G3010020221 152.40mm (6"), Class 50, Mechanical Joint, DIP | 250.00 | LF | 42.54 | $5,252.85 | $4,239.82 | $1,142.06 | $0.00 | $10,634.72 |
| **TOTAL** | | | | **$5,253** | **$4,240** | **$1,142** | **$0** | **$10,635** |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | |
| G4090 OTHER SITE ELECTRICAL UTILITIES | | | | | | | | |
| G409001 SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM | | | | | | | | |
| G4090010101 3-4.08kg (9 Lb) Magnesium Anodes, Cathodic Protection Point | 1.00 | EA | 1,146.94 | $203.63 | $897.17 | $46.14 | $0.00 | $1,146.94 |
| **TOTAL** | | | | **$204** | **$897** | **$46** | **$0** | **$1,147** |
| **Marked Up Cost:** | | | | **$105,605** | **$57,526** | **$27,323** | **$0** | **$190,453** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report

| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$190,453** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$190,453** |
| | Contingency | 20.00 % | $38,091 |
| | SIOH | 5.70 % | $13,027 |
| | Design | 6.00 % | $11,427 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $65,000 |
| **Total Project Cost:** | | | **$317,998** |

# MEASURE 15 – MODIFY CHANNEL – 60’ WIDTH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 32,000.00 | CY | 21.98 | $703,202.89 | $0.00 | $0.00 | $0.00 | $703,202.89 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020226 | 988, 5.35m3 (7 CY), Wheel Loader | 120.00 | HR | 276.39 | $0.00 | $10,060.22 | $23,106.62 | $0.00 | $33,166.84 |
| G1030020235 | Crawler Mounted, 4.21m3 (5.5 CY), Koehring 1266, Hyd Excavator | 308.00 | HR | 343.52 | $0.00 | $27,525.00 | $78,278.51 | $0.00 | $105,803.51 |
| G1030020289 | 24.47m3 (32 CY), Semi Dump | 602.00 | HR | 147.85 | $0.00 | $38,916.13 | $50,087.89 | $0.00 | $89,004.02 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 32.00 | HR | 348.43 | $0.00 | $2,682.72 | $8,467.07 | $0.00 | $11,149.80 |
| **TOTAL** | | | | | **$703,203** | **$79,184** | **$159,940** | **$0** | **$942,327** |
| **REROUTE WATER DISTRIBUTION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 50.43 | CY | 21.98 | $1,108.20 | $0.00 | $0.00 | $0.00 | $1,108.20 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 121.00 | $0.00 | $81.22 | $39.78 | $0.00 | $121.00 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 273.26 | CY | 2.99 | $0.00 | $482.59 | $334.07 | $0.00 | $816.66 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 4.00 | HR | 134.28 | $0.00 | $272.28 | $264.86 | $0.00 | $537.13 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 232.91 | CY | 2.38 | $0.00 | $212.04 | $341.27 | $0.00 | $553.31 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 40.71 | CY | 62.85 | $2,176.87 | $163.48 | $218.13 | $0.00 | $2,558.48 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 232.91 | CY | 2.52 | $0.00 | $546.41 | $40.24 | $0.00 | $586.65 |
| G1030050515 | Compact With Pogosticks | 40.71 | CY | 14.18 | $0.00 | $505.86 | $71.21 | $0.00 | $577.07 |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 1.00 | DAY | 103.00 | $89.14 | $13.86 | $0.00 | $0.00 | $103.00 |
| **TOTAL** | | | | | **$3,374** | **$2,278** | **$1,310** | **$0** | **$6,961** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3010 WATER SUPPLY | | | | | | | | | |
| G301002 POTABLE WATER DISTRIBUTION | | | | | | | | | |
| G3010020221 | 152.40mm (6"), Class 50, Mechanical Joint, DIP | 500.00 | LF | 43.75 | $10,804.42 | $8,720.75 | $2,349.07 | $0.00 | $21,874.24 |
| **TOTAL** | | | | | **$10,804** | **$8,721** | **$2,349** | **$0** | **$21,874** |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | | |
| G4090 OTHER SITE ELECTRICAL UTILITIES | | | | | | | | | |
| G409001 SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM | | | | | | | | | |
| G4090010101 | 3-4.08kg (9 Lb) Magnesium Anodes, Cathodic Protection Point | 2.00 | EA | 1,179.55 | $418.85 | $1,845.35 | $94.91 | $0.00 | $2,359.11 |
| **TOTAL** | | | | | **$419** | **$1,845** | **$95** | **$0** | **$2,359** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G  BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 869.27 | CY | 21.98 | $19,102.29 | $0.00 | $0.00 | $0.00 | $19,102.29 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 17.00 | HR | 128.31 | $0.00 | $1,380.80 | $800.54 | $0.00 | $2,181.34 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 4,195.45 | CY | 2.99 | $0.00 | $7,409.33 | $5,129.06 | $0.00 | $12,538.39 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 34.00 | HR | 153.24 | $0.00 | $2,237.92 | $2,972.40 | $0.00 | $5,210.32 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 3,500.03 | CY | 2.38 | $0.00 | $3,186.36 | $5,128.44 | $0.00 | $8,314.80 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 665.24 | CY | 62.85 | $35,572.19 | $2,671.38 | $3,564.41 | $0.00 | $41,807.98 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 3,500.03 | CY | 2.52 | $0.00 | $8,211.19 | $604.67 | $0.00 | $8,815.86 |
| G1030050515 | Compact With Pogosticks | 665.24 | CY | 14.18 | $0.00 | $8,266.23 | $1,163.59 | $0.00 | $9,429.82 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 15.00 | DAY | 103.00 | $1,337.09 | $207.86 | $0.00 | $0.00 | $1,544.94 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$56,012** | **$33,571** | **$19,363** | **$0** | **$108,946** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 7,147.00 | LF | 96.13 | $408,345.53 | $278,705.86 | $0.00 | $0.00 | $687,051.38 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 24.00 | EA | 2,195.00 | $34,585.63 | $15,712.40 | $2,381.95 | $0.00 | $52,679.97 |
| **TOTAL** | | | | | **$442,931** | **$294,418** | **$2,382** | **$0** | **$739,731** |
| **Marked Up Cost:** | | | | | **$1,216,743** | **$420,017** | **$185,439** | **$0** | **$1,822,199** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$1,822,199** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$1,822,199** |
| | Contingency | 20.00 % | $364,440 |
| | SIOH | 5.70 % | $124,638 |
| | Design | 6.00 % | $109,332 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $771,875 |
| **Total Project Cost:** | | | **$3,192,484** |

# MEASURE 16 – MODIFY CHANNEL – 70’ WIDTH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 45,000.00 | CY | 21.98 | $988,879.07 | $0.00 | $0.00 | $0.00 | $988,879.07 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020226 | 988, 5.35m3 (7 CY), Wheel Loader | 169.00 | HR | 281.42 | $0.00 | $14,425.99 | $33,134.10 | $0.00 | $47,560.09 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 381.00 | HR | 342.21 | $0.00 | $34,668.52 | $95,712.11 | $0.00 | $130,380.64 |
| G1030020289 | 24.47m3 (32 CY), Semi Dump | 847.00 | HR | 150.54 | $0.00 | $55,750.63 | $71,755.10 | $0.00 | $127,505.73 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 36.00 | HR | 354.77 | $0.00 | $3,072.99 | $9,698.82 | $0.00 | $12,771.82 |
| **TOTAL** | | | | | **$988,879** | **$107,918** | **$210,300** | **$0** | **$1,307,097** |
| **REROUTE WATER DISTRIBUTION** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 100.87 | CY | 21.98 | $2,216.63 | $0.00 | $0.00 | $0.00 | $2,216.63 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 2.00 | HR | 121.00 | $0.00 | $162.45 | $79.55 | $0.00 | $242.00 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 546.52 | CY | 2.99 | $0.00 | $965.18 | $668.14 | $0.00 | $1,633.31 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 8.00 | HR | 134.28 | $0.00 | $544.55 | $529.71 | $0.00 | $1,074.27 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 465.83 | CY | 2.38 | $0.00 | $424.08 | $682.56 | $0.00 | $1,106.64 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 81.42 | CY | 62.85 | $4,353.75 | $326.95 | $436.25 | $0.00 | $5,116.96 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 465.83 | CY | 2.52 | $0.00 | $1,092.85 | $80.48 | $0.00 | $1,173.33 |
| G1030050515 | Compact With Pogosticks | 81.42 | CY | 14.18 | $0.00 | $1,011.72 | $142.41 | $0.00 | $1,154.13 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 2.00 | DAY | 103.00 | $178.28 | $27.71 | $0.00 | $0.00 | $205.99 |
| **TOTAL** | | | | | **$6,749** | **$4,556** | **$2,619** | **$0** | **$13,923** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3010 WATER SUPPLY | | | | | | | | | |
| G301002 POTABLE WATER DISTRIBUTION | | | | | | | | | |
| G3010020221 | 152.40mm (6"), Class 50, Mechanical Joint, DIP | 1,000.00 | LF | 43.75 | $21,608.84 | $17,441.51 | $4,698.14 | $0.00 | $43,748.48 |
| **TOTAL** | | | | | **$21,609** | **$17,442** | **$4,698** | **$0** | **$43,748** |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | | |
| G4090 OTHER SITE ELECTRICAL UTILITIES | | | | | | | | | |
| G409001 SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM | | | | | | | | | |
| G4090010101 | 3-4.08kg (9 Lb) Magnesium Anodes, Cathodic Protection Point | 4.00 | EA | 1,179.55 | $837.69 | $3,690.71 | $189.82 | $0.00 | $4,718.21 |
| **TOTAL** | | | | | **$838** | **$3,691** | **$190** | **$0** | **$4,718** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 875.71 | CY | 21.98 | $19,243.81 | $0.00 | $0.00 | $0.00 | $19,243.81 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 17.00 | HR | 128.31 | $0.00 | $1,380.80 | $800.54 | $0.00 | $2,181.34 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 4,226.56 | CY | 2.99 | $0.00 | $7,464.27 | $5,167.09 | $0.00 | $12,631.36 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 35.00 | HR | 153.24 | $0.00 | $2,303.74 | $3,059.82 | $0.00 | $5,363.57 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 3,525.99 | CY | 2.38 | $0.00 | $3,210.00 | $5,166.48 | $0.00 | $8,376.48 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 670.18 | CY | 62.85 | $35,836.35 | $2,691.21 | $3,590.88 | $0.00 | $42,118.44 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 3,525.99 | CY | 2.52 | $0.00 | $8,272.09 | $609.16 | $0.00 | $8,881.25 |
| G1030050515 | Compact With Pogosticks | 670.18 | CY | 14.18 | $0.00 | $8,327.61 | $1,172.23 | $0.00 | $9,499.85 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 15.00 | DAY | 103.00 | $1,337.09 | $207.86 | $0.00 | $0.00 | $1,544.94 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | | | | | **$56,417** | **$33,858** | **$19,566** | **$0** | **$109,841** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 7,200.00 | LF | 96.13 | $411,373.69 | $280,772.66 | $0.00 | $0.00 | $692,146.35 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 24.00 | EA | 2,195.00 | $34,585.63 | $15,712.40 | $2,381.95 | $0.00 | $52,679.97 |
| **TOTAL** | | | | | **$445,959** | **$296,485** | **$2,382** | **$0** | **$744,826** |

| | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$1,520,451** | **$463,949** | **$239,755** | **$0** | **$2,224,155** |

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$2,224,155** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$2,224,155** |
| | Contingency | 20.00 % | $444,831 |
| | SIOH | 5.70 % | $152,132 |
| | Design | 6.00 % | $133,449 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easement | | | $780,000 |
| **Total Project Cost:** | | | **$3,734,567** |

# MEASURE 17 – RR CROSSING BRIDGE MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **BRIDGE** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070101 | General Area Cleanup | 1.33 | ACRE | 3,994.37 | $0.00 | $2,988.63 | $2,323.88 | $0.00 | $5,312.51 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010102 | Rough Grading, 0.0012 T (12G), 1 Pass | 122,907.00 | SY | 0.00 | $0.00 | $22.80 | $17.56 | $0.00 | $40.37 |
| G1030010107 | Fine Grading, 0.012 T (120G), 2 Passes | 5,662.00 | SY | 1.04 | $0.00 | $3,585.10 | $2,293.80 | $0.00 | $5,878.90 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020201 | Excavation, Spoil To Side | 179.00 | CY | 1.06 | $0.00 | $66.45 | $123.37 | $0.00 | $189.82 |
| G1030020282 | Soil, 8.05km (5 Mi), Dump Truck, Load/Haul off Spoil From Trench | 46.00 | CY | 4.76 | $0.00 | $94.57 | $124.53 | $0.00 | $219.10 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 9.00 | CY | 62.64 | $479.67 | $36.02 | $48.06 | $0.00 | $563.76 |
| G1030040416 | Backfill, Lrg Spot Footing Excav Material, 950, 2.29m3 (3 CY) | 143.00 | CY | 3.12 | $0.00 | $315.62 | $130.39 | $0.00 | $446.02 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050508 | Compact, Ftg Excav, Excav Material Backfill | 324.00 | CY | 8.17 | $0.00 | $2,552.11 | $96.16 | $0.00 | $2,648.28 |
| G1030050511 | Compact Soil W/Vibrating Plate | 44.00 | CY | 2.51 | $0.00 | $102.89 | $7.58 | $0.00 | $110.46 |
| G1030050513 | Spread Dumped Borrow & Compact W/Roller | 22,913.00 | CY | 2.71 | $0.00 | $57,922.25 | $4,266.37 | $0.00 | $62,188.61 |
| **TOTAL** | | | | | **$480** | **$67,686** | **$9,432** | **$0** | **$77,598** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010101 | Cement Stabilized Base | 494.00 | CY | 78.41 | $30,187.77 | $5,631.02 | $2,915.19 | $0.00 | $38,733.98 |
| G201005 GUARDRAILS & BARRIERS | | | | | | | | | |
| G2010050501 | Guardrail, Single Rail, Wood Posts | 700.00 | LF | 48.91 | $31,175.00 | $2,531.20 | $532.46 | $0.00 | $34,238.67 |
| G2010050502 | Guardrail, Single Rail, Wood Posts, Ends | 4.00 | EA | 178.39 | $513.99 | $164.89 | $34.68 | $0.00 | $713.55 |
| G2050 LANDSCAPING | | | | | | | | | |
| G205002 EROSION CONTROL MEASURES | | | | | | | | | |
| G2050020201 | Sediment Fence, Temporary | 1,456.00 | LF | 10.94 | $6,073.44 | $7,689.50 | $2,165.10 | $0.00 | $15,928.03 |
| G205004 SEEDING, SPRIGGING AND SODDING | | | | | | | | | |
| G2050040402 | Seeding, Vegetative Cover | 0.67 | ACRE | 6,941.15 | $3,314.57 | $1,138.35 | $197.66 | $0.00 | $4,650.57 |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2050040408 | Fertilizer, Hydr Spread | 0.67 | ACRE | 231.26 | $3.23 | $151.72 | $0.00 | $0.00 | $154.95 |
| **TOTAL** | | | | | **$71,268** | **$17,307** | **$5,845** | **$0** | **$94,420** |

### G90 OTHER SITE CONSTRUCTION

G9090 OTHER SITE CONSTRUCTION

G909001 BRIDGES

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010108 | Form Deck, 3 Uses | 5,173.00 | SF | 6.44 | $1,284.10 | $32,010.94 | $0.00 | $0.00 | $33,295.05 |
| G9090010109 | Rebar, Bridge Deck | 9,547.00 | lb | 1.01 | $6,133.78 | $3,549.44 | $0.00 | $0.00 | $9,683.22 |
| G9090010110 | Pour & Cure, Deck | 213.00 | CY | 248.21 | $33,590.15 | $16,769.51 | $2,508.70 | $0.00 | $52,868.37 |
| G9090010111 | Bush Hammer Finish | 7,350.00 | SF | 3.20 | $0.00 | $21,543.29 | $1,980.89 | $0.00 | $23,524.18 |
| G9090010112 | Armor Joints | 92.00 | LF | 562.44 | $42,316.23 | $9,221.32 | $207.36 | $0.00 | $51,744.91 |
| G9090010131 | Struc Steel Beams, Rolled Shapes, A36, 50.80mm - 152.40mm (2-6") Studs @ 76.20mm (3") | 94.00 | TON | 3,797.36 | $346,924.13 | $7,232.32 | $2,795.85 | $0.00 | $356,952.30 |
| G9090010132 | Structural Steel Beam Bracing | 19.00 | TON | 4,700.18 | $69,358.90 | $14,969.91 | $4,974.52 | $0.00 | $89,303.33 |
| G9090010133 | Rocker/Fixed Bearing Assembly For Steel Beams, Complete | 10,080.00 | lb | 7.31 | $69,913.78 | $2,947.21 | $855.62 | $0.00 | $73,716.61 |
| G9090010145 | Large Spot Footing, Edge Form & Strip, 4 Uses | 528.00 | SF | 6.14 | $478.01 | $2,762.25 | $0.00 | $0.00 | $3,240.26 |
| G9090010146 | Footing, Rebar | 1,254.00 | lb | 1.32 | $851.45 | $799.13 | $0.00 | $0.00 | $1,650.58 |
| G9090010147 | Large Spot Footing, Pour & Cure Concrete | 30.00 | CY | 245.73 | $4,632.44 | $1,897.79 | $841.73 | $0.00 | $7,371.97 |
| G9090010148 | Column Forms, Fiber, 609.60mm (24") Round | 352.00 | LF | 29.44 | $4,497.38 | $5,864.47 | $0.00 | $0.00 | $10,361.84 |
| G9090010149 | Columns, Rebar, Spiral | 7,040.00 | lb | 1.60 | $7,195.80 | $4,095.85 | $0.00 | $0.00 | $11,291.65 |
| G9090010150 | Columns, Pour & Finish Concrete | 93.00 | CY | 378.38 | $14,584.64 | $19,393.18 | $1,211.49 | $0.00 | $35,189.31 |
| G9090010151 | Form, Bentcap Bottom | 350.00 | SF | 13.09 | $572.39 | $4,009.01 | $0.00 | $0.00 | $4,581.40 |
| G9090010152 | Form, Bentcap Sides | 480.00 | SF | 9.54 | $827.05 | $3,751.61 | $0.00 | $0.00 | $4,578.66 |
| G9090010153 | Bentcap, Rebar | 1,488.00 | lb | 1.01 | $956.01 | $553.22 | $0.00 | $0.00 | $1,509.23 |
| G9090010154 | Bentcap, Pour & Cure | 33.00 | CY | 244.03 | $5,074.01 | $2,321.20 | $657.75 | $0.00 | $8,052.96 |
| G9090010155 | Edgeforms, 254.00mm (10") Approach Slab, 2 Uses | 876.00 | LF | 11.71 | $677.94 | $9,582.34 | $0.00 | $0.00 | $10,260.27 |
| G9090010156 | Welded Wire Mesh, Approach Slab, 6 X 6 X 4/4, 58#/SQ | 161.00 | SQ | 102.63 | $8,145.87 | $8,378.20 | $0.00 | $0.00 | $16,524.07 |
| G9090010157 | Pour & Cure, Approach Slab | 494.00 | CY | 226.19 | $77,038.32 | $30,286.39 | $4,413.87 | $0.00 | $111,738.58 |
| G9090010158 | Parapet, Form | 1,132.00 | SF | 7.78 | $1,355.40 | $7,445.93 | $0.00 | $0.00 | $8,801.33 |
| G9090010159 | Parapet, Rebar | 402.00 | lb | 1.12 | $272.95 | $179.29 | $0.00 | $0.00 | $452.24 |
| G9090010160 | Parapet, Pour & Cure | 17.00 | CY | 245.24 | $2,833.57 | $1,060.16 | $275.31 | $0.00 | $4,169.03 |
| **TOTAL** | | | | | **$699,514** | **$210,624** | **$20,723** | **$0** | **$930,861** |

## CLEAR AND GRUB

### G BUILDING SITEWORK

### G10 SITE PREPARATIONS

# Assembly Detail Report



| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| G1010 SITE CLEARING | | | | | | | | |
| G101001 CLEARING | | | | | | | | |
| G1010010102 Medium Brush W/O Grub, Clearing | 0.70 | ACRE | 295.61 | $0.00 | $91.92 | $115.01 | $0.00 | $206.93 |
| G1010010111 Medium, W/O Grub D7LGP, Wet Clearing | 0.30 | ACRE | 1,605.01 | $0.00 | $432.45 | $49.06 | $0.00 | $481.50 |
| G101002 TREE REMOVAL | | | | | | | | |
| G1010020211 Clear Trees To 304.80mm (12") Dia W/D8 Cat | 100.00 | EA | 15.55 | $0.00 | $544.45 | $1,010.82 | $0.00 | $1,555.27 |
| G1010020213 Clear Trees To914.40mm (36") Dia W/D8 Cat | 10.00 | EA | 46.66 | $0.00 | $163.33 | $303.25 | $0.00 | $466.58 |
| G101003 STUMP REMOVAL | | | | | | | | |
| G1010030311 > 152.40mm (6") < 304.80mm (12") Stump Removal, W/LGP D7 | 30.00 | EA | 5.98 | $0.00 | $62.82 | $116.63 | $0.00 | $179.45 |
| G1010030313 > 609.60mm (24") < 914.40mm (36") Stump Removal, W/LGP D7 | 3.00 | EA | 11.96 | $0.00 | $12.56 | $23.33 | $0.00 | $35.89 |
| G1010030315 > 152.40mm (6") and <= 304.80mm (12") Stump Removal, W/D8 | 70.00 | EA | 5.98 | $0.00 | $146.58 | $272.14 | $0.00 | $418.72 |
| G1010030317 > 609.60mm (24") and <= 914.40mm (36") Stump Removal, W/D8 | 7.00 | EA | 11.96 | $0.00 | $29.32 | $54.43 | $0.00 | $83.74 |
| G101004 GRUBBING | | | | | | | | |
| G1010040501 Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 84.70 | CY | 0.97 | $0.00 | $28.82 | $53.51 | $0.00 | $82.33 |
| G1010040510 Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 24.20 | CY | 0.97 | $0.00 | $8.23 | $15.29 | $0.00 | $23.52 |
| **TOTAL** | | | | **$0** | **$1,520** | **$2,013** | **$0** | **$3,534** |

## RAILROAD TRACKS AND CROSSING

### G BUILDING SITEWORK

### G10 SITE PREPARATIONS

| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| G1010 SITE CLEARING | | | | | | | | |
| G101001 CLEARING | | | | | | | | |
| G1010010107 Medium Brush, Medium Trees, Clear, Grub, Haul | 1.00 | ACRE | 8,063.21 | $0.00 | $5,524.94 | $2,538.27 | $0.00 | $8,063.21 |
| G1030 SITE EARTHWORK | | | | | | | | |
| G103001 GRADING | | | | | | | | |
| G1030010103 Rough Grading, 0.0014 T (14G), 1 Pass | 556.00 | SY | 0.00 | $0.00 | $0.21 | $0.16 | $0.00 | $0.37 |
| G1030010107 Fine Grading, 0.012 T (120G), 2 Passes | 173.00 | SY | 1.04 | $0.00 | $109.54 | $70.09 | $0.00 | $179.63 |
| G1030010108 Fine Grading, 0.013 T (130G), 2 Passes | 245.00 | SY | 1.04 | $0.00 | $155.13 | $99.25 | $0.00 | $254.39 |
| G103002 COMMON EXCAVATION | | | | | | | | |
| G1030020202 Ditch Excavation, Normal Soil, Haul off Spoil 1.61 km (1 Mile) | 149.00 | CY | 12.15 | $0.00 | $911.82 | $898.97 | $0.00 | $1,810.80 |
| G103005 COMPACTION | | | | | | | | |
| G1030050510 Dry Roll Gravel, Steel Roller | 906.00 | SY | 0.69 | $0.00 | $389.45 | $237.70 | $0.00 | $627.15 |
| **TOTAL** | | | | **$0** | **$7,091** | **$3,844** | **$0** | **$10,936** |

### G20 SITE IMPROVEMENTS

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2010 ROADWAYS | | | | | | | | | |
| G201004 MARKING & SIGNAGE | | | | | | | | | |
| G2010040404 | RR Crossing Markings, Stop Line, Per Lane | 1.00 | EA | 28.21 | $18.18 | $6.05 | $3.98 | $0.00 | $28.21 |
| G2010040411 | Traffic Signs & Posts, Average | 1.00 | EA | 115.95 | $80.31 | $29.44 | $6.19 | $0.00 | $115.95 |
| **TOTAL** | | | | | **$98** | **$35** | **$10** | **$0** | **$144** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3030 STORM SEWER | | | | | | | | | |
| G303004 CULVERTS | | | | | | | | | |
| G3030040402 | 10.36m (34') Complete, 609.60mm (24") CMP Culvert W/Headwalls | 3.00 | EA | 11,612.53 | $22,943.20 | $10,199.72 | $1,694.66 | $0.00 | $34,837.58 |
| **TOTAL** | | | | | **$22,943** | **$10,200** | **$1,695** | **$0** | **$34,838** |
| **G90 OTHER SITE CONSTRUCTION** | | | | | | | | | |
| G9090 OTHER SITE CONSTRUCTION | | | | | | | | | |
| G909002 RAILROAD SPURS | | | | | | | | | |
| G9090020201 | Ballast | 70.00 | CY | 104.61 | $3,219.71 | $3,530.95 | $572.02 | $0.00 | $7,322.68 |
| G9090020202 | Gravel (90%) & Sand Base (10%); W/CaCl 0.45-0.59 kg/m3 (3/4-1 Lb/CY) | 76.00 | CY | 37.90 | $2,824.29 | $25.25 | $30.98 | $0.00 | $2,880.53 |
| G9090020225 | Railroad Crossing Molded Rubber W/Headers, 3.66m (12') Wide | 1.00 | EA | 7,987.79 | $7,410.45 | $427.24 | $150.10 | $0.00 | $7,987.79 |
| G9090020230 | New 49.89 kg (110 lb) Track | 100.00 | LF | 242.63 | $18,690.40 | $5,142.28 | $430.09 | $0.00 | $24,262.76 |
| G9090020240 | 49.89 kg (110 lb) Angle Bar w/Bolts and Washers | 6.00 | PR | 163.82 | $747.50 | $235.44 | $0.00 | $0.00 | $982.94 |
| G9090020250 | Crossties w/49.89 kg (110 lb) Tie Plates and Spikes | 60.00 | EA | 217.80 | $7,245.45 | $4,695.82 | $1,126.71 | $0.00 | $13,067.98 |
| **TOTAL** | | | | | **$40,138** | **$14,057** | **$2,310** | **$0** | **$56,505** |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 625.00 | CY | 21.90 | $13,689.26 | $0.00 | $0.00 | $0.00 | $13,689.26 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020221 | 916, 1.15m3 (1.5 CY), Wheel Loader | 11.00 | HR | 127.89 | $0.00 | $890.52 | $516.29 | $0.00 | $1,406.81 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 10.00 | HR | 341.08 | $0.00 | $906.94 | $2,503.87 | $0.00 | $3,410.81 |
| G1030020285 | 9.17m3 (12 CY), Dump Truck | 35.00 | HR | 143.87 | $0.00 | $2,433.54 | $2,601.74 | $0.00 | $5,035.28 |

# Assembly Detail Report



## G103003 ROCK EXCAVATION

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1030030310 | D8 W/U Blade & Single Shank Ripper, Bulldozer | 1.00 | HR | 238.23 | $0.00 | $85.08 | $153.15 | $0.00 | $238.23 |
| **TOTAL** | | | | | **$13,689** | **$4,316** | **$5,775** | **$0** | **$23,780** |

| | | | | | |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$848,131** | **$332,837** | **$51,648** | **$0** | **$1,232,615** |

Note: All Costs Include ACF, Markups and Escalation

| | | |
|---|---|---|
| **Facilities Marked Up Cost:** | | **$1,232,615** |
| Pavement: | | |
| Site Improvements: | | |
| Utilities: | | |
| **Estimated Contract Cost:** | | **$1,232,615** |
| Contingency | 20.00 % | $246,523 |
| SIOH | 5.70 % | $84,311 |
| Design | 6.00 % | $73,957 |
| Other | 0.00 % | $0 |
| **Total Project Cost:** | | **$1,637,406** |

# MEASURE 18 – ST. ANDREWS BRIDGE MODIFICATION

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **BRIDGES** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070101 | General Area Cleanup | 1.44 | ACRE | 3,994.37 | $0.00 | $3,235.81 | $2,516.09 | $0.00 | $5,751.89 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010102 | Rough Grading, 0.0012 T (12G), 1 Pass | 122,255.00 | SY | 0.00 | $0.00 | $22.68 | $17.47 | $0.00 | $40.15 |
| G1030010107 | Fine Grading, 0.012 T (120G), 2 Passes | 5,010.00 | SY | 1.04 | $0.00 | $3,172.26 | $2,029.66 | $0.00 | $5,201.92 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020201 | Excavation, Spoil To Side | 114.00 | CY | 1.06 | $0.00 | $42.32 | $78.57 | $0.00 | $120.89 |
| G1030020282 | Soil, 8.05km (5 Mi), Dump Truck, Load/Haul off Spoil From Trench | 30.00 | CY | 4.76 | $0.00 | $61.68 | $81.21 | $0.00 | $142.89 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 6.00 | CY | 62.64 | $319.78 | $24.01 | $32.04 | $0.00 | $375.84 |
| G1030040416 | Backfill, Lrg Spot Footing Excav Material, 950, 2.29m3 (3 CY) | 91.00 | CY | 3.12 | $0.00 | $200.85 | $82.98 | $0.00 | $283.83 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050508 | Compact, Ftg Excav, Excav Material Backfill | 206.00 | CY | 8.17 | $0.00 | $1,622.64 | $61.14 | $0.00 | $1,683.78 |
| G1030050511 | Compact Soil W/Vibrating Plate | 28.00 | CY | 2.51 | $0.00 | $65.47 | $4.82 | $0.00 | $70.29 |
| G1030050513 | Spread Dumped Borrow & Compact W/Roller | 27,495.00 | CY | 2.71 | $0.00 | $69,505.18 | $5,119.53 | $0.00 | $74,624.71 |
| **TOTAL** | | | | | **$320** | **$77,953** | **$10,024** | **$0** | **$88,296** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010101 | Cement Stabilized Base | 592.00 | CY | 78.41 | $36,176.44 | $6,748.11 | $3,493.51 | $0.00 | $46,418.05 |
| G201005 GUARDRAILS & BARRIERS | | | | | | | | | |
| G2010050501 | Guardrail, Single Rail, Wood Posts | 700.00 | LF | 48.91 | $31,175.00 | $2,531.20 | $532.46 | $0.00 | $34,238.67 |
| G2010050502 | Guardrail, Single Rail, Wood Posts, Ends | 4.00 | EA | 178.39 | $513.99 | $164.89 | $34.68 | $0.00 | $713.55 |
| G2050 LANDSCAPING | | | | | | | | | |
| G205002 EROSION CONTROL MEASURES | | | | | | | | | |
| G2050020201 | Sediment Fence, Temporary | 1,456.00 | LF | 10.94 | $6,073.44 | $7,689.50 | $2,165.10 | $0.00 | $15,928.03 |
| G205004 SEEDING, SPRIGGING AND SODDING | | | | | | | | | |
| G2050040402 | Seeding, Vegetative Cover | 0.67 | ACRE | 6,941.15 | $3,314.57 | $1,138.35 | $197.66 | $0.00 | $4,650.57 |

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2050040408 | Fertilizer, Hydr Spread | 0.67 | ACRE | 231.26 | $3.23 | $151.72 | $0.00 | $0.00 | $154.95 |
| **TOTAL** | | | | | **$77,257** | **$18,424** | **$6,423** | **$0** | **$102,104** |

## G90 OTHER SITE CONSTRUCTION

### G9090 OTHER SITE CONSTRUCTION

### G909001 BRIDGES

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010108 | Form Deck, 3 Uses | 1,636.00 | SF | 6.44 | $406.11 | $10,123.70 | $0.00 | $0.00 | $10,529.81 |
| G9090010109 | Rebar, Bridge Deck | 3,437.00 | lb | 1.01 | $2,208.21 | $1,277.83 | $0.00 | $0.00 | $3,486.04 |
| G9090010110 | Pour & Cure, Deck | 77.00 | CY | 248.21 | $12,142.92 | $6,062.22 | $906.90 | $0.00 | $19,112.04 |
| G9090010111 | Bush Hammer Finish | 4,254.00 | SF | 3.20 | $0.00 | $12,468.73 | $1,146.49 | $0.00 | $13,615.22 |
| G9090010112 | Armor Joints | 55.00 | LF | 562.44 | $25,297.75 | $5,512.74 | $123.97 | $0.00 | $30,934.46 |
| G9090010131 | Struc Steel Beams, Rolled Shapes, A36, 50.80mm - 152.40mm (2-6") Studs @ 76.20mm (3") | 34.00 | TON | 3,797.36 | $125,483.20 | $2,615.95 | $1,011.26 | $0.00 | $129,110.41 |
| G9090010132 | Structural Steel Beam Bracing | 7.00 | TON | 4,700.18 | $25,553.28 | $5,515.23 | $1,832.72 | $0.00 | $32,901.23 |
| G9090010133 | Rocker/Fixed Bearing Assembly For Steel Beams, Complete | 2,430.00 | lb | 7.31 | $16,854.21 | $710.49 | $206.26 | $0.00 | $17,770.97 |
| G9090010145 | Large Spot Footing, Edge Form & Strip, 4 Uses | 336.00 | SF | 6.14 | $304.19 | $1,757.79 | $0.00 | $0.00 | $2,061.98 |
| G9090010146 | Footing, Rebar | 798.00 | lb | 1.32 | $541.83 | $508.54 | $0.00 | $0.00 | $1,050.37 |
| G9090010147 | Large Spot Footing, Pour & Cure Concrete | 19.00 | CY | 245.73 | $2,933.88 | $1,201.94 | $533.10 | $0.00 | $4,668.91 |
| G9090010148 | Column Forms, Fiber, 609.60mm (24") Round | 224.00 | LF | 29.44 | $2,861.97 | $3,731.93 | $0.00 | $0.00 | $6,593.90 |
| G9090010149 | Columns, Rebar, Spiral | 4,480.00 | lb | 1.60 | $4,579.15 | $2,606.45 | $0.00 | $0.00 | $7,185.60 |
| G9090010150 | Columns, Pour & Finish Concrete | 59.00 | CY | 378.38 | $9,252.62 | $12,303.20 | $768.58 | $0.00 | $22,324.40 |
| G9090010151 | Form, Bentcap Bottom | 210.00 | SF | 13.09 | $343.44 | $2,405.40 | $0.00 | $0.00 | $2,748.84 |
| G9090010152 | Form, Bentcap Sides | 288.00 | SF | 9.54 | $496.23 | $2,250.96 | $0.00 | $0.00 | $2,747.19 |
| G9090010153 | Bentcap, Rebar | 893.00 | lb | 1.01 | $573.74 | $332.00 | $0.00 | $0.00 | $905.74 |
| G9090010154 | Bentcap, Pour & Cure | 20.00 | CY | 244.03 | $3,075.15 | $1,406.79 | $398.64 | $0.00 | $4,880.58 |
| G9090010155 | Edgeforms, 254.00mm (10") Approach Slab, 2 Uses | 876.00 | LF | 11.71 | $677.94 | $9,582.34 | $0.00 | $0.00 | $10,260.27 |
| G9090010156 | Welded Wire Mesh, Approach Slab, 6 X 6 X 4/4, 58#/SQ | 193.00 | SQ | 102.63 | $9,764.93 | $10,043.43 | $0.00 | $0.00 | $19,808.36 |
| G9090010157 | Pour & Cure, Approach Slab | 592.00 | CY | 226.19 | $92,321.23 | $36,294.62 | $5,289.50 | $0.00 | $133,905.34 |
| G9090010158 | Parapet, Form | 340.00 | SF | 7.78 | $407.10 | $2,236.41 | $0.00 | $0.00 | $2,643.51 |
| G9090010159 | Parapet, Rebar | 121.00 | lb | 1.12 | $82.16 | $53.97 | $0.00 | $0.00 | $136.12 |
| G9090010160 | Parapet, Pour & Cure | 5.00 | CY | 245.24 | $833.40 | $311.81 | $80.97 | $0.00 | $1,226.19 |
| **TOTAL** | | | | | **$336,995** | **$131,314** | **$12,298** | **$0** | **$480,607** |

## GAS REROUTE

## G BUILDING SITEWORK

## G10 SITE PREPARATIONS

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 10.23 | CY | 21.90 | $224.07 | $0.00 | $0.00 | $0.00 | $224.07 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 120.60 | $0.00 | $80.96 | $39.65 | $0.00 | $120.60 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 40.00 | CY | 2.98 | $0.00 | $70.41 | $48.74 | $0.00 | $119.15 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 2.00 | HR | 133.84 | $0.00 | $135.69 | $131.99 | $0.00 | $267.68 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 32.00 | CY | 2.37 | $0.00 | $29.04 | $46.73 | $0.00 | $75.77 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 9.00 | CY | 62.64 | $479.67 | $36.02 | $48.06 | $0.00 | $563.76 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 32.00 | CY | 2.51 | $0.00 | $74.83 | $5.51 | $0.00 | $80.34 |
| G1030050515 | Compact With Pogosticks | 9.00 | CY | 14.13 | $0.00 | $111.47 | $15.69 | $0.00 | $127.16 |
| **TOTAL** | | | | | **$704** | **$538** | **$336** | **$0** | **$1,579** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3060 FUEL DISTRIBUTION | | | | | | | | | |
| G306006 GAS DISTRIBUTION PIPING (NATURAL AND PROPANE) | | | | | | | | | |
| G3060060106 | 152.40mm (6") Black Steel Pipe, Welded T & C Sch 40 | 112.00 | LF | 70.01 | $5,478.62 | $2,050.50 | $312.14 | $0.00 | $7,841.26 |
| **TOTAL** | | | | | **$5,479** | **$2,051** | **$312** | **$0** | **$7,841** |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | | |
| G4090 OTHER SITE ELECTRICAL UTILITIES | | | | | | | | | |
| G409001 SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM | | | | | | | | | |
| G4090010101 | 3-4.08kg (9 Lb) Magnesium Anodes, Cathodic Protection Point | 1.00 | EA | 1,175.67 | $208.73 | $919.64 | $47.30 | $0.00 | $1,175.67 |
| **TOTAL** | | | | | **$209** | **$920** | **$47** | **$0** | **$1,176** |
| **Marked Up Cost:** | | | | | **$420,962** | **$231,200** | **$29,441** | **$0** | **$681,603** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



**Facilities Marked Up Cost:** **$681,603**

Pavement:
Site Improvements:
Utilities:

| | | | |
|---|---|---|---|
| **Estimated Contract Cost:** | | | **$681,603** |
| | Contingency | 20.00 % | $136,321 |
| | SIOH | 5.70 % | $46,622 |
| | Design | 6.00 % | $40,896 |
| | Other | 0.00 % | $0 |

**Total Project Cost:** **$905,441**

Note: All Costs Include ACF, Markups and Escalation

Project Location: Columbia, South Carolina
Project Midpoint: Jan 2018

Area Cost Factor: 0.82
Escalation Rate: 8.18 %

# MEASURE 19 – PINEY GROVE RD BRIDGE MODIFICATION

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **BRIDGES** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070101 | General Area Cleanup | 1.44 | ACRE | 3,994.37 | $0.00 | $3,235.81 | $2,516.09 | $0.00 | $5,751.89 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103001 GRADING | | | | | | | | | |
| G1030010102 | Rough Grading, 0.0012 T (12G), 1 Pass | 122,255.00 | SY | 0.00 | $0.00 | $22.68 | $17.47 | $0.00 | $40.15 |
| G1030010107 | Fine Grading, 0.012 T (120G), 2 Passes | 5,010.00 | SY | 1.04 | $0.00 | $3,172.26 | $2,029.66 | $0.00 | $5,201.92 |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020201 | Excavation, Spoil To Side | 114.00 | CY | 1.06 | $0.00 | $42.32 | $78.57 | $0.00 | $120.89 |
| G1030020282 | Soil, 8.05km (5 Mi), Dump Truck, Load/Haul off Spoil From Trench | 30.00 | CY | 4.76 | $0.00 | $61.68 | $81.21 | $0.00 | $142.89 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 6.00 | CY | 62.64 | $319.78 | $24.01 | $32.04 | $0.00 | $375.84 |
| G1030040416 | Backfill, Lrg Spot Footing Excav Material, 950, 2.29m3 (3 CY) | 91.00 | CY | 3.12 | $0.00 | $200.85 | $82.98 | $0.00 | $283.83 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050508 | Compact, Ftg Excav, Excav Material Backfill | 206.00 | CY | 8.17 | $0.00 | $1,622.64 | $61.14 | $0.00 | $1,683.78 |
| G1030050511 | Compact Soil W/Vibrating Plate | 28.00 | CY | 2.51 | $0.00 | $65.47 | $4.82 | $0.00 | $70.29 |
| G1030050513 | Spread Dumped Borrow & Compact W/Roller | 27,495.00 | CY | 2.71 | $0.00 | $69,505.18 | $5,119.53 | $0.00 | $74,624.71 |
| **TOTAL** | | | | | **$320** | **$77,953** | **$10,024** | **$0** | **$88,296** |
| **G20 SITE IMPROVEMENTS** | | | | | | | | | |
| G2010 ROADWAYS | | | | | | | | | |
| G201001 BASES & SUBBASES | | | | | | | | | |
| G2010010101 | Cement Stabilized Base | 592.00 | CY | 78.41 | $36,176.44 | $6,748.11 | $3,493.51 | $0.00 | $46,418.05 |
| G201005 GUARDRAILS & BARRIERS | | | | | | | | | |
| G2010050501 | Guardrail, Single Rail, Wood Posts | 700.00 | LF | 48.91 | $31,175.00 | $2,531.20 | $532.46 | $0.00 | $34,238.67 |
| G2010050502 | Guardrail, Single Rail, Wood Posts, Ends | 4.00 | EA | 178.39 | $513.99 | $164.89 | $34.68 | $0.00 | $713.55 |
| G2050 LANDSCAPING | | | | | | | | | |
| G205002 EROSION CONTROL MEASURES | | | | | | | | | |
| G2050020201 | Sediment Fence, Temporary | 1,456.00 | LF | 10.94 | $6,073.44 | $7,689.50 | $2,165.10 | $0.00 | $15,928.03 |
| G205004 SEEDING, SPRIGGING AND SODDING | | | | | | | | | |
| G2050040402 | Seeding, Vegetative Cover | 0.67 | ACRE | 6,941.15 | $3,314.57 | $1,138.35 | $197.66 | $0.00 | $4,650.57 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G2050040408 | Fertilizer, Hydr Spread | 0.67 | ACRE | 231.26 | $3.23 | $151.72 | $0.00 | $0.00 | $154.95 |
| **TOTAL** | | | | | **$77,257** | **$18,424** | **$6,423** | **$0** | **$102,104** |

## G90 OTHER SITE CONSTRUCTION

### G9090 OTHER SITE CONSTRUCTION

### G909001 BRIDGES

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G9090010108 | Form Deck, 3 Uses | 1,636.00 | SF | 6.44 | $406.11 | $10,123.70 | $0.00 | $0.00 | $10,529.81 |
| G9090010109 | Rebar, Bridge Deck | 3,437.00 | lb | 1.01 | $2,208.21 | $1,277.83 | $0.00 | $0.00 | $3,486.04 |
| G9090010110 | Pour & Cure, Deck | 77.00 | CY | 248.21 | $12,142.92 | $6,062.22 | $906.90 | $0.00 | $19,112.04 |
| G9090010111 | Bush Hammer Finish | 4,254.00 | SF | 3.20 | $0.00 | $12,468.73 | $1,146.49 | $0.00 | $13,615.22 |
| G9090010112 | Armor Joints | 55.00 | LF | 562.44 | $25,297.75 | $5,512.74 | $123.97 | $0.00 | $30,934.46 |
| G9090010131 | Struc Steel Beams, Rolled Shapes, A36, 50.80mm - 152.40mm (2-6") Studs @ 76.20mm (3") | 34.00 | TON | 3,797.36 | $125,483.20 | $2,615.95 | $1,011.26 | $0.00 | $129,110.41 |
| G9090010132 | Structural Steel Beam Bracing | 7.00 | TON | 4,700.18 | $25,553.28 | $5,515.23 | $1,832.72 | $0.00 | $32,901.23 |
| G9090010133 | Rocker/Fixed Bearing Assembly For Steel Beams, Complete | 2,430.00 | lb | 7.31 | $16,854.21 | $710.49 | $206.26 | $0.00 | $17,770.97 |
| G9090010145 | Large Spot Footing, Edge Form & Strip, 4 Uses | 336.00 | SF | 6.14 | $304.19 | $1,757.79 | $0.00 | $0.00 | $2,061.98 |
| G9090010146 | Footing, Rebar | 798.00 | lb | 1.32 | $541.83 | $508.54 | $0.00 | $0.00 | $1,050.37 |
| G9090010147 | Large Spot Footing, Pour & Cure Concrete | 19.00 | CY | 245.73 | $2,933.88 | $1,201.94 | $533.10 | $0.00 | $4,668.91 |
| G9090010148 | Column Forms, Fiber, 609.60mm (24") Round | 224.00 | LF | 29.44 | $2,861.97 | $3,731.93 | $0.00 | $0.00 | $6,593.90 |
| G9090010149 | Columns, Rebar, Spiral | 4,480.00 | lb | 1.60 | $4,579.15 | $2,606.45 | $0.00 | $0.00 | $7,185.60 |
| G9090010150 | Columns, Pour & Finish Concrete | 59.00 | CY | 378.38 | $9,252.62 | $12,303.20 | $768.58 | $0.00 | $22,324.40 |
| G9090010151 | Form, Bentcap Bottom | 210.00 | SF | 13.09 | $343.44 | $2,405.40 | $0.00 | $0.00 | $2,748.84 |
| G9090010152 | Form, Bentcap Sides | 288.00 | SF | 9.54 | $496.23 | $2,250.96 | $0.00 | $0.00 | $2,747.19 |
| G9090010153 | Bentcap, Rebar | 893.00 | lb | 1.01 | $573.74 | $332.00 | $0.00 | $0.00 | $905.74 |
| G9090010154 | Bentcap, Pour & Cure | 20.00 | CY | 244.03 | $3,075.15 | $1,406.79 | $398.64 | $0.00 | $4,880.58 |
| G9090010155 | Edgeforms, 254.00mm (10") Approach Slab, 2 Uses | 876.00 | LF | 11.71 | $677.94 | $9,582.34 | $0.00 | $0.00 | $10,260.27 |
| G9090010156 | Welded Wire Mesh, Approach Slab, 6 X 6 X 4/4, 58#/SQ | 193.00 | SQ | 102.63 | $9,764.93 | $10,043.43 | $0.00 | $0.00 | $19,808.36 |
| G9090010157 | Pour & Cure, Approach Slab | 592.00 | CY | 226.19 | $92,321.23 | $36,294.62 | $5,289.50 | $0.00 | $133,905.34 |
| G9090010158 | Parapet, Form | 340.00 | SF | 7.78 | $407.10 | $2,236.41 | $0.00 | $0.00 | $2,643.51 |
| G9090010159 | Parapet, Rebar | 121.00 | lb | 1.12 | $82.16 | $53.97 | $0.00 | $0.00 | $136.12 |
| G9090010160 | Parapet, Pour & Cure | 5.00 | CY | 245.24 | $833.40 | $311.81 | $80.97 | $0.00 | $1,226.19 |
| **TOTAL** | | | | | **$336,995** | **$131,314** | **$12,298** | **$0** | **$480,607** |

## GAS REROUTE

## G BUILDING SITEWORK

## G10 SITE PREPARATIONS

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 10.23 | CY | 21.90 | $224.07 | $0.00 | $0.00 | $0.00 | $224.07 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 1.00 | HR | 120.60 | $0.00 | $80.96 | $39.65 | $0.00 | $120.60 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 40.00 | CY | 2.98 | $0.00 | $70.41 | $48.74 | $0.00 | $119.15 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 2.00 | HR | 133.84 | $0.00 | $135.69 | $131.99 | $0.00 | $267.68 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 32.00 | CY | 2.37 | $0.00 | $29.04 | $46.73 | $0.00 | $75.77 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 9.00 | CY | 62.64 | $479.67 | $36.02 | $48.06 | $0.00 | $563.76 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 32.00 | CY | 2.51 | $0.00 | $74.83 | $5.51 | $0.00 | $80.34 |
| G1030050515 | Compact With Pogosticks | 9.00 | CY | 14.13 | $0.00 | $111.47 | $15.69 | $0.00 | $127.16 |
| **TOTAL** | | | | | **$704** | **$538** | **$336** | **$0** | **$1,579** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3060 FUEL DISTRIBUTION | | | | | | | | | |
| G306006 GAS DISTRIBUTION PIPING (NATURAL AND PROPANE) | | | | | | | | | |
| G3060060106 | 152.40mm (6") Black Steel Pipe, Welded T & C Sch 40 | 112.00 | LF | 70.01 | $5,478.62 | $2,050.50 | $312.14 | $0.00 | $7,841.26 |
| **TOTAL** | | | | | **$5,479** | **$2,051** | **$312** | **$0** | **$7,841** |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | | |
| G4090 OTHER SITE ELECTRICAL UTILITIES | | | | | | | | | |
| G409001 SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM | | | | | | | | | |
| G4090010101 | 3-4.08kg (9 Lb) Magnesium Anodes, Cathodic Protection Point | 1.00 | EA | 1,175.67 | $208.73 | $919.64 | $47.30 | $0.00 | $1,175.67 |
| **TOTAL** | | | | | **$209** | **$920** | **$47** | **$0** | **$1,176** |

## REROUTE ELECTRICAL

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G40 SITE ELECTRICAL UTILITIES** | | | | | | | | | |
| G4010 ELECTRICAL DISTRIBUTION | | | | | | | | | |
| G401004 OVERHEAD ELECTRIC CONDUCTORS | | | | | | | | | |
| G4010040301 | 1/0 Acsr Conductor | 264.00 | LF | 3.81 | $693.57 | $255.13 | $58.25 | $0.00 | $1,006.95 |
| G4010040310 | 1/C #2 Alum, Bare, Wire | 158.00 | LF | 3.81 | $415.09 | $152.69 | $34.86 | $0.00 | $602.64 |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G401005 TOWERS, POLES, CROSSARMS & INSULATORS | | | | | | | | | |
| G4010050402 | 10.67m (35') Class 3 Treated Power Pole | 2.00 | EA | 1,541.63 | $1,533.20 | $1,385.19 | $164.87 | $0.00 | $3,083.26 |
| G4010050430 | Terminal Structure, 5 KV Pole Top | 2.00 | EA | 5,992.73 | $5,837.83 | $5,245.63 | $902.01 | $0.00 | $11,985.47 |
| G401006 UNDERGROUND ELECTRIC CONDUCTORS | | | | | | | | | |
| G4010060545 | 5 KV, 1/0 To 4/0 Conductor, Terminations & Splicing | 6.00 | EA | 708.35 | $2,575.77 | $1,674.32 | $0.00 | $0.00 | $4,250.09 |
| G4020 SITE LIGHTING | | | | | | | | | |
| G402003 OTHER AREA LIGHTING | | | | | | | | | |
| G4020039902 | 101.60mm (4") Rigid Steel Conduit | 35.00 | LF | 59.71 | $1,201.00 | $888.68 | $0.00 | $0.00 | $2,089.69 |
| **TOTAL** | | | | | **$12,256** | **$9,602** | **$1,160** | **$0** | **$23,018** |
| **Marked Up Cost:** | | | | | **$433,219** | **$240,801** | **$30,601** | **$0** | **$704,621** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$704,621** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$704,621** |
| | Contingency | 20.00 % | $140,924 |
| | SIOH | 5.70 % | $48,196 |
| | Design | 4.00 % | $28,185 |
| | Other | 0.00 % | $0 |
| **Total Project Cost:** | | | **$921,926** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Jan 2018

Area Cost Factor: 0.82
Escalation Rate: 8.18 %

# MEASURE 20 – MODIFY CHANNEL AROUND K-2 CONFLUENCE

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 18,750.00 | CY | 21.90 | $410,677.72 | $0.00 | $0.00 | $0.00 | $410,677.72 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020224 | 966, 3.06m3 (4 CY), Wheel Loader | 112.00 | HR | 197.65 | $0.00 | $9,067.13 | $13,070.17 | $0.00 | $22,137.30 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 275.00 | HR | 341.08 | $0.00 | $24,940.91 | $68,856.32 | $0.00 | $93,797.23 |
| G1030020288 | 19.88m3 (26 CY), Semi Dump | 448.00 | HR | 143.21 | $0.00 | $29,390.95 | $34,768.03 | $0.00 | $64,158.98 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 15.00 | HR | 353.61 | $0.00 | $1,276.20 | $4,027.88 | $0.00 | $5,304.09 |
| **TOTAL** | | | | | **$410,678** | **$64,675** | **$120,722** | **$0** | **$596,075** |
| **CLEAR AND GRUB** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1010 SITE CLEARING | | | | | | | | | |
| G101001 CLEARING | | | | | | | | | |
| G1010010102 | Medium Brush W/O Grub, Clearing | 4.00 | ACRE | 295.61 | $0.00 | $525.25 | $657.19 | $0.00 | $1,182.44 |
| G1010010111 | Medium, W/O Grub D7LGP, Wet Clearing | 1.00 | ACRE | 1,605.01 | $0.00 | $1,441.49 | $163.52 | $0.00 | $1,605.01 |
| G101002 TREE REMOVAL | | | | | | | | | |
| G1010020211 | Clear Trees To 304.80mm (12") Dia W/D8 Cat | 500.00 | EA | 15.55 | $0.00 | $2,722.25 | $5,054.08 | $0.00 | $7,776.34 |
| G1010020212 | Clear Trees To 609.60mm (24") Dia W/D8 Cat | 50.00 | EA | 23.33 | $0.00 | $408.33 | $758.11 | $0.00 | $1,166.45 |
| G1010020213 | Clear Trees To914.40mm (36") Dia W/D8 Cat | 100.00 | EA | 46.66 | $0.00 | $1,633.33 | $3,032.45 | $0.00 | $4,665.78 |
| G101003 STUMP REMOVAL | | | | | | | | | |
| G1010030311 | > 152.40mm (6") < 304.80mm (12") Stump Removal, W/LGP D7 | 100.00 | EA | 5.98 | $0.00 | $209.40 | $388.77 | $0.00 | $598.17 |
| G1010030315 | > 152.40mm (6") and <= 304.80mm (12") Stump Removal, W/D8 | 400.00 | EA | 5.98 | $0.00 | $837.59 | $1,555.09 | $0.00 | $2,392.69 |
| G101004 GRUBBING | | | | | | | | | |
| G1010040501 | Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 484.00 | CY | 0.97 | $0.00 | $164.68 | $305.77 | $0.00 | $470.45 |
| G1010040510 | Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 80.67 | CY | 0.97 | $0.00 | $27.45 | $50.96 | $0.00 | $78.41 |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 3,451.00 | CY | 21.90 | $75,586.60 | $0.00 | $0.00 | $0.00 | $75,586.60 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 67.00 | HR | 127.89 | $0.00 | $5,424.09 | $3,144.68 | $0.00 | $8,568.76 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 135.00 | HR | 152.74 | $0.00 | $8,856.65 | $11,763.35 | $0.00 | $20,620.00 |
| **TOTAL** | | | | | **$75,587** | **$22,251** | **$26,874** | **$0** | **$124,711** |
| **REROUTE SANITARY SEWER** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 364.88 | CY | 21.90 | $7,991.90 | $0.00 | $0.00 | $0.00 | $7,991.90 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020220 | 910, 0.96m3 (1.25 CY), Wheel Loader | 9.00 | HR | 120.60 | $0.00 | $728.61 | $356.81 | $0.00 | $1,085.42 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 1,761.07 | CY | 2.98 | $0.00 | $3,099.89 | $2,145.88 | $0.00 | $5,245.77 |
| G1030020284 | 6.12m3 (8 CY), Dump Truck | 27.00 | HR | 133.84 | $0.00 | $1,831.82 | $1,781.90 | $0.00 | $3,613.72 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 1,469.16 | CY | 2.37 | $0.00 | $1,333.10 | $2,145.62 | $0.00 | $3,478.71 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 279.24 | CY | 62.64 | $14,882.61 | $1,117.64 | $1,491.27 | $0.00 | $17,491.52 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 1,469.16 | CY | 2.51 | $0.00 | $3,435.36 | $252.98 | $0.00 | $3,688.34 |
| G1030050515 | Compact With Pogosticks | 279.24 | CY | 14.13 | $0.00 | $3,458.41 | $486.82 | $0.00 | $3,945.23 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 6.00 | DAY | 102.66 | $533.08 | $82.87 | $0.00 | $0.00 | $615.95 |
| **TOTAL** | | | | | **$23,408** | **$15,088** | **$8,661** | **$0** | **$47,157** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 3,000.00 | LF | 95.82 | $170,841.93 | $116,603.82 | $0.00 | $0.00 | $287,445.75 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 10.00 | EA | 2,187.78 | $14,363.28 | $6,525.30 | $989.21 | $0.00 | $21,877.79 |
| **TOTAL** | | | | | **$185,205** | **$123,129** | **$989** | **$0** | **$309,324** |

| | | | | | |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$694,877** | **$225,143** | **$157,247** | **$0** | **$1,077,267** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$1,077,267** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$1,077,267** |
| | Contingency | 20.00 % | $215,453 |
| | SIOH | 5.70 % | $73,685 |
| | Design | 6.00 % | $64,636 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easements | | | $325,000 |
| **Total Project Cost:** | | | **$1,756,041** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Jan 2018

Area Cost Factor: 0.82
Escalation Rate: 8.18 %

# MEASURE 21 – MODIFY CHANNEL DOWNSTREAM OF SHOPPING MALL TO BELOW RR CROSSING

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 62,500.00 | CY | 21.98 | $1,373,443.15 | $0.00 | $0.00 | $0.00 | $1,373,443.15 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020226 | 988, 5.35m3 (7 CY), Wheel Loader | 235.00 | HR | 281.42 | $0.00 | $20,059.81 | $46,074.04 | $0.00 | $66,133.85 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 915.00 | HR | 342.21 | $0.00 | $83,259.05 | $229,859.80 | $0.00 | $313,118.85 |
| G1030020289 | 24.47m3 (32 CY), Semi Dump | 1,176.00 | HR | 150.54 | $0.00 | $77,405.83 | $99,626.91 | $0.00 | $177,032.75 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 50.00 | HR | 354.77 | $0.00 | $4,268.04 | $13,470.59 | $0.00 | $17,738.63 |
| **TOTAL** | | | | | **$1,373,443** | **$184,993** | **$389,031** | **$0** | **$1,947,467** |
| **CLEAR AND GRUB** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1010 SITE CLEARING | | | | | | | | | |
| G101001 CLEARING | | | | | | | | | |
| G1010010102 | Medium Brush W/O Grub, Clearing | 10.40 | ACRE | 296.59 | $0.00 | $1,370.16 | $1,714.34 | $0.00 | $3,084.50 |
| G1010010111 | Medium, W/O Grub D7LGP, Wet Clearing | 2.60 | ACRE | 1,610.30 | $0.00 | $3,760.24 | $426.55 | $0.00 | $4,186.79 |
| G101002 TREE REMOVAL | | | | | | | | | |
| G1010020211 | Clear Trees To 304.80mm (12") Dia W/D8 Cat | 1,300.00 | EA | 15.60 | $0.00 | $7,101.22 | $13,183.98 | $0.00 | $20,285.20 |
| G1010020212 | Clear Trees To 609.60mm (24") Dia W/D8 Cat | 260.00 | EA | 23.41 | $0.00 | $2,130.34 | $3,955.19 | $0.00 | $6,085.54 |
| G101003 STUMP REMOVAL | | | | | | | | | |
| G1010030311 | > 152.40mm (6") < 304.80mm (12") Stump Removal, W/LGP D7 | 260.00 | EA | 6.00 | $0.00 | $546.23 | $1,014.15 | $0.00 | $1,560.38 |
| G1010030312 | > 304.80mm (12") < 609.60 (24") Stump Removal, W/LGP D7 | 52.00 | EA | 9.00 | $0.00 | $163.87 | $304.24 | $0.00 | $468.12 |
| G1010030315 | > 152.40mm (6") and <= 304.80mm (12") Stump Removal, W/D8 | 1,040.00 | EA | 6.00 | $0.00 | $2,184.93 | $4,056.59 | $0.00 | $6,241.52 |
| G1010030316 | > 304.80mm (12") and <= 609.60mm (24") Stump Removal, W/D8 | 208.00 | EA | 9.00 | $0.00 | $655.50 | $1,216.98 | $0.00 | $1,872.47 |
| G101004 GRUBBING | | | | | | | | | |
| G1010040501 | Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 1,258.40 | CY | 0.98 | $0.00 | $429.58 | $797.63 | $0.00 | $1,227.21 |
| G1010040510 | Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 209.73 | CY | 0.98 | $0.00 | $71.60 | $132.94 | $0.00 | $204.53 |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 7,217.60 | CY | 21.98 | $158,607.41 | $0.00 | $0.00 | $0.00 | $158,607.41 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020224 | 966, 3.06m3 (4 CY), Wheel Loader | 43.00 | HR | 198.31 | $0.00 | $3,492.62 | $5,034.57 | $0.00 | $8,527.19 |
| G1030020288 | 19.88m3 (26 CY), Semi Dump | 173.00 | HR | 143.68 | $0.00 | $11,387.08 | $13,470.35 | $0.00 | $24,857.44 |
| **TOTAL** | | | | | **$158,607** | **$33,293** | **$45,308** | **$0** | **$237,208** |

## REROUTE SANITARY SEWER

| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 1,313.57 | CY | 21.98 | $28,865.82 | $0.00 | $0.00 | $0.00 | $28,865.82 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020222 | 926, 1.53m3 (2.0 CY), Wheel Loader | 25.00 | HR | 128.31 | $0.00 | $2,030.59 | $1,177.26 | $0.00 | $3,207.85 |
| G1030020259 | Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 6,339.84 | CY | 2.99 | $0.00 | $11,196.41 | $7,750.63 | $0.00 | $18,947.05 |
| G1030020287 | 15.29m3 (20 CY), Semi Dump | 52.00 | HR | 153.24 | $0.00 | $3,422.71 | $4,546.02 | $0.00 | $7,968.73 |
| G103004 FILL & BORROW | | | | | | | | | |
| G1030040401 | 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 5,288.98 | CY | 2.38 | $0.00 | $4,814.99 | $7,749.71 | $0.00 | $12,564.70 |
| G1030040405 | 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 1,005.26 | CY | 62.85 | $53,753.99 | $4,036.78 | $5,386.26 | $0.00 | $63,177.03 |
| G103005 COMPACTION | | | | | | | | | |
| G1030050511 | Compact Soil W/Vibrating Plate | 5,288.98 | CY | 2.52 | $0.00 | $12,408.13 | $913.74 | $0.00 | $13,321.86 |
| G1030050515 | Compact With Pogosticks | 1,005.26 | CY | 14.18 | $0.00 | $12,491.30 | $1,758.33 | $0.00 | $14,249.63 |
| G103010 TEMPORARY DEWATERING | | | | | | | | | |
| G1030101002 | 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 22.00 | DAY | 103.00 | $1,961.06 | $304.86 | $0.00 | $0.00 | $2,265.92 |
| **TOTAL** | | | | | **$84,581** | **$50,706** | **$29,282** | **$0** | **$164,569** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | | |
| G3020010104 | 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 10,800.00 | LF | 96.13 | $617,060.54 | $421,158.99 | $0.00 | $0.00 | $1,038,219.53 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | | |

# Assembly Detail Report



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 36.00 | EA | 2,195.00 | $51,878.44 | $23,568.59 | $3,572.92 | $0.00 | $79,019.96 |
| **TOTAL** | | | | | **$668,939** | **$444,728** | **$3,573** | **$0** | **$1,117,239** |

| | | | | | |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$2,285,570** | **$713,719** | **$467,194** | **$0** | **$3,466,484** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$3,466,484** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$3,466,484** |
| | Contingency | 20.00 % | $693,297 |
| | SIOH | 5.70 % | $237,107 |
| | Design | 6.00 % | $207,989 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easements | | | $1,170,000 |
| **Total Project Cost:** | | | **$5,774,877** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Mar 2018

Area Cost Factor: 0.82
Escalation Rate: 8.54 %

# MEASURE 22 – MODIFY CHANNEL 30' WIDTH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 60,000.00 | CY | 21.98 | $1,318,505.42 | $0.00 | $0.00 | $0.00 | $1,318,505.42 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020226 | 988, 5.35m3 (7 CY), Wheel Loader | 226.00 | HR | 281.42 | $0.00 | $19,291.56 | $44,309.51 | $0.00 | $63,601.07 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 879.00 | HR | 342.21 | $0.00 | $79,983.28 | $220,816.14 | $0.00 | $300,799.42 |
| G1030020289 | 24.47m3 (32 CY), Semi Dump | 1,129.00 | HR | 150.54 | $0.00 | $74,312.23 | $95,645.23 | $0.00 | $169,957.46 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 48.00 | HR | 354.77 | $0.00 | $4,097.32 | $12,931.76 | $0.00 | $17,029.09 |
| **TOTAL** | | | | | **$1,318,505** | **$177,684** | **$373,703** | **$0** | **$1,869,892** |
| **CLEAR AND GRUB** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1010 SITE CLEARING | | | | | | | | | |
| G101001 CLEARING | | | | | | | | | |
| G1010010102 | Medium Brush W/O Grub, Clearing | 4.00 | ACRE | 296.59 | $0.00 | $526.98 | $659.36 | $0.00 | $1,186.35 |
| G1010010111 | Medium, W/O Grub D7LGP, Wet Clearing | 1.00 | ACRE | 1,610.30 | $0.00 | $1,446.25 | $164.06 | $0.00 | $1,610.30 |
| G101002 TREE REMOVAL | | | | | | | | | |
| G1010020211 | Clear Trees To 304.80mm (12") Dia W/D8 Cat | 500.00 | EA | 15.60 | $0.00 | $2,731.24 | $5,070.76 | $0.00 | $7,802.00 |
| G1010020212 | Clear Trees To 609.60mm (24") Dia W/D8 Cat | 50.00 | EA | 23.41 | $0.00 | $409.68 | $760.61 | $0.00 | $1,170.30 |
| G1010020213 | Clear Trees To914.40mm (36") Dia W/D8 Cat | 100.00 | EA | 46.81 | $0.00 | $1,638.72 | $3,042.46 | $0.00 | $4,681.18 |
| G101003 STUMP REMOVAL | | | | | | | | | |
| G1010030311 | > 152.40mm (6") < 304.80mm (12") Stump Removal, W/LGP D7 | 100.00 | EA | 6.00 | $0.00 | $210.09 | $390.06 | $0.00 | $600.15 |
| G1010030315 | > 152.40mm (6") and <= 304.80mm (12") Stump Removal, W/D8 | 400.00 | EA | 6.00 | $0.00 | $840.36 | $1,560.23 | $0.00 | $2,400.58 |
| G101004 GRUBBING | | | | | | | | | |
| G1010040501 | Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 484.00 | CY | 0.98 | $0.00 | $165.22 | $306.78 | $0.00 | $472.00 |
| G1010040510 | Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 80.67 | CY | 0.98 | $0.00 | $27.54 | $51.13 | $0.00 | $78.67 |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| G102007 SITE CLEANUP | | | | | | | | |
| G1020070401 Dump Charge | 3,451.00 | CY | 21.98 | $75,836.04 | $0.00 | $0.00 | $0.00 | $75,836.04 |
| G1030 SITE EARTHWORK | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | |
| G1030020222 926, 1.53m3 (2.0 CY), Wheel Loader | 67.00 | HR | 128.31 | $0.00 | $5,441.99 | $3,155.05 | $0.00 | $8,597.04 |
| G1030020287 15.29m3 (20 CY), Semi Dump | 135.00 | HR | 153.24 | $0.00 | $8,885.87 | $11,802.17 | $0.00 | $20,688.04 |
| **TOTAL** | | | | **$75,836** | **$22,324** | **$26,963** | **$0** | **$125,123** |
| **REROUTE SANITARY SEWER** | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | |
| G1020070401 Dump Charge | 1,263.46 | CY | 21.98 | $27,764.65 | $0.00 | $0.00 | $0.00 | $27,764.65 |
| G1030 SITE EARTHWORK | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | |
| G1030020222 926, 1.53m3 (2.0 CY), Wheel Loader | 24.00 | HR | 128.31 | $0.00 | $1,949.37 | $1,130.17 | $0.00 | $3,079.54 |
| G1030020259 Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 6,097.99 | CY | 2.99 | $0.00 | $10,769.29 | $7,454.97 | $0.00 | $18,224.26 |
| G1030020287 15.29m3 (20 CY), Semi Dump | 50.00 | HR | 153.24 | $0.00 | $3,291.06 | $4,371.17 | $0.00 | $7,662.24 |
| G103004 FILL & BORROW | | | | | | | | |
| G1030040401 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 5,087.22 | CY | 2.38 | $0.00 | $4,631.31 | $7,454.08 | $0.00 | $12,085.39 |
| G1030040405 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 966.92 | CY | 62.85 | $51,703.84 | $3,882.82 | $5,180.83 | $0.00 | $60,767.49 |
| G103005 COMPACTION | | | | | | | | |
| G1030050511 Compact Soil W/Vibrating Plate | 5,087.22 | CY | 2.52 | $0.00 | $11,934.79 | $878.88 | $0.00 | $12,813.67 |
| G1030050515 Compact With Pogosticks | 966.92 | CY | 14.18 | $0.00 | $12,014.89 | $1,691.27 | $0.00 | $13,706.16 |
| G103010 TEMPORARY DEWATERING | | | | | | | | |
| G1030101002 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 21.00 | DAY | 103.00 | $1,871.92 | $291.00 | $0.00 | $0.00 | $2,162.92 |
| **TOTAL** | | | | **$81,340** | **$48,765** | **$28,161** | **$0** | **$158,266** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | |
| G3020010104 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 10,388.00 | LF | 96.13 | $593,520.82 | $405,092.55 | $0.00 | $0.00 | $998,613.37 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 35.00 | EA | 2,195.00 | $50,437.37 | $22,913.91 | $3,473.67 | $0.00 | $76,824.96 |
| **TOTAL** | | | | | **$643,958** | **$428,006** | **$3,474** | **$0** | **$1,075,438** |

| | | | | | |
|---|---|---|---|---|---|
| **Marked Up Cost:** | **$2,119,640** | **$676,779** | **$432,300** | **$0** | **$3,228,720** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$3,228,720** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$3,228,720** |
| | Contingency | 20.00 % | $645,744 |
| | SIOH | 5.70 % | $220,844 |
| | Design | 6.00 % | $193,723 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easements | | | $1,129,375 |
| **Total Project Cost:** | | | **$5,418,406** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Mar 2018

Area Cost Factor: 0.82
Escalation Rate: 8.54 %

2014 CB
1.2.0

# MEASURE 23 – MODIFY CHANNEL 85’ WIDTH

# Assembly Detail Report



| ASSEMBLY | | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|---|
| **PRIMARY FACILITIES** | | | | | | | | | |
| **EXCAVATION, CUT AND FILL** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | | |
| G1020070401 | Dump Charge | 137,500.00 | CY | 22.01 | $3,026,808.54 | $0.00 | $0.00 | $0.00 | $3,026,808.54 |
| G1030 SITE EARTHWORK | | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | | |
| G1030020226 | 988, 5.35m3 (7 CY), Wheel Loader | 517.00 | HR | 281.91 | $0.00 | $44,208.02 | $101,538.46 | $0.00 | $145,746.49 |
| G1030020234 | Crawler Mounted, 3.06m3 (4 CY), Koehring 1166 Hyd Excavator | 2,013.00 | HR | 342.80 | $0.00 | $183,487.17 | $506,567.46 | $0.00 | $690,054.64 |
| G1030020289 | 24.47m3 (32 CY), Semi Dump | 2,587.00 | HR | 150.80 | $0.00 | $170,574.60 | $219,541.88 | $0.00 | $390,116.48 |
| G103003 ROCK EXCAVATION | | | | | | | | | |
| G1030030312 | D10 W/U Blade & Single Shank Ripper, Bulldozer | 110.00 | HR | 355.39 | $0.00 | $9,405.96 | $29,686.62 | $0.00 | $39,092.59 |
| **TOTAL** | | | | | **$3,026,809** | **$407,676** | **$857,334** | **$0** | **$4,291,819** |
| **CLEAR AND GRUB** | | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | | |
| G1010 SITE CLEARING | | | | | | | | | |
| G101001 CLEARING | | | | | | | | | |
| G1010010102 | Medium Brush W/O Grub, Clearing | 4.00 | ACRE | 297.10 | $0.00 | $527.90 | $660.50 | $0.00 | $1,188.40 |
| G1010010111 | Medium, W/O Grub D7LGP, Wet Clearing | 1.00 | ACRE | 1,613.09 | $0.00 | $1,448.75 | $164.34 | $0.00 | $1,613.09 |
| G101002 TREE REMOVAL | | | | | | | | | |
| G1010020211 | Clear Trees To 304.80mm (12") Dia W/D8 Cat | 500.00 | EA | 15.63 | $0.00 | $2,735.97 | $5,079.54 | $0.00 | $7,815.51 |
| G1010020212 | Clear Trees To 609.60mm (24") Dia W/D8 Cat | 50.00 | EA | 23.45 | $0.00 | $410.39 | $761.93 | $0.00 | $1,172.32 |
| G1010020213 | Clear Trees To914.40mm (36") Dia W/D8 Cat | 100.00 | EA | 46.89 | $0.00 | $1,641.56 | $3,047.73 | $0.00 | $4,689.29 |
| G101003 STUMP REMOVAL | | | | | | | | | |
| G1010030311 | > 152.40mm (6") < 304.80mm (12") Stump Removal, W/LGP D7 | 100.00 | EA | 6.01 | $0.00 | $210.45 | $390.73 | $0.00 | $601.19 |
| G1010030315 | > 152.40mm (6") and <= 304.80mm (12") Stump Removal, W/D8 | 400.00 | EA | 6.01 | $0.00 | $841.81 | $1,562.93 | $0.00 | $2,404.74 |
| G101004 GRUBBING | | | | | | | | | |
| G1010040501 | Dozer 78.33 kW (105 HP) D5, Grubbing & Stacking | 484.00 | CY | 0.98 | $0.00 | $165.51 | $307.31 | $0.00 | $472.82 |
| G1010040510 | Dozer 78.33 kW (105 HP) D5 LGP, Wet Grubbing & Stacking | 80.67 | CY | 0.98 | $0.00 | $27.59 | $51.22 | $0.00 | $78.81 |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

| ASSEMBLY | Quantity | UOM | Unit Cost | Material | Labor | Equip | Sub Bid | Total |
|---|---|---|---|---|---|---|---|---|
| G102007 SITE CLEANUP | | | | | | | | |
| G1020070401 Dump Charge | 3,451.00 | CY | 22.01 | $75,967.39 | $0.00 | $0.00 | $0.00 | $75,967.39 |
| G1030 SITE EARTHWORK | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | |
| G1030020222 926, 1.53m3 (2.0 CY), Wheel Loader | 67.00 | HR | 128.54 | $0.00 | $5,451.41 | $3,160.52 | $0.00 | $8,611.93 |
| G1030020287 15.29m3 (20 CY), Semi Dump | 135.00 | HR | 153.51 | $0.00 | $8,901.26 | $11,822.61 | $0.00 | $20,723.88 |
| **TOTAL** | | | | **$75,967** | **$22,363** | **$27,009** | **$0** | **$125,339** |
| **REROUTE SANITARY SEWER** | | | | | | | | |
| **G BUILDING SITEWORK** | | | | | | | | |
| **G10 SITE PREPARATIONS** | | | | | | | | |
| G1020 SITE DEMOLITION & RELOCATIONS | | | | | | | | |
| G102007 SITE CLEANUP | | | | | | | | |
| G1020070401 Dump Charge | 1,418.90 | CY | 22.01 | $31,234.46 | $0.00 | $0.00 | $0.00 | $31,234.46 |
| G1030 SITE EARTHWORK | | | | | | | | |
| G103002 COMMON EXCAVATION | | | | | | | | |
| G1030020222 926, 1.53m3 (2.0 CY), Wheel Loader | 27.00 | HR | 128.54 | $0.00 | $2,196.84 | $1,273.64 | $0.00 | $3,470.48 |
| G1030020259 Cat 225, 1.15m3 (1.5 CY), Soil/Sand, Trenching | 6,848.20 | CY | 2.99 | $0.00 | $12,115.14 | $8,386.62 | $0.00 | $20,501.76 |
| G1030020287 15.29m3 (20 CY), Semi Dump | 56.00 | HR | 153.51 | $0.00 | $3,692.38 | $4,904.19 | $0.00 | $8,596.57 |
| G103004 FILL & BORROW | | | | | | | | |
| G1030040401 950, 2.29m3 (3 CY), Backfill W/Excavated Material | 5,713.08 | CY | 2.38 | $0.00 | $5,210.09 | $8,385.63 | $0.00 | $13,595.72 |
| G1030040405 950, 2.29m3 (3 CY), Delivered & Dumped, Backfill W/Sand | 1,085.87 | CY | 62.96 | $58,164.99 | $4,368.03 | $5,828.25 | $0.00 | $68,361.28 |
| G103005 COMPACTION | | | | | | | | |
| G1030050511 Compact Soil W/Vibrating Plate | 5,713.08 | CY | 2.52 | $0.00 | $13,426.29 | $988.72 | $0.00 | $14,415.01 |
| G1030050515 Compact With Pogosticks | 1,085.87 | CY | 14.20 | $0.00 | $13,516.32 | $1,902.62 | $0.00 | $15,418.94 |
| G103010 TEMPORARY DEWATERING | | | | | | | | |
| G1030101002 50.80mm (2") Dia Contractor's Trash Pump, 283.91 L/min (75 GPM) | 24.00 | DAY | 103.17 | $2,143.04 | $333.15 | $0.00 | $0.00 | $2,476.19 |
| **TOTAL** | | | | **$91,542** | **$54,858** | **$31,670** | **$0** | **$178,070** |
| **G30 SITE CIVIL/MECHANICAL UTILITIES** | | | | | | | | |
| G3020 SANITARY SEWER | | | | | | | | |
| G302001 SANITARY SEWER PIPING | | | | | | | | |
| G3020010104 203.20mm (8"), CL 50, B&S Sanitary Sewer, Cast Iron Pipe | 11,666.00 | LF | 96.30 | $667,694.15 | $455,717.67 | $0.00 | $0.00 | $1,123,411.83 |
| G302002 SANITARY SEWER MANHOLES & CLEANOUTS | | | | | | | | |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G3020020201 | Precast, CIP Base, 1.22m Dia, 1.83m Deep (4' Dia, 6' Deep), Manhole | 39.00 | EA | 2,198.80 | $56,298.99 | $25,576.87 | $3,877.37 | $0.00 | $85,753.23 |
| **TOTAL** | | | | | **$723,993** | **$481,295** | **$3,877** | **$0** | **$1,209,165** |

| **Marked Up Cost:** | **$3,918,312** | **$966,191** | **$919,891** | **$0** | **$5,804,394** |
|---|---|---|---|---|---|

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$5,804,394** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$5,804,394** |
| | Contingency | 20.00 % | $1,160,879 |
| | SIOH | 5.70 % | $397,021 |
| | Design | 6.00 % | $348,264 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Construction Easements | | | $1,267,500 |
| **Total Project Cost:** | | | **$8,978,056** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Apr 2018

Area Cost Factor: 0.82
Escalation Rate: 8.73 %

# MEASURES 24, 25 & 26 – ACQUISITION OF STRUCTURES

# Assembly Detail Report



## PRIMARY FACILITIES

### DEMOLITION

**G BUILDING SITEWORK**

**G10 SITE PREPARATIONS**

G1020 SITE DEMOLITION & RELOCATIONS

G102001 BUILDING MASS DEMOLITION

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G1020010103 | Multi-Level, Masonry, Non-Explosive, Bldg Demolition | 45,000.00 | CF | 0.31 | $0.00 | $8,036.79 | $5,763.06 | $0.00 | $13,799.84 |
| **TOTAL** | | | | | **$0** | **$8,037** | **$5,763** | **$0** | **$13,800** |
| | **Marked Up Cost:** | | | | **$0** | **$8,037** | **$5,763** | **$0** | **$13,800** |

Note: All Costs Include ACF, Markups and Escalation

# Assembly Detail Report



| | | | |
|---|---|---|---|
| **Facilities Marked Up Cost:** | | | **$13,800** |
| Pavement: | | | |
| Site Improvements: | | | |
| Utilities: | | | |
| **Estimated Contract Cost:** | | | **$13,800** |
| | Contingency | 5.00 % | $690 |
| | SIOH | 5.70 % | $826 |
| | Design | 4.00 % | $552 |
| | Other | 0.00 % | $0 |
| Project Lump Sum(s): | | | |
| Real Estate Cost | | | $234,132 |
| **Total Project Cost:** | | | **$250,000** |

Note: All Costs Include ACF, Markups and Escalation



Project Location: Columbia, South Carolina
Project Midpoint: Oct 2017

Area Cost Factor: 0.82
Escalation Rate: 5.54 %

# MEASURES 27 & 28 – ELEVATING STRUCTURES

Lexington County Elevate Structure
This estimate is to elevate the standard structure for Lexington County.

| | |
|---|---|
| Estimated by | |
| Designed by | |
| Prepared by | Jeffery Fersner |
| Preparation Date | 7/10/2015 |
| Effective Date of Pricing | 7/10/2015 |
| Estimated Construction Time | 60 Days |

| Description | Quantity | UOM | DirectLabor | DirectEQ | DirectMatl | DirectSubBid | SubCMU | PrimeCMU | ProjectCost |
|---|---|---|---|---|---|---|---|---|---|
| **Project Owner Summary** | | | **32,810.57** | **1,604.72** | **37,144.20** | **17,400.00** | **201.02** | **23,422.77** | **112,583.28** |
| **Elevate structure** | **1.00** | **EA** | **32,810.57** | **1,604.72** | **37,144.20** | **0.00** | **201.02** | **23,422.77** | **95,183.28** |
| **Excavation** | **1.00** | **EA** | **1,009.09** | **203.19** | **0.00** | **0.00** | **0.00** | **395.69** | **1,607.98** |
| Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering | 175.00 | BCY | 279.98 | 203.19 | 0.00 | 0.00 | 0.00 | 157.71 | 640.88 |
| Excavating, trench or continuous footing, common earth, by hand with pick and shovel, 2' to 6' deep, light soil, excludes sheeting or dewatering | 50.00 | BCY | 729.12 | 0.00 | 0.00 | 0.00 | 0.00 | 237.98 | 967.10 |
| **Install beams** | **1.00** | **EA** | **1,046.15** | **558.04** | **6,000.00** | **0.00** | **0.00** | **2,482.02** | **10,086.22** |
| Structural steel member, beam, 10-ton project, W8x10, A992 steel, shop fabricated, incl shop primer, bolted connections | 400.00 | LF | 1,046.15 | 558.04 | 6,000.00 | 0.00 | 0.00 | 2,482.02 | 10,086.22 |
| **Hydraulic jacks** | **1.00** | **EA** | **24,617.75** | **701.54** | **0.00** | **0.00** | **0.00** | **8,264.27** | **33,583.56** |
| Lifting equipment, hydraulic lifts, 20,000 lbs. used to elevate structure | 8.00 | EA | 24,617.75 | 701.54 | 0.00 | 0.00 | 0.00 | 8,264.27 | 33,583.56 |
| **Foundation** | **1.00** | **EA** | **5,860.82** | **93.65** | **30,400.00** | **0.00** | **0.00** | **11,866.17** | **48,220.65** |
| Structural concrete, in place, pile cap (3000 psi), square or rectangular, over 10 C.Y., includes forms(4 uses), reinforcing steel, concrete, placing and finishing | 200.00 | CY | 5,860.82 | 93.65 | 30,400.00 | 0.00 | 0.00 | 11,866.17 | 48,220.65 |
| **Connect electric** | **1.00** | **EA** | **166.46** | **0.00** | **323.20** | **0.00** | **92.06** | **189.87** | **771.59** |
| Rigid galvanized steel conduit, 2" diameter, to 15' H, incl 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF | 20.00 | LF | 118.13 | 0.00 | 175.00 | 0.00 | 55.11 | 113.67 | 461.91 |
| Wire, copper, stranded, 600 volt, 1/0, type THW, in raceway | 0.60 | CLF | 48.33 | 0.00 | 148.20 | 0.00 | 36.95 | 76.21 | 309.68 |
| **Connect water/sewer** | **1.00** | **EA** | **110.29** | **48.30** | **421.00** | **0.00** | **108.96** | **224.75** | **913.30** |
| Public Sanitary Utility Sewerage Piping, piping DWV PVC, Sch 40, 10' length, 6" diameter, excludes excavation or backfill | 20.00 | LF | 25.12 | 0.00 | 169.00 | 0.00 | 36.50 | 75.27 | 305.89 |
| Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, no fittings, 18' lengths, 4" diameter, class 50, excludes excavation or backfill | 20.00 | LF | 85.17 | 48.30 | 252.00 | 0.00 | 72.47 | 149.47 | 607.40 |
| **Temporary Quarters/Per diem** | **1.00** | **EA** | **0.00** | **0.00** | **0.00** | **17,400.00** | **0.00** | **0.00** | **17,400.00** |
| **(Note: Assume average family of 2 to be in temporary quarters for 60 days.)** | | | | | | | | | |
| Personnell, per diem for Lexington County | 120.00 | DAY | 0.00 | 0.00 | 0.00 | 17,400.00 | 0.00 | 0.00 | 17,400.00 |

Currency in US dollars

# Appendix H:  Environmental Documentation

Jurisdictional Determination Request for Identifying Waters of the U.S., Including Wetlands and Tributaries

U.S. Army Corps of Engineers – Charleston District - Regulatory Division

# JURISDICTIONAL DETERMINATION REQUEST

**For Identifying Waters of the U.S., Including Wetlands and Tributaries**

**Project Name & Location Address**:______________________________________________

**County**:________________________ **Total Acreage of Tract**:______________ **Date**:______________

| **Property Owner :**___________________________ | **Agent:**____________________________________ |
|---|---|
| Address:____________________________________ | Address:____________________________________ |
| Address:____________________________________ | Address:____________________________________ |
| Phone:______________________________________ | Phone:______________________________________ |
| Email:______________________________________ | Email:______________________________________ |

**1) Select the Type of Request**:

☐ I am requesting that the Corps investigate the above property for the presence or absence of wetlands, tributaries, or other Waters of the U.S., and establish the limits of these areas. *Please note that while the Corps offers wetland delineation services, time frames to fulfill requests are dependent on property size, property conditions, workload priorities, and staffing levels. To expedite the wetland delineation process, property owners are encouraged to hire an environmental consultant*. The first two following items must accompany your request:

- Accurate location maps (from County Map, USGS Quad Sheet, etc.), street address and directions to property from a nearby major intersection.
- Copy of Survey Plat or Tax Map of Property.
- Additional information such as soil survey sheet, aerial photograph, topographic survey, conceptual site plan, description of the proposed use of property, status of project, etc, may also be provided but are not required.

☐ I am submitting a wetland delineation for review and verification by the Corps. Please refer to page 2 for the “Information Required in a Wetland Delineation Submittal.”

**2) Select the Type of Jurisdictional Determination Requested:**

☐ Accurate-Approved ☐ Approximate-Approved ☐ Accurate-Preliminary ☐ Approximate-Preliminary

Refer to the below definitions:

Preliminary – Preliminary determinations will identify whether wetlands or other waters are present on the site and will presume that they are jurisdictional; therefore, a Preliminary can often be completed more quickly than an Approved jurisdictional determination.

Approved – Approved determinations will identify whether wetlands or other waters are present on the site and will include a determination of their jurisdictional status.

Accurate: Verified location and extent of all Waters of the U.S. must be surveyed by a registered land surveyor. Project boundary must be surveyed or represented by a tax map (or by GPS points if no Waters of the U.S. are present).

Approximate: Verified location and extent of all Waters of the U.S. are depicted approximately on a sketch. Project boundary may be surveyed or represented by a tax map or GPS coordinates.

**IMPORTANT NOTE: Legible printed name and signature required. The person signing this form must be the present property owner or have the specific authority of the property owner to authorize Corps of Engineers employees or their agents to enter onto the property for on-site investigations if such is deemed necessary. Do not sign this form unless you are the owner, or have the specific authority of the property owner.**

**PRINTED NAME of person signing this form, below:**_______________________________________

**Signature of Property Owner or Authorized Agent:**_______________________________________

HQ and South Branch
69-A Hagood Avenue
Charleston, SC 29403
843-329-8044

Northeast Branch
1949 Industrial Park Rd, Room 140
Conway, SC 29526
843-365-4239

Northwest Branch
1835 Assembly St., Room 865-B1
Columbia, SC 29201
803-253-3444



Copies of this form may be obtained at: http://www.sac.usace.army.mil

Form Last Revised: June 2013

# U.S. Army Corps of Engineers
# Charleston District - Regulatory Division
## Information Required In A Wetland Delineation Submittal

**This document provides a list of detailed information that is required for all delineations of aquatic resources and upland determinations that are submitted to the Corps for approval. Items 1-3 are required for ALL submittals. Item 4 is required for Approximate depictions of aquatic resources. Item 5 is required for Accurate depictions of aquatic resources. Item 6 is required for upland depictions (no wetlands or waters of the U.S. present).**

☐ **1. Jurisdictional Determination (JD) Request Form - Current version from Charleston District website**

- ☐ The form must be completed fully and the person signing the form must be the legal and current property owner or have the specific authority of the property owner to authorize Corps of Engineers employees or their agents to inspect the property.
- ☐ **The legal and current property owner contact information must be listed on the form.**
- ☐ Indicate the type of JD requested.

☐ **2. Wetland Determination Data Forms - Current version from appropriate Regional Supplement**

- ☐ Appropriate data forms must be used and completed fully.
- ☐ A minimum of one data point (one completed data form) is required for properties containing no wetlands. Additional data points should be taken on larger sites and in any upland areas that appear to be wetlands based on aerial photos, NWI maps, etc.
- ☐ Data points must be located such that there is a pair of points at multiple locations for each wetland type, on both sides of the wetland line in positions that illustrate the distinction between wetland and non-wetland.
- ☐ Sufficient number/location of data points should be taken to represent the wetland/upland status of the entire investigation area.
- ☐ Description of the local site conditions at the time of the field inspection (e.g. temperature, weather, local rainfall data compared to NRCS WETS tables (use additional narrative within the submittal if necessary)).

☐ **3. Maps, Wetland/Upland Sketches and Photos**

- ☐ Location Maps: large-scale and small-scale maps, including streets, intersections, cities and an accurate depiction of the project boundary.
- ☐ Overlay project boundary on
  - Aerial photo
  - USGS topographic map
  - Soil Survey map
  - National Wetlands Inventory map
- ☐ Landscape photos of representative upland areas and aquatic resources. Display photo location and direction on wetland/upland sketch.
- ☐ Maps, aerials and narrative describing connections to downstream waters (not required for "Preliminary JD"). The description of the connection to downstream waters may include simply an identification of a potential flow path. A determination of the type of connection, such as RPW, is not necessary.
- ☐ Sketch of all aquatic resources and pertinent features that are present (Wetlands, Tributaries, Lakes, Borrow Pits, Ponds, Rivers, Drainage Features, Ditches) preferably on an aerial photo using no-fill polygons.
  - Data point locations with labels
  - Photo locations and directions

☐ **4. Required Elements of an Approximate Depiction of Aquatic Resources (Non-Surveyed Depiction)**

- ☐ Title Block with project name, applicant, county, state, date
- ☐ Solid bold line depicting project area boundary clearly labeled
- ☐ North arrow
- ☐ Clearly marked boundaries of all aquatic resources and other pertinent features that are present (Wetlands, Tributaries, Lakes, Borrow Pits, Ponds, Rivers, Drainage Features, Ditches). Non-jurisdictional linear features or ditches are not required to be included on the approximate depiction but must be shown on a supplemental sketch.
- ☐ Label all aquatic resources.
  - Refer to the *Jurisdictional Status Label Table* on page 4 for a list of standardized labels that should be used.
  - Include size (acres) and length (linear feet) of each aquatic resource on the approximate depiction.
  - A table displaying the above information may be provided on the approximate depiction

## 5. Required Elements of an Accurate Depiction of Aquatic Resources (Survey Plat)

- ☐ Title Block with project name, applicant, county and state
- ☐ Vicinity map
- ☐ Labeled names of significant adjacent and/or internal roads, water bodies or other unique reference features
- ☐ North arrow / compass rose
- ☐ Distance scale
- ☐ Preparation date, <u>revision dates</u> and original signature and the raised-seal stamp of a <u>SC-Registered Land Surveyor</u>
- ☐ SCDHEC-OCRM signature approving critical line boundaries and acreage (if applicable).
    - o Please note that the Mean High Water line should be identified and labeled in addition to the critical line.
- ☐ Solid bold line depicting project area boundary clearly labeled
- ☐ Surveyed boundaries of all Jurisdictional Wetlands and Non-Jurisdictional Wetlands
- ☐ Non-Jurisdictional Borrow Pits/Ponds do not have to be surveyed but <u>must</u> be shown on the survey plat. (The survey plat can include a note that these features are depicted "Not to Scale")
- ☐ Non-jurisdictional linear features or ditches are not required to be included on the survey plat but <u>must</u> be shown on a supplemental sketch.
- ☐ Tributaries should be delineated and displayed on the survey plat. In circumstances when a portion of a tributary is located within wetlands and is no longer distinct from the wetland, then that portion of the tributary need not be surveyed but the approximate location should be displayed on the survey plat.
- ☐ "Floating" polygons must be tied to a referenced survey point
- ☐ Survey data table, listing prominent labeled polygon point locations, expressed in *Metes & Bounds* or *State-Plane coordinates*
- ☐ Label all aquatic resources.
    - o <u>Refer to the *Jurisdictional Status Label Table* on page 4 for a list of standardized labels that should be used.</u>
    - o Include size (acres) and length (linear feet) of each aquatic resource on the survey plat.
    - o A table displaying the above information may be provided on the survey plat.

## 6. Required Elements for Upland Depictions (No Wetlands or Waters Present)- 3 Options Available

☐ <u>Option 1: Survey Plat- Survey Plats may be provided for any Upland Depictions</u>

- ☐ Title Block with project name, applicant, county and state
- ☐ Vicinity map
- ☐ Labeled names of significant adjacent and/or internal roads, water bodies or other unique reference features
- ☐ North arrow / compass rose
- ☐ Distance scale
- ☐ Preparation date, <u>revision dates</u> and original signature and the raised-seal stamp of a <u>SC-Registered Land Surveyor</u>
- ☐ Solid bold line depicting project area boundary clearly labeled
- ☐ Uplands label, including acreage
- ☐ Survey data table, listing prominent labeled polygon point locations, expressed in *Metes & Bounds* or *State-Plane coordinates*
- ☐ Non-Jurisdictional Borrow Pits/Ponds do not have to be surveyed but must be shown on the survey plat and properly labeled. (The survey plat can include a note that these features are depicted "Not to Scale") <u>Refer to the *Jurisdictional Status Label Table* on page 4 for a list of standardized labels that should be used.</u>
- ☐ Non-Jurisdictional Linear Features or Ditches are not required to be included on the survey plat but must be shown on a supplement sketch.

☐ <u>Option 2: Tax Maps- Valid Tax Maps from County websites may be provided for Upland Depictions if the subject review area includes the entire parcel</u>

- ☐ Title Block with project name, applicant, county, state, source of tax map, date of preparation (print date)
- ☐ Tax Map Parcel Numbers, Property Identification Numbers, etc., must be shown on the Tax Map
- ☐ Acreage of the parcel must be included
- ☐ Non-Jurisdictional Borrow Pits/Ponds must be shown on the Tax Map and properly labeled. <u>Refer to the *Jurisdictional Status Label Table* on page 4 for a list of standardized labels that should be used.</u>
- ☐ Non-Jurisdictional Linear Features or Ditches are not required to be included on the Tax Map but must be shown on a supplemental sketch.

☐ <u>Option 3: GPS Coordinates- GPS coordinates may be provided for Upland Depictions when it is for a portion of a larger parcel</u>

- ☐ Title Block with project name, applicant, county, state, date of preparation
- ☐ Solid bold line depicting the project area boundary with the points (corners) marked on depiction
- ☐ GPS coordinates of the points (corners) of the project area boundary provided on the sketch (at corner points or listed in a table).
- ☐ Acreage of project area
- ☐ Solid bold line (different color or line type) depicting the boundaries of the larger parcel.
- ☐ Non-Jurisdictional Borrow Pits/Ponds must be shown and labeled. <u>Refer to the *Jurisdictional Status Label Table* on page 4 for a list of standardized labels that should be used.</u>
- ☐ Non-Jurisdictional Linear Features or Ditches are not required to be included on the GPS Upland Depiction, but must be shown on a supplemental sketch.

**<u>Note:</u> Prior to site verification, all aquatic resource boundaries, data point locations, and property corners must be marked for field inspection. Incomplete submittals may cause a delay in the verification process. Additional information not required above may be included with the submittal.**

# Jurisdictional Status Label Table

| Label[1] | Description |
|---|---|
| **Jurisdictional Features** | |
| TNW x[2] | Traditionally Navigable Water |
| TNW Tidal Ditch x | Tidally-influenced ditches (below MHW line) |
| Jurisdictional pRPW Tributary x | Jurisdictional perennial Relatively Permanent Water |
| Jurisdictional sRPW Tributary x | Jurisdictional seasonal Relatively Permanent Water |
| Jurisdictional non-RPW Tributary x | Jurisdictional non-Relatively Permanent Water |
| Jurisdictional Ditch x[3] | Jurisdictional Ditch[3] |
| Jurisdictional Wetland x | Meeting 3-parameters per 1987 Delineation Manual |
| Jurisdictional Lake x | |
| Jurisdictional Impoundment of WOUS x | Jurisdictional Impoundment of waters of the U.S. |
| Jurisdictional Pond x | |
| **Non-jurisdictional Features** | |
| Non-jurisdictional non-RPW Tributary x | Non-jurisdictional non-Relatively Permanent Water |
| Non-jurisdictional wetland x | |
| Non-jurisdictional isolated wetland x | |
| Non-jurisdictional ditch x | |
| Non-jurisdictional linear conveyance x | |
| Non-jurisdictional Borrow Pit x | |
| Non-jurisdictional manmade Lake x | |
| Non-jurisdictional upland excavated Pond x | |
| Non-jurisdictional Impoundment x | |
| Upland | |

1 = Suggested labels typically required for jurisdictional and non-jurisdictional features on depictions that support jurisdictional determinations. Note that for some features more than one label may be acceptable (i.e., a tidal marsh wetland might be labeled "Jurisdictional Wetland x" or "TNW x"). The intent is to suggest labels that are consistent with current guidance and thus minimize the need to edit plat labels later in the process. Ultimately, determination of the jurisdictional status of aquatic resources is the responsibility of the Corps of Engineers and a plat should not be considered final until the Corps of Engineers has approved all labels regarding jurisdictional status. Additional labels may be added to this list in subsequent revisions of this form.

2 = Each feature label must include a unique alpha-numeric label so that multiple features of a given type can be distinguished (i.e., Jurisdictional Wetland 1, Jurisdictional Wetland 2, etc.). Exception: Upland areas should be labeled "Upland" with no additional label data.

3 = Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water are generally not waters of the United States because they are not tributaries or they do not have a significant nexus to downstream traditional navigable waters. Consistent with current Rapanos Guidance, the category "jurisdictional ditch" should be reserved for those non-tributary linear conveyance features which are manmade and that do carry a relatively permanent flow of water. The most common examples include ditches excavated between and connecting two or more wetlands or waters of the United States. The Corps of Engineers will evaluate these features on a case-by-case basis.

Joint Federal and State Application From for Activities Affection Waters of the United States or Critical Areas of the State of South Carolina

| **Joint Federal and State Application Form**<br>**For Activities Affecting Waters of the United States**<br>**Or Critical Areas of the State of South Carolina** | **This Space for Official Use Only**<br>Application No.________________________________<br>Date Received________________________________<br>Project Manager______________________________<br>Watershed # ________________________________ |
|---|---|

*Authorities:* 33 USC 401, 33 USC 403, 33 USC 407, 33 USC 408, 33 USC 1341, 33 USC 1344, 33 USC 1413 and Section 48-39-10 et. Seq of the South Carolina Code of Laws. These laws require permits for activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. The Corps of Engineers and the State of South Carolina have established a joint application process for activities requiring both Federal and State review or approval. Under this joint process, you may use this form, together with the required drawings and supporting information, to apply for both the Federal and/or State permit(s).

*Drawings and Supplemental Information Requirements:* In addition to the information on this form, you must submit a set of drawings and, in some cases, additional information. A completed application form together with all required drawings and supplemental information is required before an application can be considered complete. See the attached instruction sheets for details regarding these requirements. You may attach additional sheets if necessary to provide complete information.

| | | | |
|---|---|---|---|
| 1. Applicant Last Name: | | 11. Agent Last Name (agent is not required): | |
| 2. Applicant First Name: | | 12. Agent First Name: | |
| 3. Applicant Company Name: | | 13. Agent Company Name: | |
| 4. Applicant Mailing Address: | | 14. Agent Mailing Address: | |
| 5. Applicant City: | | 15. Agent City: | |
| 6. Applicant State: | 7. Applicant Zip: | 16. Agent State: | 17. Agent Zip: |
| 8. Applicant Area Code and Phone No.: | | 18. Agent Area Code and Phone No.: | |
| 9. Applicant Fax No.: | | 19. Agent Fax No.: | |
| 10. Applicant E-mail: | | 20. Agent E-mail: | |

| | | | |
|---|---|---|---|
| 21. Project Name: | | 22. Project Street Address: | |
| 23. Project City: | 24. Project County: | 25. Project Zip Code: | 26. Nearest Waterbody: |
| 27. Tax Parcel ID: | | 28. Property Size (acres): | |
| 29. Latitude: | | 30. Longitude: | |

31. Directions to Project Site (Include Street Numbers, Street Names, and Landmarks and attach additional sheet if necessary):

32. Description of the Overall Project and of Each Activity in or Affecting U.S. Waters or State Critical Areas (attach additional sheets if needed)

33. Overall Project Purpose and the Basic Purpose of Each Activity In or Affecting U.S. Waters (attach additional sheets if needed):

34. Type and quantity of Materials to Be Discharged

| | | |
|---|---|---|
| Dirt or Topsoil: | _________ | ☐cubic yards |
| Clean Sand: | _________ | ☐cubic yards |
| Mud: | _________ | ☐cubic yards |
| Clay: | _________ | ☐cubic yards |
| Gravel, Rock, or Stone: | _________ | ☐cubic yards |
| Concrete: | _________ | ☐cubic yards |
| Other (describe): | _________ | ☐cubic yards |
| TOTAL: | _________ | cubic yards |

35. Type and Quantity of Impacts to U.S. Waters (including wetlands).

| | | | | | |
|---|---|---|---|---|---|
| Filling: | ___________ | ☐acres | ☐ sq.ft. | _________ | ☐cubic yards |
| Backfill & Bedding: | ___________ | ☐acres | ☐ sq.ft | _________ | ☐cubic yards |
| Landclearing: | ___________ | ☐acres | ☐ sq.ft | _________ | ☐cubic yards |
| Dredging: | ___________ | ☐ acres | ☐ sq.ft. | _________ | ☐cubic yards |
| Flooding: | ___________ | ☐acres | ☐ sq.ft. | _________ | ☐cubic yards |
| Draining/Excavation: | ___________ | ☐acres | ☐ sq.ft. | _________ | ☐cubic yards |
| Shading: | ___________ | ☐acres | ☐ sq.ft. | _________ | ☐cubic yards |
| TOTALS: | _____________ | acres | ___________ sq.ft. | _________ | cubic yards |

36. Individually list wetland impacts including mechanized clearing, fill, excavation, flooding, draining, shading, etc. and attach a site map with location of each impact (attach additional sheets if needed).

| Impact No. | Wetland Type | Distance to Receiving Water body (LF) | Purpose of Impact (road crossing, impoundment, flooding, etc) | Impact Size (acres) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | Total Wetland Impacts (acres) | |

37. Individually list all seasonal and perennial stream impacts and attach a site map with location of each impact (attach additional sheets )

| Impact No. | Seasonal or Perennial Flow | Average Stream Width (LF) | Impact Type (road crossing, impoundment, flooding, etc) | Impact Length (LF) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | Total Stream Impacts (Linear Feet) | |

38. Have you commenced work on the project site? ☐ YES ☐ NO If yes, describe all work that has occurred and provide dates.

39. Describe measures taken to avoid and minimize impacts to Waters of the United States:

40. Provide a brief description of the proposed mitigation plan to compensate for impacts to aquatic resources or provide justification as to why mitigation should not be required (Attach a copy of the proposed mitigation plan for review).

41. See the attached sheet to list the names and addresses of adjacent property owners.

42. List all Corps Permit Authorizations and other Federal , State, or Local Certifications, Approvals, Denials received for work described in this application.

43. Authorization of Agent. I hereby authorize the agent whose name is given on page one of this application to act in my behalf in the processing of this application and to furnish supplemental information in support of this application. [1]

Applicant's Signature Date

44. Certification. Application is hereby made for a permit or permits to authorize the work and uses of the work as described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent for the applicant. [1]

Applicant's Signature Date Agent's Signature Date

**[1]The application must be signed by the person who desires to undertake the proposed activity or it may be signed by a duly authorized agent if the authorization statement in blocks 11 and 43 have been completed and signed. 18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.**

# Nationwide Permit Checklist

**U.S. Army Corps of Engineers - Charleston District**
**Checklist for 2012 Nationwide Permit Review**
**Nationwide Permit 3**

**Maintenance**
**(10/404)**

SAC#: ____________________________________________

Applicant Name: ____________________________________

Waterway/Location: _________________________________

Project Name: ______________________________________

**I. Nationwide Permit 3 (a), (b), and/or (c)** *Complete #1-4 of this section I for ALL Nationwide Permit 3 projects. Complete Sections II, III and/or IV as appropriate.*

1. Does the activity involve beach nourishment, new stream channelization, or stream relocation, or maintenance dredging for navigation, including excavation of accumulated sediment or other material in areas adjacent to existing private or commercial dock facilities, canals dug for boating access, marinas, or boat slips?

   ☐ Yes ☐ No

2. Does the activity comply with all of the NWP General and Regional Conditions, including mitigation, endangered species, and cultural resources, and if any Federally listed species and/or designated critical habitat occurs in the action area, have you made an effect determination and properly documented it in the administrative record?

   ☐ Yes ☐ No

3. Is the project located adjacent to an authorized Federal Navigation project? These Federal Navigation areas include Adams Creek, Atlantic Intracoastal Waterway (AIWW), Ashley River, Brookgreen Garden Canal, Calabash Creek, Charleston Harbor (including the Cooper River and Town Creek), Folly River, Georgetown Harbor (Winyah Bay, Sampit River, and Bypass Canal), Jeremy Creek, Little River Inlet, Murrells Inlet (Main Creek), Port Royal Harbor, Savannah River, Shem Creek (including Hog Island Channel & Mount Pleasant Channel), Shipyard Creek, Village Creek and the Wando River.

   ☐ Yes* ☐ No

4. Is the activity proposed in designated critical resource waters or their adjacent wetlands? (critical resource waters include NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves)

☐ Yes* ☐ No

**II. Nationwide Permit 3 (a)** *(Complete #1- 6 of this section II if paragraph (a) applies to project)*

☐ N/A -*Skip to Sections III and/or IV as appropriate.*

1. Is the activity for repair, rehabilitation, or replacement of any previously authorized, currently serviceable[1] structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3?

☐ Yes _ No

2. Will the structure or fill be put to uses different from those specified in the original permit or the most recently authorized modification?

_ Yes ☐ No

3. Are the deviations in the structure's configuration or filled area, including those due to changes in materials, construction techniques, requirements of other regulatory agencies, or current construction codes or safety standards that are necessary to make the repair, rehabilitation, or replacement that occur with the project considered minor?

☐ Yes _ No ☐ N/A

4. For any stream modifications that are associated with the project, are they limited to the minimum necessary for the repair, rehabilitation, or replacement of the structure or fill AND/OR are the modifications, including the removal of material from the stream channel, located immediately adjacent to the project or within the boundaries of the structure or fill?

☐ Yes _ No ☐ N/A

5. If the activity involves the repair, rehabilitation, or replacement of structures or fills that were destroyed or damaged by storms, floods, fire or other discrete events, has the work commenced or is under contract to commence within two years of the date of the destruction or damage, OR in cases of catastrophic events, such as hurricanes or tornadoes where this two-year limited may be waived, has the permittee demonstrated delays due to funding, contract, etc?

☐ Yes _ No ☐ NA

6. Does the discharge of dredge or fill material cause a loss of greater than 1/10 acre of waters of the United States or is there a discharge in a special aquatic site, including wetlands and riffle pool complexes?

☐ Yes* ☐ No

**III. Nationwide Permit 3 (b)** *(Complete #1- 6 of this section III if paragraph (b) applies to project) NOTE: All Nationwide Permit 3 (b) activities require a Pre-Construction Notification*

☐ N/A -*Skip to Section IV as appropriate.*

1. Does the activity involve the removal of accumulated sediments and/or debris in the vicinity of existing structures (e.g. bridges, culverted road crossings, water intake structures, etc.) AND/OR the placement of new or additional riprap to protect the structure?

☐ Yes* _ No

2. Is the removal of the sediment and/or debris limited to the minimum work necessary to restore the waterway in the vicinity of the structure, to the approximate dimensions that existed when the structure was built AND does the removal activities extend less than 200 feet in any direction from the structure?

☐ Yes* _ No

3. Does the activity involve the maintenance dredging for removal of accumulated sediments that are blocking or restricting outfall and intake structures OR does the activity involve the maintenance dredging for removal of accumulated sediments from canals associated with outfall and intake structures? (The 200 foot limit does not apply).

☐ Yes* ☐ No

4. Will all dredged or excavated materials be deposited in and retained in an area with no waters of the U.S. unless otherwise specifically approved by the district engineer under separate authorization?

☐ Yes* _ No

5. Will the placement of new or additional riprap be directly associated with a structure AND will the riprap be the minimum necessary to protect or ensure the safety of the structure? ***NOTE:*** *Any bank stabilization measures not directly associated with a structure will require a separate authorization from the district engineer.*

☐ Yes* _ No ☐ NA

6. Does the Pre-Construction Notification (PCN) include information regarding the original design capacities and configurations of the outfalls, intakes small impoundments, and canals?

☐ Yes _ No

**IV. Nationwide Permit 3 (c)** *(complete #1- 5 if paragraph (c) applies to project)* ☐ N/A

1. Does the activity involve temporary structures, fills, and work necessary to conduct the maintenance activity

☐ Yes _ No

2. Have appropriate measures been taken to maintain normal downstream flooding to the maximum extent practicable, when the temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites.

☐ Yes _ No

3. Do the temporary fills consist of materials, and will they be placed in a manner, that will not be eroded by expected high flows?

☐ Yes _ No

4. Will the temporary fills be removed in their entirety, the affected areas returned to pre-construction elevations, and the affected areas revegetated as appropriate?

☐ Yes _ No

5. Does the discharge of dredge or fill material cause a loss of greater than 1/10 acre of waters of the United States or is there a discharge in a special aquatic site, including wetlands and riffle pool complexes?

☐ Yes* ☐ No

TO QUALIFY FOR THE NWP, UNLESS OTHERWISE NOTED, EVERY NUMBERED ITEM MUST HAVE A CHECKED BOX.

* - REQUIRES A PRE-CONSTRUCTION NOTIFICATION (PCN) TO THE DISTRICT ENGINEER. **SEE THE SEPARATE PCN CHECKLIST TO ENSURE THE PROSPECTIVE PERMITTEE SUBMITS THE REQUISITE INFORMATION.** Remember, determination of completeness must be made within 30 days of the date of receipt. If all required information is not provided, the prospective permittee will be notified that the preconstruction notification (PCN) is still incomplete and the review will not commence until all requested information has been received. If the applicant has not received any written notice from the DE within ***45 days*** of the date of receipt of the PCN, ***the verification is issued by default.***

Reviewed by:

Date:

**U.S. Army Corps of Engineers - Charleston District**
**Checklist for 2012 Nationwide Permit Review**
**Nationwide Permit 13**

**Bank Stabilization**
**(10/404)**

SAC#:________________________________________________

Applicant Name:__________________________________________

Waterway/Location:_______________________________________

Project Name:___________________________________________

1. Is the activity for bank stabilization which is necessary to prevent erosion?

   ☐ Yes   _ No

2. Does the activity involve the placement of material in excess of the minimum needed for erosion protection?

   _ Yes   ☐ No

3. Is the activity more than 500 linear feet in length along the bank?

   ☐ Yes*   ☐ No

4. Does the activity involve the discharge of greater than an average of one cubic yard of material per running foot placed along the bank below the plane of ordinary high water mark or the high tide line?

   ☐ Yes*   ☐ No

5. Does the activity involve the discharge of dredged or fill material into a special aquatic site, including wetlands?

   ☐ Yes*   ☐ No

6. Does this activity include the channelization of any waters of the U.S.?

   _ Yes   ☐ No

7. Is the material placed in a manner that will be eroded by normal or expected high flows?

_ Yes ☐ No

8. Are all of the applicable NWP General Conditions satisfied, including mitigation, endangered species, and cultural resources, and if any Federally listed species and/or designated critical habitat occurs in the action area, have you made an effect determination and properly documented it in the administrative record?

☐ Yes _ No

9. Is the project located adjacent to an authorized Federal Navigation project? These Federal Navigation areas include Adams Creek, Atlantic Intracoastal Waterway (AIWW), Ashley River, Brookgreen Garden Canal, Calabash Creek, Charleston Harbor (including the Cooper River and Town Creek), Folly River, Georgetown Harbor (Winyah Bay, Sampit River, and Bypass Canal), Jeremy Creek, Little River Inlet, Murrells Inlet (Main Creek), Port Royal Harbor, Savannah River, Shem Creek (including Hog Island Channel & Mount Pleasant Channel), Shipyard Creek, Village Creek and the Wando River.

☐ Yes* ☐ No

10. Is the activity proposed in designated critical resource waters or their adjacent wetlands? (critical resource waters include NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves)

☐ Yes* ☐ No

11. Does the activity also involve temporary structures, fills, and work necessary to construct the bank stabilization activity?

☐ Yes ☐ No

12. Have the appropriate measures been taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary work, structures, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites?

☐ Yes _ No ☐ N/A

13. Will temporary fills be removed in their entirety and the affected areas returned to pre-construction elevations AND will the areas affected by temporary fills be revegetated, as appropriate?

☐ Yes _ No ☐ N/A

14. Are invasive plant species being used for bioengineering or vegetative bank stabilization?

_ Yes ☐ No

TO QUALIFY FOR THE NWP, UNLESS OTHERWISE NOTED, EVERY NUMBERED ITEM MUST HAVE A CHECKED BOX.

* - REQUIRES A PRE-CONSTRUCTION NOTIFICATION (PCN) TO THE DISTRICT ENGINEER. **SEE THE SEPARATE PCN CHECKLIST TO ENSURE THE PROSPECTIVE PERMITTEE SUBMITS THE REQUISITE INFORMATION.** Remember, determination of completeness must be made within 30 days of the date of receipt. If all required information is not provided, the prospective permittee will be notified that the preconstruction notification (PCN) is still incomplete and the review will not commence until all requested information has been received. If the applicant has not received any written notice from the DE within ***45 days*** of the date of receipt of the PCN, ***the verification is issued by default.***

Reviewed by:______________________

Date:_____________________________

**U.S. Army Corps of Engineers - Charleston District**
**Checklist for 2012 Nationwide Permit Review**
**Nationwide Permit 12**

**Utility Line Activities**
**(10/404)**

SAC #:________________________________________

Applicant Name:____________________________________

Waterway/Location:__________________________________

Project Name:_____________________________________

1. Is the activity proposed in designated critical resource waters or their adjacent wetlands? (critical resource waters include NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves)

   _ Yes ☐ No

2. Does the activity involve the construction, maintenance, repair, and removal of utility lines and/or associated facilities in waters of the U.S., AND will the activity result in no greater than ½ acre of waters of the U.S. for each single and complete project?

   ☐ Yes _ No

3. Does the activity meet the definition of a utility line, which includes any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose , and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and radio and television communication, or pipes that convey drainage from another area. (The term “utility line” does not include activities that drain a water of the U.S., such as drainage tile or French drains).

   ☐ Yes _ No

3. Does the activity involve the construction, maintenance, or repair of utility lines, including outfall and intake structures, and the associated excavation, backfill, or bedding for the utility lines, in all waters of the U.S., provided there is no change in pre-construction contours?

   ☐ Yes _ No ☐ N/A

4. If trench excavation occurs with the activity, will the excavated material be temporarily sidecast into waters of the U.S. for less than 3 months AND be done in a manner that it will not be dispersed by currents or other forces?

   ☐ Yes _ No ☐ N/A

5. If a trench is necessary for the activity, will the trench be constructed or backfilled in such a manner as to drain waters of the U.S. (e.g. backfilling with extensive gravel layers, creating a French drain effect)?

_ Yes ☐ No ☐ N/A

6. Will any exposed slopes and stream banks that are cleared of vegetation be stabilized using bioengineering techniques and/or the planting of deep-rooted native species immediately upon completion of the utility line crossing of each waterbody?

☐ Yes _ No ☐ N/A

7. Will the construction, maintenance, or expansion of any substation facility associated with a power line or utility line in non-tidal waters of the U.S., in combination with all other activities included in one single and complete project, result in the loss of greater than ½-acre of waters of the U.S.?

_ Yes ☐ No ☐ N/A

8. Will the discharges for the construction, maintenance, or expansion of substation facilities occur in non-tidal wetlands adjacent to tidal waters of the U.S.?

_ Yes ☐ No ☐ N/A

9. Will the foundations for overhead utility line towers, poles, and anchors in all waters of the U.S. be of the minimum size necessary AND be separate for each tower leg (rather than a larger single pad) when feasible?

☐ Yes _ No ☐ N/A

10. Will the construction, maintenance, or expansion of access roads associated with a power line or utility line in non-tidal waters of the U.S., in combination with all other activities included in one single and complete project, result in the loss of greater than ½-acre of waters of the U.S.?

_ Yes ☐ No ☐ N/A

11. Will the discharges for the construction, maintenance, or expansion of access roads occur in non-tidal wetlands adjacent to tidal waters of the U.S.?

_ Yes ☐ No ☐ N/A

12. Will the access roads be of the minimum width necessary, be constructed so that the length of the road minimizes any adverse effects on waters of the U.S., be as near as possible to pre-construction contours and elevations, AND/OR be properly bridged or culverted to maintain surface flow if above pre-construction contours?

☐ Yes   _ No   ☐ N/A

13. Does the activity involve the construction, maintenance, or repair of utility lines under, in, and/or over Section 10 waters? (*Note: A copy of the PCN and verification will be sent by the Corps to NOAA for charting of the utility line to protect navigation and/or the Department of Defense Siting and Clearinghouse for evaluation of potential effects on military activities.)*

☐ Yes*   ☐ No

14. Does the activity involve the construction of temporary structures, fills, and/or work?

☐ Yes *   ☐ No

15. For any temporary structures, fills, and work associated with the utility line, will the appropriate measures be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable?

☐ Yes*   _ No   ☐ N/A

16. For any temporary structures, fills, and work associated with the utility line, will the temporary fills be removed in their entirety, the affected areas returned to pre-construction elevations, AND the affected areas revegetated as appropriate?

☐ Yes*   _ No   ☐ N/A

17. For activities that involve temporary structures, fills, and work, does the PCN include specifications of how pre-construction contours will be re-established and verified after construction?

☐ Yes*   _ No   ☐ N/A

18. Does the activity involve mechanized land clearing in a forested wetland for the utility line right-of-way?

☐ Yes*   ☐ No

19. Will the utility line in waters of the U.S., excluding overhead lines, exceed 500 feet?

☐ Yes*   ☐ No   ☐ N/A

20. Will the activity line be placed within a jurisdictional area (i.e. water of the U.S.) where it runs parallel to or along a stream bed that is within that jurisdictional area?

☐ Yes* ☐ No ☐ N/A

21. Will the discharges result in a loss of greater than 1/10-acre of waters of the U.S.?

☐ Yes* ☐ No

22. For activities involving a permanent access road, will the road be constructed above grade in waters of the U.S. AND will it be more than 500 feet in length?

☐ Yes* ☐ No ☐ N/A

23. For activities involving a permanent access road, will the access road constructed in waters of the U.S. be of impervious materials?

☐ Yes* ☐ No ☐ N/A

24. Are all of the applicable NWP General and Regional Conditions satisfied, including endangered species, and cultural resources, and if any Federally listed species and/or designated critical habitat occurs in the action area, have you made an effect determination and properly documented it in the administrative record?

☐ Yes _ No

25. Is the project located adjacent to an authorized Federal Navigation project? These Federal Navigation areas include Adams Creek, Atlantic Intracoastal Waterway (AIWW), Ashley River, Brookgreen Garden Canal, Calabash Creek, Charleston Harbor (including the Cooper River and Town Creek), Folly River, Georgetown Harbor (Winyah Bay, Sampit River, and Bypass Canal), Jeremy Creek, Little River Inlet, Murrells Inlet (Main Creek), Port Royal Harbor, Savannah River, Shem Creek (including Hog Island Channel & Mount Pleasant Channel), Shipyard Creek, Village Creek and the Wando River.

☐ Yes* ☐ No

26. Will the activity impact more than 25 linear feet of streambed?

☐ Yes* ☐ No

27. Will the NWP 12 be used in conjunction with NWP 14, 29, 39, 43, 51 and/or 52 for an activity that is considered *a single and complete project*?

_ Yes ☐ No

28. Will the activity cause the loss of greater than 300 linear feet of streambed?

_ Yes ☐ No

29. Will the excavated material be returned to the trench AND will any remaining material be relocated and retained in an upland disposal site?

☐ Yes _ No

30. Will the substrate containing roots, rhizomes, seeds, etc, be kept viable and replaced at the surface of the excavated area AND will the impacted wetlands be replanted with native wetland species or allowed to naturally re-vegetate from the replaced substrate, as long as the resulting vegetation is native?

☐ Yes _ No ☐ N/A

31. Does the activity involve maintained utility crossings?

☐ Yes* ☐ No

32. For activities that require a PCN that involve maintained utility crossings, does the notification include a justification for the required width of the maintained crossing that impacts waters of the U.S?

☐ Yes* _ No ☐ N/A

.

33. Does the activity involve the construction of a sub-station in waters of the U.S.?

☐ Yes* ☐ No

34. For activities that include construction of a substation in waters of the U.S., does the notification include a statement of avoidance and minimization for the loss of waters of the U.S. impacted by the substation?

☐ Yes* _ No ☐ N/A

35. Does the activity involve the permanent conversion of forested wetlands to herbaceous wetlands?

☐ Yes* ☐ No

36. For activities that involve the permanent conversion of forested wetlands to herbaceous wetlands, does the required PCN include the acreage of conversion impacts of waters of the U.S. AND a compensatory mitigation proposal OR a statement of why compensatory mitigation should not be required?

☐ Yes* _ No ☐ N/A

37. For activities that include intake structures, does the intake structure include a screen to prevent entrainment of juvenile and larval organisms AND is the inflow velocity of the associated intake structures limited to $\leq$ 0.5 ft/sec?

☐ Yes _ No ☐ N/A

38. For utility lines buried in waters of the U.S. that require a PCN, does the notification include a description of construction techniques that will prevent draining, such as anti-seep collars, OR does the notification include appropriate documentation that such techniques are not required to prevent drainage of waters of the U.S.?

☐ Yes _ No ☐ N/A

TO QUALIFY FOR THE NWP, UNLESS OTHERWISE NOTED, EVERY NUMBERED ITEM MUST HAVE A CHECKED BOX.

* - REQUIRES A PRE-CONSTRUCTION NOTIFICATION (PCN) TO THE DISTRICT ENGINEER. **SEE THE SEPARATE PCN CHECKLIST TO ENSURE THE PROSPECTIVE PERMITTEE SUBMITS THE REQUISITE INFORMATION.**

Remember, determination of completeness must be made within 30 days of the date of receipt. If all required information is not provided, the prospective permittee will be notified that the preconstruction notification (PCN) is still incomplete and the review will not commence until all requested information has been received. If the applicant has not received any written notice from the DE within ***45 days*** of the date of receipt of the PCN, ***the verification is issued by default.***

Reviewed by:____________________________________

Date:___________________________________________

# C11. U.S. Army Corps of Engineers Nationwide Permit General Conditions

*2012 Nationwide Permit General Conditions*

1. Navigation
2. Aquatic Life Movements
3. Spawning Areas
4. Migratory Bird Breeding Areas
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12. Soil Erosion and Sediment Controls
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16. Wild and Scenic Rivers
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20. Historic Properties
21. Discovery of Previously Unknown Remains and Artifacts
22. Designated Critical Resource Waters
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24. Safety of Impoundment Structures
25. Water Quality
26. Coastal Zone Management
27. Regional and Case-by-Case Conditions
28. Use of Multiple Nationwide Permits
29. Transfer of Nationwide Permit Verifications
30. Compliance Certification
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*District Engineer's Decision*

*Further Information*

*Definitions*

Best management practices (BMPs)
Compensatory mitigation
Currently serviceable
Direct effects
Discharge
Enhancement
Ephemeral stream
Establishment (creation)
High Tide Line
Historic property
Independent utility

Indirect effects
Intermittent stream
Loss of waters of the United States
Non-tidal wetland
Open water
Ordinary high water mark
Perennial stream
Practicable
Pre-construction notification
Preservation
Re-establishment
Rehabilitation
Restoration
Riffle and pool complex
Riparian areas
Shellfish seeding
Single and complete linear project
Single and complete non-linear project
Stormwater management
Stormwater management facilities
Stream bed
Stream channelization
Structure Tidal
wetland
Vegetated
shallows
Wterbody

## C. Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR §§ 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR § 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

17. Tribal Rights. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address ESA compliance for the NWP activity, or whether additional ESA consultation is necessary.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed work or that utilize the designated critical habitat that might be affected by the proposed work. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have "no effect" on listed species or critical habitat, or until Section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific regional endangered species conditions to the NWPs.

(e) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. FWS or the NMFS, The Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.noaa.gov/fisheries.html respectively.

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for obtaining any “take” permits required under the U.S. Fish and Wildlife Service’s regulations governing compliance with the Migratory Bird Treaty Act or the Bald and Golden Eagle Protection Act. The permittee should contact the appropriate local office of the U.S. Fish and Wildlife Service to determine if such “take” permits are required for a particular activity.

20. Historic Properties. (a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address section 106 compliance for the NWP activity, or whether additional section 106 consultation is necessary.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of Section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties on which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.

(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR §800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non-Federal applicant that he or she cannot begin work until Section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 31, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal, and provides a project-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in minimal adverse effects on the aquatic environment.

(2) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.

(3) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) – (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(4) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(5) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream rehabilitation, enhancement, or preservation, to ensure that the activity results in minimal adverse effects on the aquatic environment.

(e) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any project resulting in the loss of greater than 1/2-acre of waters of



the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWPs.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the restoration or establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to establish a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or establishing a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(g) Permittees may propose the use of mitigation banks, in-lieu fee programs, or separate permittee-responsible mitigation. For activities resulting in the loss of marine or estuarine resources, permittee-responsible compensatory mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

(Transferee)

(Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized work was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the work and mitigation.

31. Pre-Construction Notification. (a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 20 that the activity may have the

potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project

(3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause, including the anticipated amount of loss of water of the United States expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(4) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(5) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse effects are minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and

(7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the

proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through (7) of this general condition. A letter containing the required information may also be used.

(d) Agency Coordination: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(2) For all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States, for NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed, and for all NWP 48 activities that require pre-construction notification, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(4) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

**D. District Engineer's Decision**

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. For a linear project, this determination will include an evaluation of the individual crossings to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to intermittent or ephemeral streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51 or 52, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in minimal adverse effects. When making minimal effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

2. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for projects with smaller impacts. The district engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the district engineer to be minimal, the district engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

3. If the district engineer determines that the adverse effects of the proposed work are more than minimal, then the district engineer will notify the applicant either: (a) that the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the project is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level; or (c) that the project is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period, with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation or a requirement that the applicant submit a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level. When mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

**E. Further Information**

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project.

**F. Definitions**

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term "discharge" means any discharge of dredged or fill material. Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps regulatory program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

Intermittent stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the linear feet of stream bed that is filled or excavated. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities eligible for exemptions under Section 404(f) of the Clean Water Act are not considered when calculating the loss of waters of the United States.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. The definition of a wetland can be found at 33 CFR 328.3(b). Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of standing or flowing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of "open waters" include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: An ordinary high water mark is a line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas (see 33 CFR 328.3(e)).

Perennial stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands adjacent to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term “single and complete project” is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term “single and complete project” is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of “independent utility”). Single and complete non-linear projects may not be “piecemealed” to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream’s course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

Tidal wetland: A tidal wetland is a wetland (i.e., water of the United States) that is inundated by tidal waters. The definitions of a wetland and tidal waters can be found at 33 CFR

328.3(b) and 33 CFR 328.3(f), respectively. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line, which is defined at 33 CFR 328.3(d).

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a jurisdictional water of the United States. If a jurisdictional wetland is adjacent – meaning bordering, contiguous, or neighboring – to a waterbody determined to be a water of the United States under 33 CFR 328.3(a)(1)-(6), that waterbody and its adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)). Examples of “waterbodies” include streams, rivers, lakes, ponds, and wetlands.

# C12. U.S. Army Corps of Engineers Nationwide Permit Regional Conditions

**2012 APPROVED**
**NATIONWIDE PERMIT REGIONAL CONDITIONS**
**FOR SOUTH CAROLINA**

The following Regional Conditions have been proposed by the Charleston District for the nationwide permits (NWP) published in the February 21, 2012, Federal Register as authorized under General Condition # 26. Regional conditions are authorized to modify NWP's by adding conditions on a generic basis applicable to certain activities or specific geographic areas. Certain terminologies used in the following conditions are identified in *italics* and are defined in the above referenced Federal Register under Definitions.

## For All Nationwide Permits:

1. The applicant must implement *best management practices* during and after all construction to minimize erosion and migration of sediments off site. These practices may include use of devices capable of preventing erosion and migration of sediments in waters of the U.S., including wetlands. These devices must be maintained in a functioning capacity until the area is permanently stabilized. All disturbed land surfaces must be stabilized upon project completion.

2. All wetland and stream crossings must be stabilized immediately following completion of construction/installation and must be aligned and designed to minimize the *loss of waters of the U.S.*

3. Necessary measures must be taken to prevent oil, tar, trash, debris and other pollutants from entering the adjacent waters or wetlands.

4. Any excess excavated materials not utilized as authorized back fill must be placed and contained on high land and permanently stabilized to prevent erosion into waters of the U.S., including wetlands.

5. Placement and/or stockpiling (double handling) of excavated material in waters of the U.S, including wetlands, is prohibited unless specifically authorized by the nationwide permit verification. Should double handling be authorized, the material must be placed in a manner that does not impede circulation of water and will not be dispersed by currents or other erosive forces.

6. Once project construction is initiated, it must be carried to completion in an expeditious manner in order to minimize the period of disturbance to aquatic resources and the surrounding environment.

7. The permittee must notify the Corps of Engineers, Charleston District in the event archaeological or paleontological remains are found during the course of work. Archaeological remains consist of any materials made or altered by man, which remain from past historic or prehistoric times (i.e., older than 50 years). Examples include old pottery fragments, metal, wood, arrowheads, stone implements or tools, human burials, historic docks, structures, or non-recent (i.e., older than 100 years) vessel ruins.

Paleontological remains consist of old animal remains, original or fossilized, such as teeth, tusks, bone, or entire skeletons.

8. Use of nationwide permits does not obviate requirements to obtain other Federal, State, county, or local government authorizations.

9. With the exception of NWP 38, no NWP is authorized in areas of known or suspected sediment contamination.

## FOR SPECIFIC NATIONWIDE PERMITS:

10. For **NWP's 12, 14, 18, 27, 29, 38, 39, 40, 42, 43**, **44, 51 and 52,** a discharge cannot cause the loss of greater than 300 linear feet of *streambed*.

11. For **NWP's 1, 3, 5, 7, 8, 10, 11, 12, 13, 14, 15, 36**, **51, and 52**, a notification must be submitted for any activity that would be located adjacent to an authorized Federal Navigation project. These Federal navigation areas include Adams Creek, Atlantic Intracoastal Waterway (AIWW), Ashley River, Brookgreen Garden Canal, Calabash Creek Charleston Harbor (including the Cooper River and Town Creek), Folly River, Georgetown Harbor (Winyah Bay, Sampit River, and Bypass Canal), Jeremy Creek, Little River Inlet, Murrells Inlet (Main Creek), Port Royal Harbor, Savannah River, Shem Creek (including Hog Island Channel & Mount Pleasant Channel), Shipyard Creek, Village Creek and the Wando River.

12. For **NWP 3, paragraph (a) and (c) activities**, the prospective permittee must notify the District Engineer in accordance with General Condition 31, if the proposed discharge of dredged or fill material will cause the loss of greater than 1/10-acre of waters of the U.S. or if the proposed discharge will be located within a special aquatic site, including wetlands and riffle pool complexes.

13. For **NWP 3**, **paragraph (b) activities,** excavation of accumulated sediment or other material is not authorized in areas adjacent to existing private or commercial dock facilities, piers, canals dug for boating access, marinas, or boat slips.

14. For **NWP's 7 and 12**, the associated intake structure must be screened to prevent entrainment of juvenile and larval organisms and the inflow velocity of the associated intake structures must be limited to $\leq$ 0.5 ft/sec.

15. Activities authorized by **NWP 7** must occur in the immediate vicinity of the outfall, and must be necessary for the overall construction or operation of the outfall (e.g. pump equipment, rip-rap). NWP 7 shall not be used to authorize ancillary activities such as construction of access roads, installation of utility lines leading to or from the outfall or intake structures, construction of buildings, distant activities, etc.

16. **NWP's 12, 14, 29, 39, 43, 51 and 52** will not be used in conjunction with one another for an activity that is considered a *single and complete project*.

17. For **NWPs 12, 14,** and **18,** the prospective permittee must submit a pre-construction notification (PCN) to the District Engineer in accordance with General Condition 31, prior to commencing the activity if the proposed discharge will impact more than **25 linear feet of streambed.** This notification requirement is in addition to the notification criteria listed for these NWPs.

18. For **NWP 12**, excavated material shall be returned to the trench and any remaining material shall be relocated and retained on an upland disposal site. Substrate containing roots, rhizomes, seeds, etc., must be kept viable and replaced at the surface of the excavated site. Impacted wetlands will be replanted with native wetland species or allowed to naturally re-vegetate from the replaced substrate, as long as the resulting vegetation is native.

19. For **NWP 12**, stream banks that are cleared of vegetation will be stabilized using bioengineering techniques and/ or the planting of deep-rooted native species.

20. For **NWP 12**, construction techniques to prevent draining, such as anti-seep collars, will be required for utility lines buried in waters of the U.S. when necessary. If no construction techniques to prevent draining are proposed, the applicant must provide appropriate documentation that such techniques are not required to prevent drainage of waters of the U.S.

21. For **NWP 12,** the prospective permittee must submit a pre-construction notification (PCN) to the District Engineer in accordance with General Condition 31, prior to commencing the activity if the activity will involve temporary structures, fills, and/or work. To be complete, the PCN must also include the specifications of how pre-construction contours will be re-established and verified after construction. This notification requirement is in addition to the notification criteria listed for this NWP.

22. For **NWP 12,** the prospective permittee must submit a pre-construction notification (PCN) to the District Engineer in accordance with General Condition 31, prior to commencing the activity if the activity will involve maintained utility crossings. To be complete, the PCN must also include a justification for the required width of the maintained crossing that impacts waters of the U.S. This notification requirement is in addition to the notification criteria listed for this NWP.

23. For **NWP 12**, the prospective permittee must submit a pre-construction notification (PCN) to the District Engineer in accordance with General Condition 31, prior to commencing the activity if the activity will involve the construction of a sub-station in waters of the U.S. To be complete, the PCN must also include a statement of avoidance and minimization for the

loss of waters of the U.S. impacted by the utility line sub-station. This notification requirement is in addition to the notification criteria listed for this NWP.

24. For **NWP 12,** the prospective permittee must submit a pre-construction notification (PCN) to the District Engineer in accordance with General Condition 31, prior to commencing the activity if the activity will involve the permanent conversion of forested wetlands to herbaceous wetlands. To be complete, the PCN must also include the acreage of conversion impacts of waters of the U.S. and a compensatory mitigation proposal or a statement of why compensatory mitigation should not be required. This notification requirement is in addition to the notification criteria listed for this NWP.

25. For **NWP's, 14, 29, 39**, **46, 51 and 52,** all notifications must include appropriately sized and positioned culverts that meet the requirements of General Conditions 2, 9 and 10 for each individual crossing of waters of the U.S.

26. For **NWP's 14, 29, 39**, **51 and 52,** each individual stream crossing is required to accommodate bankfull* flows by maintaining the existing bankfull channel cross sectional area. Flows that exceed bankfull flow must be accommodated by placement of additional culverts above the bankfull elevation.

27. Notifications for aquatic habitat *restoration,* establishment, and enhancement activities authorized by **NWP 27** will require coordination with appropriate Federal, State, and local agencies. The coordination activity will be conducted by the Corps of Engineers. Agencies will generally be granted 15 days to review and provide comments unless the District Engineer determines that an extension of the coordination period is reasonable and prudent.

28. For **NWP 29**, the loss of waters of the U.S. is limited to a maximum of ¼-acre for a single family residence.

29. For **NWP 36**, the width of the boat ramp will be limited to **16 feet** and only one boat ramp may be constructed on a single lot or tract of land (e.g. each lot within a subdivision). NWP 36 may be used to authorize the construction of all boat ramps.

30. For **NWP 38**, notifications require the following information:
    - documentation that the specific activities are required to effect the containment, stabilization, or removal of hazardous or toxic waste materials as performed, ordered, or sponsored by a government agency with established legal or regulatory authority;
    - a narrative description indicating the size and location of the areas to be restored, the work involved and a description of the anticipated results from the restoration;
    - a plan for the monitoring, operation, or maintenance of the restored area.

31. For **NWP's 29 and 39**, the discharges of dredged or fill material for the construction of *stormwater management facilities* in *perennial streams* are not authorized.

32. For **NWP 41**, notification must be submitted for projects that require mechanized land clearing in waters of the U.S., including wetlands, in order to access or perform reshaping activities.

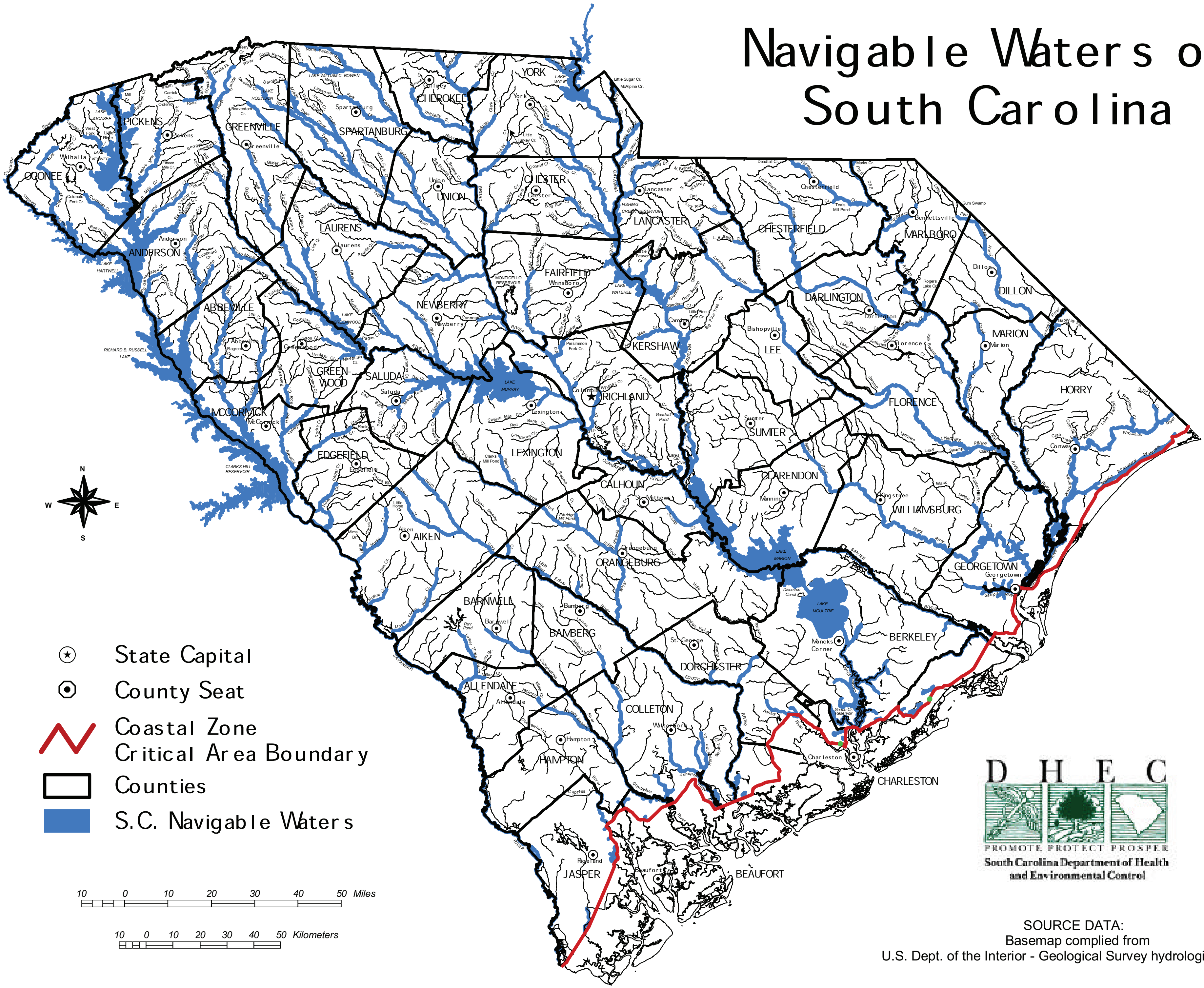
33. **NWP 41** is prohibited in channelized streams or stream relocation projects that exhibit natural stream characteristics and/or perform natural stream functions.

34. For **NWP 48**, a copy of the lease or permit issued by an appropriate state or local government agency, a treaty, or a legal contractual document establishing a valid property interest, must be provided with the pre-construction notification (PCN) for commercial shellfish aquaculture activities that occur in a new project area. This is in addition to the information specifically required for this NWP as well as the required information found in General Condition 31.

*Bankfull corresponds to the discharge at which channel-forming processes, such as forming or removing bars or meanders, is most effective. It is typically associated with the 1.5-year storm event, the "ordinary high water mark", and the elevation on the stream bank where flooding begins in a stable stream system. It can often be identified in the field by the elevation of the highest depositional feature (e.g. point bars), a recognizable floodplain, or a break in perennial vegetation.

C13. South Carolina Navigable Waters Map

# Navigable Waters of South Carolina




SOURCE DATA:
Basemap complied from
U.S. Dept. of the Interior - Geological Survey hydrologic unit maps

# Appendix I:  Real Estate Analysis

# REAL ESTATE SUMMARY

## Table of Contents

# SECTION 1. THE REAL ESTATE REPORT

## 1.1 Statement of Purpose

Under the Planning Assistance to States Program (PAS), Lexington County has requested the Charleston District, US Army Corps of Engineers, to assist in analyzing potential measures to address flood related impacts in the Kinley Creek Sub-watershed, near the Town of Irmo, Lexington County, South Carolina.

The purpose of the real estate report is to address all known real estate requirements identified during the study.

## 1.2 Study Authority

The Study Authority for this project is authorized by Section 22 of the Water Resources Development Act (WRDA) of 1974 (Public Law 93-251), as amended, otherwise known as the Planning Assistance to States (PAS) program. The PAS program authorizes the Secretary of the Army, acting through the Chief of Engineers, to assist the States in the preparation of comprehensive plans for the development, utilization and conservation of water and related resources of drainage basins, watersheds or ecosystems located within the boundaries of the state.

Section 319 of WRDA of 1990 (Public Law 101-640) authorizes the Secretary of the Army to collect fees from states and other non-federal government entities for the purpose of recovering 50 percent of the cost of the program established by the WRDA of 1974, Section 22.

## 1.3 Project Location

The Kinley Creek watershed is a highly developed watershed approximately 4,480 acres in size. Kinley Creek starts north of SC Highway 60, and ends in the Saluda River. Elevations in watershed vary from 410 feet to 180 feet NGVD 29. Kinley Creek and its tributaries are typical of small Piedmont streams, exhibiting deeply incised channels with widely varying widths. Due to extensive residential and commercial development, the floodplain also varies greatly. The 14 acre Lake Quail Valley was created by impounding Kinley Creek above Harbison Boulevard (and outside of the project area). With the exception of a few isolated reaches, most of the floodplain within the project area has little or no unaltered floodplain remaining. It is not until Kinley Creek is below the CSX Railroad Bridge that the floodplain expands to natural conditions.

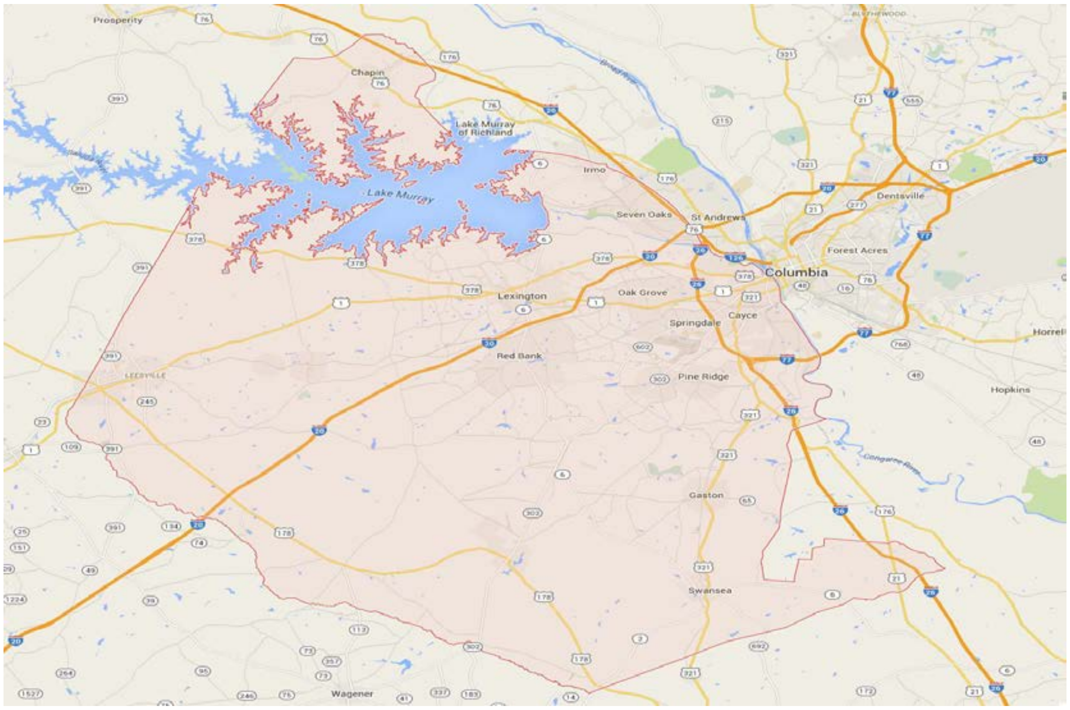



**Figure 1.3-1. Project Vicinity/Location Map**

# 1.4 Project Description

The study area shown on figure 1.4-1 is the Kinley Creek watershed located in Lexington County, South Carolina. Kinley Creek runs from just south of Lake Murray Boulevard, under Harbison Boulevard, and Piney Grove Road near the Town of Irmo. Flooding has been a longstanding problem within this watershed, with two tributaries K-1 and K-2, respectively, being of particular concern. The headwaters of Tributary K-1 are just southwest of Interstate 26 and flow through residential areas. Tributary K-2 starts northeast of Interstate 26 and is the larger of the two. This project involves evaluating and developing alternative solutions to address flood related impacts within the watershed.

Based on GIS Data provided by Lexington County, there are approximately 190 properties within the footprint of the proposed project. Although Lexington County currently maintains Kinley Creek, no easements or other rights have ever been acquired from the adjoining land owners. The Standard Drainage Ditch Easement Estate is recommended in Section 1.20 of this report for use on this project.

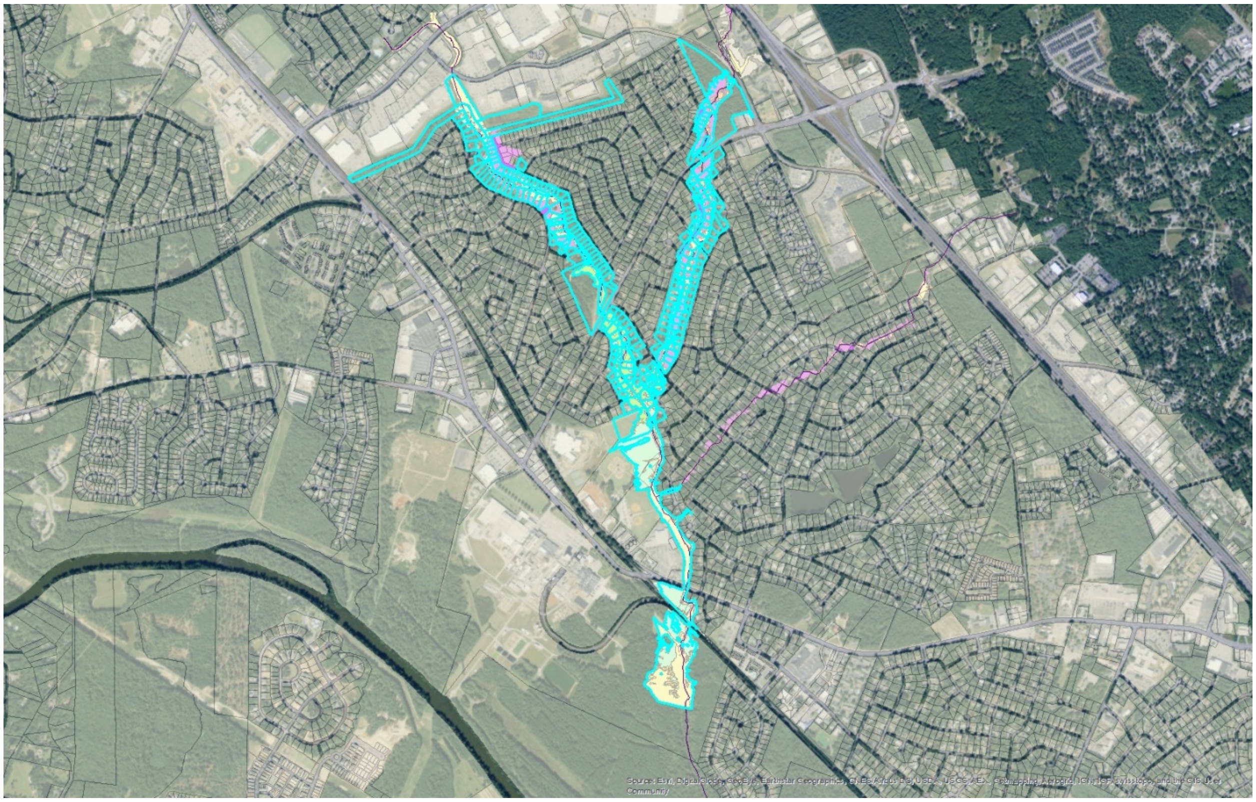


**Figure 1.4-1. Project Map**

## 1.5 Real Estate Responsibilities and Requirements

The requirements for lands, easements, rights-of-way and relocations, and disposal/borrow areas should include the rights to construct, maintain, repair, operate, patrol and replace a drainage ditch. All components of the project can be constructed under the standard drainage ditch estate and the temporary work area easement estate described in Section 1.19 of this report.

## 1.6 Utility/Facility Relocation

The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility or town when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided by Federal statute or any project report or House or Senate document referenced therein. Providing a functionally equivalent facility may take the form of adjusting, altering, lowering, raising, or replacement and attendant removal of the affected facility or part thereof. It is important to note that relocation assistance under Public Law 91-646 relates specifically to displaced persons, and should be distinguished from the separate concept of facility or utility relocations.

The project would impact numerous public road crossings. This would require new or upgraded pipelines, roads and utilities. Any road crossing modifications will need to be coordinated with the appropriate State, City of County agency in charge of the road. Any modifications to privately owned utilities must be accomplished under a relocation contract with the appropriate entity and will increase the estimated real estate cost presented in Section 1.20.

## 1.7 Existing Projects

There are no existing Federal funded projects within the proposed project area.

## 1.8 Environmental Impacts

Environmental impacts are addressed in the environmental appendix to the main report.

## 1.9 Government Owned Property

There is no Government owned land within the areas proposed for construction of the project.

## 1.10 Historical Significance

Historical significance is addressed in the environmental appendix to the main report.

## 1.11 Mineral Rights

There are no known mineral activities within the scope of the proposed project.

## 1.12 Hazardous, Toxic, and Radioactive Waste (HTRW)

There are no known mineral activities within the scope of the proposed project.

## 1.13 Navigation Servitude

Navigation Servitude is not applicable to this project.

## 1.14 Zoning Ordinances

Zoning ordinances are not of issue with this project. Application or enactment of zoning ordinances is not to be used in lieu of acquisition.

## 1.15 Induced Flooding

There will be no flooding induced by the construction or the operation and maintenance of the project.

## 1.16 Public Law 91-646, Relocation Assistance Benefits

Many of the alternatives studied include the purchase and relocation of home owners. The average estimated per home value to include relocation payments under Public Law 91-646 is $250,000.000. The estimated demolition cost of the homes is $16,000.00.

## 1.17 Attitude of Property Owners

The project is fully supported. There are no known objections to the project from landowners within the project area at this time.

## 1.18 Acquisition Schedule

Lexington County will be responsible for acquiring all real estate interests required for the project. It is projected that the proposed easements can be accomplished within 12-18 months. Acquisition can begin when final plans and specs have been completed by Lexington County.

## 1.19 Recommended Estates for Proposed Project

The standard Drainage Ditch Easement is recommended for the project along with Temporary Staging Area Easement for any staging areas identified during design.

DRAINAGE DITCH EASEMENT.

A perpetual and assignable easement and right-of-way in, over and across (the land described in Schedule A) (Tracts Nos. ____, ____ and _____) to construct, maintain, repair, operate, patrol and replace a drainage ditch, reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

TEMPORARY WORK AREA EASEMENT.

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____), for a period not to exceed ___________________, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the ____________________ Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

## 1.20 Real Estate Estimate

The estimated real estate cost for the project was provided by Lexington County and should be considered a Rough Order of Magnitude Estimate per parcel. The estimated real estate costs generally include the land cost for acquisition of land, relocation costs, and administrative costs. Administrative costs are those costs incurred for verifying ownership of lands, certification of those lands required for project purposes, legal opinions, analysis or other requirements that may be necessary during Planning, Engineering and Design. The average estimated cost of the recommended easement estate is $1,500 per property. The estimated administrative cost to include survey, title and closing services is $4,000 per property.

**Table 1.21-1 Real Estate Estimate**
**PAS Lexington County - Kinley Creek**
**Average Estimated Real Estate Cost per Parcel**

| | | | | |
|---|---|---|---|---|
| a. Lands | | | | |
| | Easement | | $ | 1,500 |
| b. Purchase, Relocation & Demolition | | | $ | 250,000 |
| | Residential | $ 203,000 | | |
| | P.L. 91-646 | | | |
| | Relocation Cost | $ 31,000 | | |
| | Demolition Cost | $ 16,000 | | |
| c. Administrative Cost | | | $ | 5,000 |

## 1.21 Potential Real Estate Issues

The number of impacted landowners was estimated at the time of the report. Any increase or decrease in the number of impacted landowners will affect the cost.

Facility/Utility Relocation impacts are not fully known at this time. Increased land requirements could be another factor that will increase the real estate cost.

# Appendix J: Project Source/Funding Fact Sheets

## Who Is Eligible to Apply?

- State and local governments
- Certain private nonprofit organizations and institutions
- Indian Tribes and authorized Tribal organizations, and Alaska native villages and organizations
- Individuals and businesses may not apply directly to the State or FEMA, but eligible local governments or private nonprofit organizations may apply to benefit the private entity

## Additional Grant Programs and More Information

FEMA has four additional mitigation grant programs which provide funding for similar activities on an annual basis, regardless of disaster activity:

- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

You may also be eligible for assistance under these programs.

For more information about HMGP or the programs mentioned above, go to **http://www.fema.gov/government/grant/hma/index.shtm**, contact your State Hazard Mitigation Officer (SHMO), or contact the FEMA Regional Office for your State (listed on the back of this brochure).

## FEMA Regional Contacts

**Region I** Main Number: 617-956-7506
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont

**Region II** Main Number: 212-680-3600
New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands

**Region III** Main Number: 215-931-5608
Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia

**Region IV** Main Number: 770-220-5200
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee

**Region V** Main Number: 312-408-5500
Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin

**Region VI** Main Number: 940-898-5399
Arkansas, Louisiana, New Mexico, Oklahoma, and Texas

**Region VII** Main Number: 816-283-7063
Iowa, Kansas, Missouri, and Nebraska

**Region VIII** Main Number: 303-235-4800
Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming

**Region IX** Main Number: 510-627-7100
Arizona, California, Hawaii, Nevada, American Samoa, Guam, and Commonwealth of the Northern Mariana Islands

**Region X** Main Number: 425-487-4600
Alaska, Idaho, Oregon, and Washington

5/09

# Hazard Mitigation Grant Program

U.S. DEPARTMENT OF HOMELAND SECURITY FEMA

# Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) was created in November 1988, by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (amendments include the Hazard Mitigation and Relocation Assistance Act of 1993 and the Disaster Mitigation Act of 2000). The HMGP assists States, Tribes, and local communities in implementing long-term hazard mitigation measures following a major disaster declaration.

## What Is the Purpose of the HMGP?

The Program's objectives are to:

- Significantly reduce or permanently eliminate future risk to lives and property from natural hazards
- Provide funds to implement projects in accordance with priorities identified in State, Tribal, or local hazard mitigation plans
- Enable mitigation measures to be implemented during the recovery from a disaster

## What Types of Projects Can Be Funded?

The HMGP can be used to fund projects to protect either public or private property, as long as the project fits within State and local government mitigation strategies to address areas of risk and complies with HMGP guidelines. Examples of projects include:

- Acquiring and relocating structures from hazard-prone areas
- Retrofitting structures to protect them from floods, high winds, earthquakes, or other natural hazards
- Constructing certain types of minor and localized flood control projects
- Constructing safe rooms inside schools or other buildings in tornado-prone areas
- Developing State, local, or Tribal mitigation plans

## How Much Money Is Available Under the HMGP?

Federal funding under the HMGP is available following a major disaster declaration if requested by the Governor. HMGP funding is allocated using a "sliding scale" formula based on the percentage of funds spent on Public and Individual Assistance for each Presidentially declared disaster. For States with a FEMA-approved Standard State Mitigation Plan, the formula provides for up to 15% of the first $2 billion of estimated aggregate amounts of disaster assistance, up to 10% for amounts between $2 billion and $10 billion, and 7.5% for amounts between $10 billion and $35.333 billion. For States with a FEMA-approved Enhanced Mitigation Plan, up to 20% of the total of Public and Individual

**Since 1988, the HMGP has been providing States and communities with the resources to invest in long-term actions today to reduce the toll from natural hazards tomorrow.**

Assistance funds authorized for the disaster (up to $35.333 billion of such assistance) are available.

These grant funds may be used to pay up to 75% of the eligible project costs. The non-Federal match does not need to be cash; in-kind services or materials may be used.

## What Are the Roles of Communities, States, and FEMA?

During the recovery phase of a disaster, local jurisdictions select projects that could reduce property damage from future disasters, and submit grant applications to the State. Indian Tribes and certain nonprofit organizations may also apply; and local governments may apply for assistance to benefit individual property owners and businesses.

The States administer the HMGP by establishing their mitigation priorities, facilitating the development of applications, and submitting applications to FEMA based on State criteria and available funding. The State also manages the project, monitors progress, and evaluates the effectiveness of projects implemented.

FEMA conducts a final eligibility review to ensure compliance with Federal regulations. HMGP projects must comply with Federal environmental laws and regulations, be cost-effective, and be technically feasible.

Federal law requires States and local jurisdictions to have a mitigation plan prior to receipt of HMGP funds. The plan identifies hazards, assesses community needs, and describes a community-wide strategy for reducing risks associated with natural disasters.

FEMA

# Fact Sheet

## FY 2015 Pre-Disaster Mitigation (PDM) Grant Program

*In Fiscal Year 2015, $30,000,000 is available to assist State, Tribal Territorial and local governments reduce overall risk to the population and structures from future hazard events, while also reducing reliance on federal funding from future disasters.*

### Overview

As appropriated by the Department of Homeland Security Appropriations Act, PDM 2015 (Public Law 114-4); the Fiscal Year (FY) 2015 Pre-Disaster Mitigation (PDM) Grant Program provides resources to assist states, tribal governments, territories and local communities in their efforts to implement a sustained pre-disaster natural hazard mitigation program, as authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended (42 U.S.C. 5133).

The Hazard Mitigation Assistance (HMA) Unified Guidance applies to the FY 2015 PDM Grant Program application cycle. Applicants are encouraged to review the Notice of Funding Opportunity announcement and the HMA Guidance for detailed information regarding eligibility and to contact their FEMA Regional Office for additional information.

### Funding

In FY 2015, the total amount of funds distributed under the FY 2015 PDM Grant Program will be $30,000,000.

- All 50 States, the District of Columbia, American Samoa, Guam, Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands are eligible to receive a set aside of 1 percent of the total appropriated PDM funding, or $250,000.
- $5 million will be set aside for Federally-recognized Tribal governments to receive a set aside of up to 1 percent of the total appropriated PDM funding, or $250,000 per tribe.
- The balance of PDM Grant Program funds will be distributed on a competitive basis to all eligible applicants.

### Eligibility

All 50 States, the District of Columbia, Federally-recognized Tribal governments, American Samoa, Guam, Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands are eligible to apply for the FY 2015 PDM Grant Program. Local governments are considered sub-applicants and must apply to their applicant state/territory. Either the state Emergency Management Agency (EMA) or the office that has primary emergency management responsibility is eligible to apply directly to FEMA for PDM Grant Program funds as an applicant; however, only one application will be accepted from each state, tribe or territory.

## Funding Guidelines

The maximum federal share for sub-applications per HMA Guidance is as follows:

- $3 Million for mitigation projects
- $400,000 for new mitigation plans
- $150,000 for mitigation plan updates

A maximum of 10% of the total of mitigation planning and project grants can be used for dissemination of information about the activity. Additionally, a maximum 10 percent of grant funds awarded can be used for applicant management costs, and a maximum of 5 percent of grant funds awarded can be used for subapplicant management costs.

Federal funding is available for up to 75 percent of the eligible activity costs. Small impoverished communities may be eligible for up to a 90 percent Federal cost share in accordance with the Stafford Act. The remaining eligible activity costs are derived from non-Federal sources.

The period of performance for the PDM Grant Program begins with the opening of the application period and ends no later than 36 months from the selection date.

## Key FY 2015 PDM Grant Program Changes

- FEMA revised the application limits from FY 2014 to allow a maximum of 3 project sub-applications out of 11 sub-applications per applicant: 10 for mitigation planning and projects, plus 1 management cost sub-application for applicant management costs up to 10% of the total of the planning and project sub-applications.
- FEMA will prioritize mitigation planning and project sub-applications from applicants without Hazard Mitigation Grant Program (HMGP) funds available before applications from applicants with HMGP funds available.
- FEMA will prioritize activities in communities with the highest assessed Building Code Effectiveness Grading Schedule rating from a grade of 1 to 10.

## Application Submission and Review Process

Applications and sub-applications for the PDM Grant Program must be submitted via the Mitigation eGrants system on the FEMA Grants Portal: https://portal.fema.gov. If a subapplicant does not use the eGrants system, then the applicant must enter the paper sub-application(s) into the eGrants system on the sub-applicant's behalf.

Applicants may submit a maximum of 11 sub-applications, including 1 management cost sub-application for Applicant management costs. Of the 10 sub-applications for mitigation activities, a maximum of 3 projects may be included.

Applicants must rank their sub-applications in priority order. To be considered for the State and Tribal set asides, each applicant's number one ranked sub-application must not exceed $250,000 federal share.

If any applicant submits more than 10 sub-applications for mitigation activities, FEMA will only consider the 10 highest ranked sub-applications. If any Applicant submits more than 3 project sub-applications, FEMA will only consider the 3 highest ranked projects.

PDM Grant Program applications will undergo a complete eligibility review within their respective FEMA Region. FEMA will review planning and project sub-applications plus one management sub-application submitted by each applicant through the Mitigation eGrants system to ensure compliance with the HMA Guidance, including eligibility of the applicant and sub-applicant; eligibility of proposed activities and costs; completeness of the sub-application; cost effectiveness and engineering feasibility of projects; and eligibility and availability of non-federal cost share.

## Evaluation Criteria

FEMA will select eligible planning and project sub-applications in order of the agency's priorities for the FY 2015 PDM Grant Program:

- 1st priority: Mitigation planning and project sub-applications up to $250,000 Federal share per states/territories/District of Columbia consistent with Section 203 (f) of the Stafford Act
- 2nd priority: Up to $5 million for mitigation planning and project sub-applications up to $250,000 Federal share per tribal applicant
- 3rd priority: Mitigation planning sub-applications from applicants that do not have Hazard Mitigation Grant Program (HMGP) available
- 4th priority: Non-flood hazard mitigation projects from applicants that do not have HMGP funds available
- 5th priority: Flood mitigation projects from applicants that do not have HMGP funds available
- 6th priority: Planning activities from applicants that have HMGP funds available
- 7th priority: Non-flood hazard mitigation projects from applicants that have HMGP funds available
- 8th priority: Flood mitigation projects from applicants that have HMGP funds available

FEMA will prioritize planning and project activities within the 3rd through 8th categories above in order by communities with the highest assessed Building Code Effectiveness Grading Schedule (BCEGS) rating from a grade of 1 (exemplary commitment to building code enforcement) to 10. If necessary, FEMA will further prioritize projects by the highest FEMA-validated Benefit Cost Ratio.

## For Additional Information

Please see the Notice of Funding Opportunity announcement posted on grants.gov and the HMA Guidance available on the FEMA Internet: http://www.fema.gov/hazard-mitigation-assistance for more detailed information regarding eligibility.

###

***"FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards."***

***May 2011***

FEMA

# Fact Sheet

## FY 2015 Flood Mitigation Assistance (FMA) Grant Program

### Overview

*In Fiscal Year 2015, $150,000,000 is available to assist States, Tribal, Territorial and local governments reduce or eliminate claims under the National Flood Insurance Program (NFIP).*

As appropriated by the Department of Homeland Security Appropriations Act, 2015 (Public Law 114-4); the Fiscal Year (FY) 2015 Flood Mitigation Assistance (FMA) Grant Program provides resources to assist states, tribal governments, territories and local communities in their efforts to reduce or eliminate the risk of repetitive flood damage to buildings and structures insurable under the National Flood Insurance Program (NFIP) as authorized by the National Flood Insurance Act of 1968, as amended.

The FMA Grant Program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 with the goal of reducing or eliminating claims under the NFIP.

Consistent with Biggert-Waters Flood Insurance Reform Act of 2012 (Public Law 112-141), the FMA Grant Program changed in FY 2013 to allow more federal funds for repetitive loss properties and severe repetitive loss properties, and the Repetitive Flood Claims and Severe Repetitive Loss Grant Programs were eliminated.

The Hazard Mitigation Assistance (HMA) Unified Guidance applies to the FY 2015 FMA Grant Program application cycle. Applicants are encouraged to review the Notice of Funding Opportunity announcement and the HMA Guidance for detailed information regarding eligibility and to contact their FEMA Regional Office for additional information.

### Funding

In FY 2015, the total amount of funds distributed under the FY 2015 FMA Grant Program will be $150,000,000. The FMA Grant Program funds will be distributed on a competitive basis.

### Eligibility

All 50 States, the District of Columbia, Federally-recognized Tribal governments, American Samoa, Guam, Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands are eligible to apply for the FY 2015 FMA Grant Program.

Local governments are considered sub-applicants and must apply to their applicant state/territory.

Either the state Emergency Management Agency (EMA) or the office that has primary floodplain management responsibility is eligible to apply directly to FEMA for FMA Grant Program funds as an applicant; however, only one application will be accepted from each state, tribe or territory.

## Funding Guidelines

The maximum Federal share for planning sub-applications per 42 U.S.C. 4104c is $100,000 per Applicant with a maximum of $50,000 for state plans and $25,000 for local plans.

Technical Assistance up to $50,000 is available for states who were awarded FMA Grant Program funds totaling at least $1,000,000 in Fiscal Year 2014.

Additionally, a maximum 10 percent of grant funds awarded can be used by the state EMA for management costs, and a maximum of 5 percent of grant funds awarded can be used by the local EMA for management costs. For more information, please see the FY 2015 Notice of Funding Opportunity announcement.

The period of performance for the FMA Grant Program begins with the opening of the application period and ends no later than 36 months from the selection date.

## Key FY 2015 FMA Grant Program Changes

- FEMA revised the priorities for selection of mitigation projects on a competitive basis:
  - Projects with the highest percentage of severe repetitive loss properties with at least 2 claims exceeding market value
  - Projects with the highest percentage of repetitive loss properties
  - Projects with the highest percentage of severe repetitive loss properties with 4 or more claims exceeding $5,000 each for a total exceeding $20,000
- FEMA added mitigation of contiguous NFIP-insured properties as the last priority for funding

## Application Submission and Review Process

Applications and sub-applications for the FMA Grant Program must be submitted via the Mitigation eGrants system on the FEMA Grants Portal: https://portal.fema.gov. If a subapplicant does not use the eGrants system, then the applicant must enter the paper sub-application(s) into the eGrants system on the sub-applicant's behalf.

FMA Grant Program applications will undergo a complete eligibility review within their respective FEMA Region. FEMA will review planning and project sub-applications plus one management cost and one technical assistance sub-application submitted by each applicant through the Mitigation eGrants system to ensure compliance with the HMA Guidance, including eligibility of the applicant and sub-applicant; eligibility of proposed activities and costs; completeness of the sub-application; cost effectiveness and engineering feasibility of projects; and eligibility and availability of non-federal cost share.

## Evaluation Criteria

FEMA will select eligible planning and project sub-applications in order of the agency's priorities for the FY 2015 FMA Grant Program:

- 1st priority: Mitigation planning sub-applications consistent with 44 CFR Part 201 up to a maximum of $100,000 federal share per applicant
- 2nd priority: Projects that mitigate at least 50 percent of structures that meet definition part (b)(ii) of a Severe Repetitive Loss (SRL) property: At least 2 separate NFIP claim payments have been made with the cumulative amount of such claims exceeding the market value of the insured structure
- 3rd priority: Project sub-applications that mitigate at least 50 percent of structures that meet the definition of a Repetitive Loss (RL) property: Have incurred flood-related damage on 2 occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event
- 4th priority: Projects that mitigate at least 50 percent of structures meet definition part (b)(i) of a SRL property: 4 or more separate NFIP claims payments have been made with the amount of each claim exceeding $5,000, and with the cumulative amount of claims payments exceeding $20,000
- 5th priority: Projects that will reduce the risk profile in communities through mitigation of the largest number of contiguous NFIP-insured properties

FEMA will prioritize projects within the 2nd through 4th category above in order by the highest percentage of properties from 100 to 50 percent. If more than one project has the same percentage of properties that meet the definition, FEMA will prioritize projects by the largest number of properties to be mitigated that meet the definition. If necessary, FEMA will further prioritize projects by the highest FEMA-validated Benefit Cost Ratio.

## For Additional Information

Please see the Notice of Funding Opportunity announcement posted on grants.gov and the HMA Guidance available on the FEMA Internet: http://www.fema.gov/hazard-mitigation-assistance for more detailed information regarding eligibility.

###

*"FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards."*

*May 2011*

U.S. Army Corps
of Engineers ®
Charleston District

# Continuing Authorities Program (CAP)

CONTINUTING AUTHORITIES PROGRAM

**What is it?**
The Continuing Authorities Program (CAP) is sometimes referred to as the Small Projects Authorities. Small refers to the scale of the Federal funds spent as compared to much larger projects. Congress appropriates money to the overall program each year, which has standing authorities for the different Corps missions. The authorities are often referred to by a section number, which represents the section of the law that authorized the program, such as Section 205 for Small Flood Control projects and Section 206 for Aquatic Ecosystem Restoration projects.

**What is the process and how long does it take?**
Projects and studies under CAP vary in time and cost. However, all studies begin with an initial request from a governmental body or non-profit organization asking the Corps to assess a particular water resource problem. Once a request is received – all that's required is a letter asking for assistance – representatives from the Corps will coordinate a field visit to determine which of the CAP authorities apply to the situation. The process includes two phases:

(1) Feasibility Phase. The feasibility phase is the project formulation phase during which all planning activities are performed that are required to demonstrate that Federal participation in a specific project is warranted and to prepare for the initiation of the design and implementation phase for that project. Feasibility phase costs in excess of $100,000 require an executed Feasibility Cost Sharing Agreement and are cost shared 50/50 with the non-Federal sponsor.
(2) Design and Implementation Phase. This phase includes all post-feasibility phase activities, including design and construction, but not operation, maintenance, repair, replacement, or rehabilitation (OMRR&R) activities. Design and implementation phase costs are shared in accordance with general legislation for the applicable project purpose. OMRR&R of all CAP projects are the responsibility of the non-Federal sponsor.

**What does it cost?**
- Initial site visits and meetings to determine applicability are at full Federal expense.
- Portions of the initial studies are at full Federal expense.
- The remaining study and construction costs are cost shared at varying percentages, depending on the particular authority. Most are 65% Federal, 35% non-Federal sponsor.
- OMRR&R are at full non-Federal sponsor expense.


**Points of Contact:**

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Charleston District
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CONTINUING AUTHORITIES PROGRAM – Section 205

U.S. Army Corps
of Engineers ®
Charleston District

# Section 205 – Flood Damage Reduction

**What is it?**
Section 205 of the Continuing Authorities Program (CAP) gives the U.S. Army Corps of Engineers the authority to plan, design and construct flood control projects. These projects can be structural projects, such as modified channels, small reservoirs or small levees, or can be non-structural measures such as raising structures in place or removing them from the floodplain.

**Who can apply?**
Any non-Federal government entity can serve as the Sponsor for a Section 205 study. All it takes is a simple request to the local Corps office and a representative will discuss your problem with you and let you know if you qualify for the program. All Section 205 Sponsors must comply with the Federal flood insurance plan and prepare floodplain management plans within 1 year of project completion.

**What does it cost?**
- First $100,000 of the Feasibility Phase is 100% Federally Funded.
- The remainder of the Feasibility Phase is cost-shared 50%/50%.
- The Design and Implementation Phase is cost shared 65% Federal and 35% Non-Federal.
- There is a spending cap of $10 million of Federal expenditure per Section 205 project.
- All studies are subject to availability of Federal appropriations.

**How long does it take?**
CAP feasibility studies can take up to 2 years to complete and include two major milestones. The first milestone is a Federal Interest Determination document to be accomplished with the first $100,000. The second milestone is an Alternative Formulation Briefing (AFB) to discuss the selected alternatives for a potential construction project. The outcome of the AFB and the feasibility study will be a Detailed Project Report. The feasibility study includes all alternatives analysis, design work, NEPA compliance, and benefit-cost analysis. Construction time varies depending on the project being implemented.


**Points of Contact:**

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