



COUNTY COUNCIL OF BEAUFORT COUNTY  
BEAUFORT COUNTY PURCHASING DEPARTMENT  
106 Industrial Village Road, Beaufort, SC 29901

To: All Prospective Bidders  
Date: January 10, 2018

**ADDENDUM #1**  
**2018 Beaufort County Roads Resurfacing**  
**IFB #020818E**

The following information and attachments will amend, modify, and/or clarify the bid documents described above and are hereby part of the same. Please incorporate these items into the bidding documents for the above referenced project. Please acknowledge receipt of this on the bid form.

1. The McCracken Circle Drainage Improvement Report dated March 16, 2010, as prepared by Thomas & Hutton Engineering Co. is provided for INFORMATION ONLY.
  - a. Exhibit F – Engineer’s Opinion of Costs is not included.

Should you have any questions regarding this, please call the Beaufort County Purchasing at (843) 255-2304. As always, we appreciate your interest in doing business with Beaufort County.

Sincerely,

Original Signed

Dave Thomas, CPPO, CPPB  
Purchasing Director  
Beaufort County

**MCCRACKEN CIRCLE  
DRAINAGE IMPROVEMENTS REPORT**

**FOR**

**BEAUFORT COUNTY  
TOWN OF BLUFFTON, SOUTH CAROLINA**

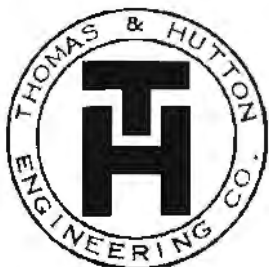
**J – 22171**

**FEBRUARY, 2010  
REVISED : MARCH 16, 2010**

PREPARED BY:

**THOMAS & HUTTON ENGINEERING CO.**

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# McCracken Circle Drainage Improvements Report

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# McCracken Circle Drainage Improvements Report

## PROJECT HISTORY

HE McCracken Circle, located in the Town of Bluffton, is approximately six thousand linear feet and is owned and maintained by Beaufort County. The road commences and terminates at Buckwalter Parkway as it loops around the HE McCracken Middle School, Elementary School and the Boys and Girls Club. The road was constructed prior to 2002, although the exact date of acceptance by Beaufort County is unknown by Thomas & Hutton.

Beaufort County and the Town of Bluffton have a vested interest in the roadway as it is owned and maintained by Beaufort County but falls within the municipal limits of the Town of Bluffton. Flooding or standing water has been continuously witnessed in areas along McCracken Circle since its construction was completed, most notably in the area adjacent to the entrance to Pinecrest and the Boys and Girls Club. The standing water appears to occur during varying types of rainfall. We do not have data verifying the specific storm event(s) causing the flooding but hypothesize standing water may occur in events as insignificant as the two (2) year storm. The storm event is related to the probability that a certain intensity of rain will fall in any given year. In the case of the two "2" year storm in Bluffton, the probability is 1 in 2 (or 50%) that 4.7 inches of rain will fall within a given year during a 24 hour period. Considering the number of times the road has flooded in the past, it would be reasonable to assume flooding begins to occur during rainfall events between 0 and 4.7 inches. Beaufort County's and the Town of Bluffton's design standards require the road to be designed and constructed to accommodate the twenty-five (25) year storm event which is equivalent to 8 inches of rain in 24 hours. At the present time, McCracken Circle does not meet these standards.

The area bound by and including McCracken Circle drains to three existing ponds. The pond analyzed in this report and associated stormwater model, is located within the Boys and Girls Club site across from the entrance to Pinecrest and is associated with the flooding problems on McCracken Circle. This pond is designated as *Pond A* and is shown on the attached Exhibit.

Thomas & Hutton has knowledge in regard to the standing water on McCracken Circle. Thomas & Hutton was hired by Centex Homes to design the Pinecrest subdivision in 2001. Prior to any design or construction, representatives from Centex Homes notified the Engineer of Record for McCracken Circle of their concerns regarding the flooding problems that were witnessed. There was concern the road might have a grade bust and that standing water could cause problems to the future homeowners. Centex Homes never received a response and to our knowledge nothing was ever done to remedy the situation.



# McCracken Circle Drainage Improvements Report

## PROJECT SCOPE

Thomas & Hutton was hired by Beaufort County to prepare a report to evaluate the flooding issues along McCracken Circle near the entrance to Pinecrest.

## PROJECT ANALYSIS

The Project Analysis was divided into steps in order to determine the problem(s) and potential solution(s). The steps are as follows:

- Step 1 – Compile Existing Data
- Step 2 – Site Visits
- Step 3 – Acquire Survey Information
- Step 4 – Stormwater Modeling for the area of concern
- Step 5 – Solutions

### Step 1 – Compile Existing Data

Thomas & Hutton has extensive knowledge of the area and specifically the problems occurring on McCracken Circle. We completed the design and permitting for Pinecrest, as well as Pine Ridge for Centex Homes and the survey information and the stormwater models for these projects were compiled and used as background information. The information compiled in this Phase is vital in determining the cause and solution for the flooding problems.

### Step 2 – Site Visits

Our previous experience designing the adjacent communities allowed us to have an understanding of the stormwater routing associated with McCracken Circle. We identified the areas of the roadway and roadside swales consistently holding stormwater runoff. We observed the path of the stormwater as it exits the pond at the Boys & Girls Club and enters the Box Culvert under Buckwalter Parkway. The stormwater flows as described below. This information is more clearly illustrated on the attached Exhibit.

Boys & Girls Club/School Run-off → Boys & Girls Club Pond (Pond "A") →  
Control Structure/Pipe (Pipe "A") → Bubbler behind Pinecrest (Bubbler) →  
Ditch to Pine Ridge (Ditch "A") → Pipe in Pine Ridge (Pipe "B") →  
Ditch through Pine Ridge (Ditch "B") → Pipe to Pine Ridge Pond (Pipe "C") →



# MCCRACKEN CIRCLE DRAINAGE IMPROVEMENTS REPORT

## Control Structure/Pipe to Culvert under Buckwalter Parkway ("Box Culvert")

During our site visit we observed the water surface elevation at critical points including the ponds, control structures, wetland ditches, and pipes/culverts listed above. It was our intent to determine if a blockage along the routing path may be causing the issues on McCracken Circle.

We started our evaluation of water surface elevations at *Pond A* and ended with the *Box Culvert* constructed under Buckwalter Parkway. We do not have the design plans for the Boys & Girls Club, therefore, we were originally unable to determine if the normal water elevation within *Pond A* was at the designed elevation. However, the weir elevation in the control structure was consistent with the normal water elevation of the pond so it appeared to be operating as designed. As shown above, the water exits *Pond A* and travels through a drainage pipe to the *Bubbler* within Pinecrest. The *Bubbler* is the outfall for a portion of the stormwater runoff from Pinecrest. As is often the case in the Bluffton and Beaufort County area, wetland ditches are used as a means of stormwater conveyance. The wetland ditches are an indicator of flow patterns, but often times can not be counted on for true conveyance or storage due to lack of topographic relief and regular maintenance. During storm events, these ditches tend to fill quickly and the associated wetland stages rise to varying levels according to the storm event. It is imperative to evaluate the wetland staging elevations if the outfall to a ditch within a wetland system.

The stormwater at the *Bubbler* location was observed to be at or slightly above the weir within the *Bubbler* and was slowly flowing into *Ditch A* indicating no blockages. Stormwater was observed to be moving slowly through *Ditch A* and *Pipe B* in Pine Ridge. The slopes in these ditches are typically flat and velocities will only increase during rain events that cause a head differential. *Pipe B* was flowing at 75% capacity and no blockages were observed in the pipe. *Ditch B* had similar characteristics of *Ditch A*. Water was observed to be traveling slowly through the ditch. *Ditch B* appeared to be more overgrown with vegetation than *Ditch A*. Water flowed through *Pipe C* into *Pond B* without any observed obstruction. The Stormwater then exited *Pond B* into the *Box Culvert* under Buckwalter Parkway without any observed obstruction.

It was determined that no significant obstructions exist in the system that would cause the flooding problems on McCracken Circle.

### **Step 3 – Acquire Survey Information**

After completing steps 1 and 2, additional survey information was gathered to complete the analysis. Field survey was collected at critical locations including McCracken Circle, wetland ditches, control structures and pipes. The additional survey was combined with the existing survey information to be used for the modeling analysis.



# McCracken Circle Drainage Improvements Report

## Step 4 – Stormwater Modeling

The intent of this report is to provide solutions to the flooding problems by retrofitting hydraulic elements within the stormwater system. To test the solutions a stormwater model was prepared for the observed system. The model consisted of a combination of existing information and new information collected during site visits and field survey. The Bluffton and Beaufort County Design Ordinances require streets of this classification to be designed to the 25 year/24 hour storm event. The model prepared included the hydrology simulation based on this requirement.

The existing and proposed conditions were analyzed using the Advanced Interconnected Channel and Pond Routing (ICPR) computer program developed by Streamline Technologies. The program is used to model rainfall and stormwater runoff and to perform hydraulic routing through the storm drainage system.

The hydrologic input data consists of information for each drainage basin, or subwatershed, within the project. Input variables include runoff curve number (CN), rainfall distribution pattern (Type III), hydrograph peaking factor (UH 323), area of each drainage basin (in Acres), and time of concentration (in Minutes).

The model hydraulic input data consists of a system of nodes and links. Nodes represent locations where flows enter or exit the system, pipe or channel characteristics change, or where stage/storage/time relationships are provided. Links represent traditional types of hydraulic conveyance such as pipes, channels, drop structures, weirs, etc. The sizes, inverts, lengths, and Manning n values for all pipes connecting the lagoons are input into the model. In addition to pipe information, all lagoon stage-storage information and the respective outfall structure information is input into the model. The node and link conditions are analyzed within the model for the 25 year/24 hour storm, and flow conditions are determined.

The Pinecrest and Pine Ridge models were merged and modified to only include hydraulic input of significance relating to the flooding problem on McCracken Circle. The watershed delineation needed to be modified to represent actual build out conditions as development in this area has impacted watershed boundaries since the completion of these two communities. The watershed was delineated with the use of a hydrologically enforced Digital Elevation Model (DEM), produced from lidar and record drawing information regarding stormwater flow patterns in the area. The preparation of a hydrological enforcement refers to adding features such as culverts, ditches, and canals to the DEM so that flow-networks depicting drainage patterns will be accurately defined.

Multiple iterations of the stormwater model were run based on the modification of different hydraulic elements such as weir, pipe and ditch elevations throughout the system. It quickly became apparent that modification of one or more elements had limited impact on the ponding elevations in the lagoon at the Boys and Girls Club (*Pond A*) and subsequently the amount of ponding water on McCracken Circle. During the design storm event, the water surface elevations at *Pond A* and throughout the system are always controlled by the downstream



## MCCRACKEN CIRCLE DRAINAGE IMPROVEMENTS REPORT

hydraulic grade. In this case, the downstream boundary condition was selected to be the *Box Culvert* under Buckwalter Parkway. Existing studies completed to date including the Pine Ridge Model, Buckwalter Drainage Study, Beaufort County Stormwater Management Plan as well as information collected in the field defined the tailwater in the Box Culvert under Buckwalter Parkway. As this tailwater backs up through the system, the resulting water surface elevations at McCracken Circle eliminate potential retrofit solutions. Flooding on McCracken Circle will continue to occur regardless of whether a weir, ditch or pipe invert is lowered. Additionally, because water travels through flat, overgrown terrain it moves very slowly. Therefore when a significant storm event occurs, McCracken Circle experiences extended periods of flooding. The hydraulic head differential created by the rain event and the eventual lowering of the wetlands elevations relieves the situation but it is a slow process.

### Step 5 – Solutions

#### **SOLUTION #1:**

Based on the results of the stormwater modeling, we determined that to hydraulically improve the situation another point of discharge for *Pond A* is required. The logical location was into the wetland along the northern entrance road at the Farm at Buckwalter. This location and elevation is shown on the attached exhibit. The elevations of the wetland are low enough to provide relief and prevent water from ponding on McCracken Circle. In our opinion, the cost and difficulty of constructing the amount of drainage pipe required to reach this location made the solution undesirable.

#### **SOLUTION #2:**

Based on the information and results of each of the steps listed above, the most viable solution to correct the flooding issues at McCracken Circle is to raise the elevations of the road to a level where it will remain dry during the 25 year / 24 hour storm event. The amount the road needs to be raised is represented on the attached exhibit. This study only looked at the area of McCracken circle adjacent to the entrance of Pinecrest. Beaufort County and the Town of Bluffton may also want to consider other areas of concern as well. We did not observe any other areas of flooding during our site visits. We recommend observing the roadway immediately following a significant rain event to determine if there are other areas of concern that need to be addressed during the design, permitting and construction for the improvements. As mentioned, we have prepared an exhibit to illustrate the estimated elevations of the roadway improvements. We have included as an attachment an Engineers opinion of cost of Probable Construction Cost for the required improvements, as well as, estimates for the required design, permitting and construction observation costs associated with the improvements.

The proposed solution shown on the attached exhibit includes two types of pavement sections. Section A will be used in areas where the grade difference between proposed and existing ground is less than approximately six to ten inches. Section A includes tacking the existing asphalt, placing leveling course to the required elevation and then applying a two inch surface





## MCCRACKEN CIRCLE DRAINAGE IMPROVEMENTS REPORT

course. Section B will be used areas where the grade difference is greater than approximately six to ten inches. Section B will include removing the existing pavement, adding fill material to create the subgrade, followed by a rock base and surface course. The thickness of the select fill and rock base course will depend on the finished grade elevations compared to existing. Specific means of construction should be further evaluated when design plans are prepared to ensure the most cost effective solution. In addition to the improvements to the roadway, Beaufort County may also want to consider adding material to the roadside swales to limit the amount of water standing within them. Currently, portions of the roadside swales are below the normal water of the pond and therefore hold water at all times. This has been considered in the cost estimate but is not a necessity.

Construction staging should not be a major issue for either of the school campuses. HE McCracken is a "loop road" and thus allows access from both sides. Pinecrest has multiple entrances and therefore traffic could be routed to the main access off Bluffton Parkway. The entrance to the Boys and Girls club will be impacted so construction may have to occur in stages or in the evening. There is the potential to construct a temporary access road from the area of McCracken not being impacted by the proposed improvements. Either way, it would be ideal to complete the improvements in the summer time while the traffic along McCracken Circle is at a minimum.

Thomas & Hutton recommends hiring a geotechnical consultant to evaluate the existing structural integrity of the roadway section being modified. Portions of the roadway may need to be removed and replaced if they have been compromised due to the standing water. This is difficult to quantify at this time and has not been included in the cost estimate. Budgets should be set prior to receiving the results of the geotechnical reports.

Improvements to the wetland ditches through Pinecrest and Pine Ridge should also be considered. As mentioned within the report, ditches require maintenance in order to function properly over time. Improving the ditches located within wetlands may require approval from the U.S. Army Corps of Engineers. Improving these ditches may help to decrease the amount of time required for the stormwater system to recover after rain events. The cost and time required to obtain approval to improve the wetland ditches may be prohibitive and not worth the benefit. Costs have not been included in our estimate but could be provided upon request.



# **MCCRACKEN CIRCLE DRAINAGE IMPROVEMENTS REPORT**

## **EXHIBIT A**

### **MCCRACKEN CIRCLE DRAINAGE IMPROVEMENTS**

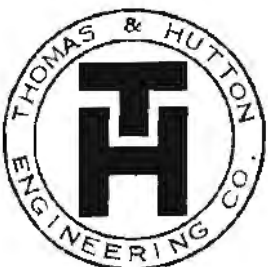
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**FEBRUARY, 2010**

PREPARED BY:

**THOMAS & HUTTON ENGINEERING CO.**

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# McCRACKEN CIRCLE DRAINAGE IMPROVEMENT EXHIBIT "A"

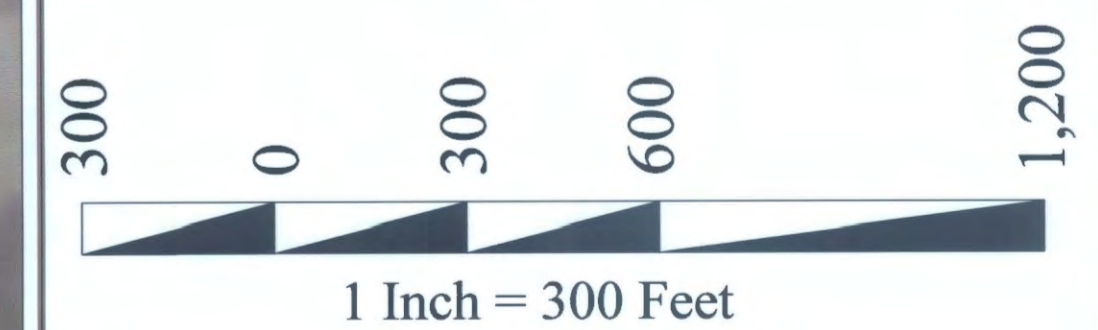
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TOWN OF BLUFFTON  
South Carolina

January, 2010  
J-22171.0000



## LEGEND

	DITCH
	24" RCP
	30" RCP
	36" RCP
	42" RCP
	48" RCP
	5' x 5' BOX CULVERT
	LAGOON
	MAY RIVER SUB BASIN
	CONTROL STRUCTURE
	FLOW PATTERN
	STORM MANHOLE
	WATER SURFACE ELEVATION



Note:  
Aerial photography: 2008  
Parcels shown: Beaufort County Tax Map Parcel Information - April 2009

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50 PARK OF COMMERCE WAY • PO BOX 2727  
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This map illustrates a general plan of the development which is for discussion purposes only, does not limit or bind the owner/developer, and is subject to change and revision without prior written notice to the holder. Dimensions, boundaries and position locations are for illustrative purposes only and are subject to an accurate survey and property description.

1 Inch = 60 Feet

**MCCRACKEN CIRCLE  
DRAINAGE IMPROVEMENTS REPORT**

**EXHIBIT B**

**MCCRACKEN CIRCLE  
LIDAR TOPOGRAPHY**

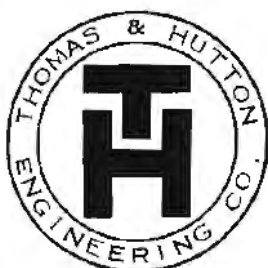
**J - 22171**

**FEBRUARY, 2010**

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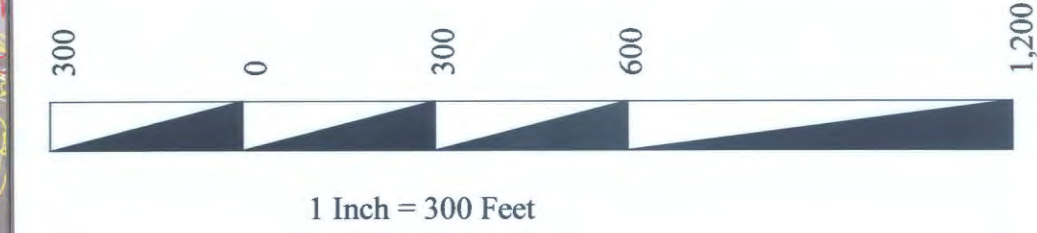
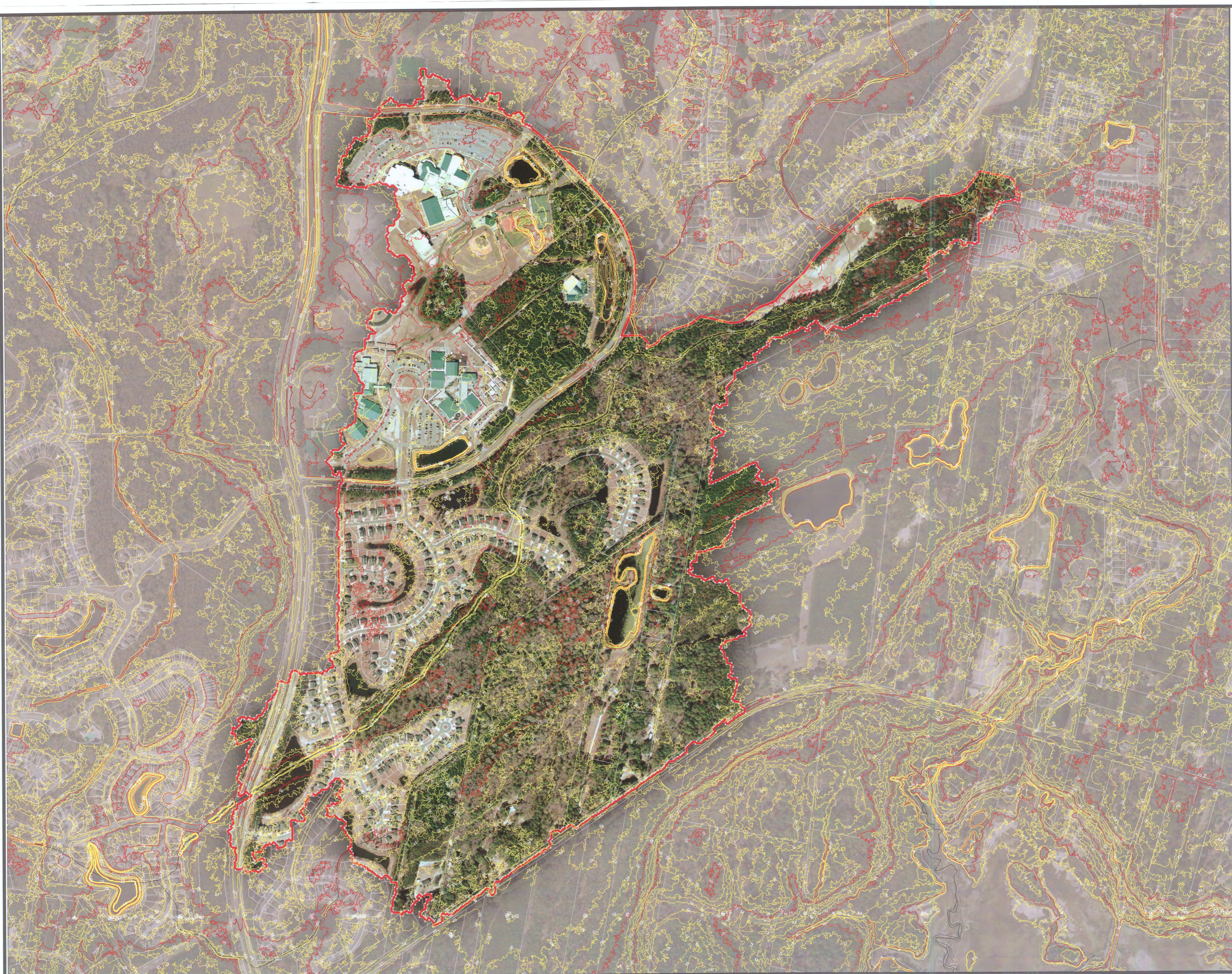
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# LIDAR TOPOGRAPHY EXHIBIT "B"

## BEAUFORT COUNTY & TOWN OF BLUFFTON South Carolina

January, 2010  
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1 Inch = 300 Feet

**Note:**  
Aerial photography: 2008  
Parcels shown: Beaufort County Tax Map  
Parcel Information - April 2009

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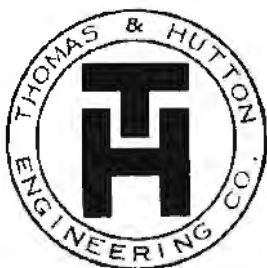
**McCracken Circle  
Drainage Improvements Report**

**EXHIBIT C**

**McCracken Circle  
Solution #1**

**J - 22171**

**FEBRUARY, 2010**



**MCCRACKEN CIRCLE  
DRAINAGE IMPROVEMENTS REPORT**

**EXHIBIT D**

**MCCRACKEN CIRCLE  
SOLUTION #2**

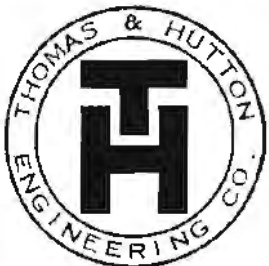
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**FEBRUARY, 2010**

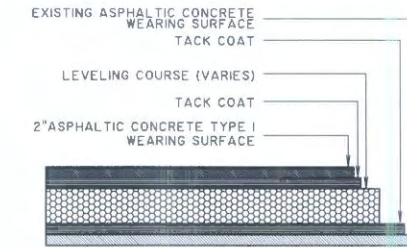
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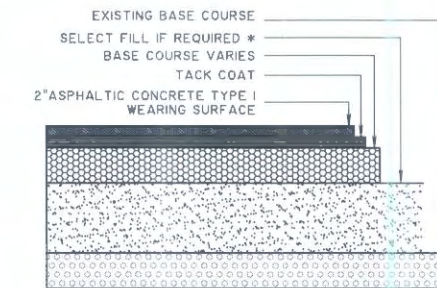


## SOLUTION #2 PAVEMENT SECTIONS



**PAVEMENT SECTION "A"**  
( USE SECTION "A" IN FILL SECTIONS FROM STATION 0 - 0+75 AND 4+05 - 8+60 )

NOT TO SCALE



**PAVEMENT SECTION "B"**  
( USE SECTION "B" IN FILL SECTIONS FROM STATION 0+75 - 4+05 )

NOT TO SCALE

- \* SELECT FILL TO BE USED WHEN DIFFERENCE BETWEEN FINISH GRADE AND EXISTING GRADE IS GREATER THAN 10"
- \* PAVEMENT SECTIONS TO BE DETERMINED BY GEOTECH

## McCRACKEN CIRCLE EXHIBIT "D" SOLUTION #2

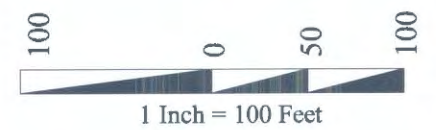
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South Carolina

FEBRUARY, 2010  
J-22171.0000



### LEGEND

	EXISTING PAVEMENT
	0"-6" FILL
	6"-12" FILL
	12"-24" FILL



**Note:**

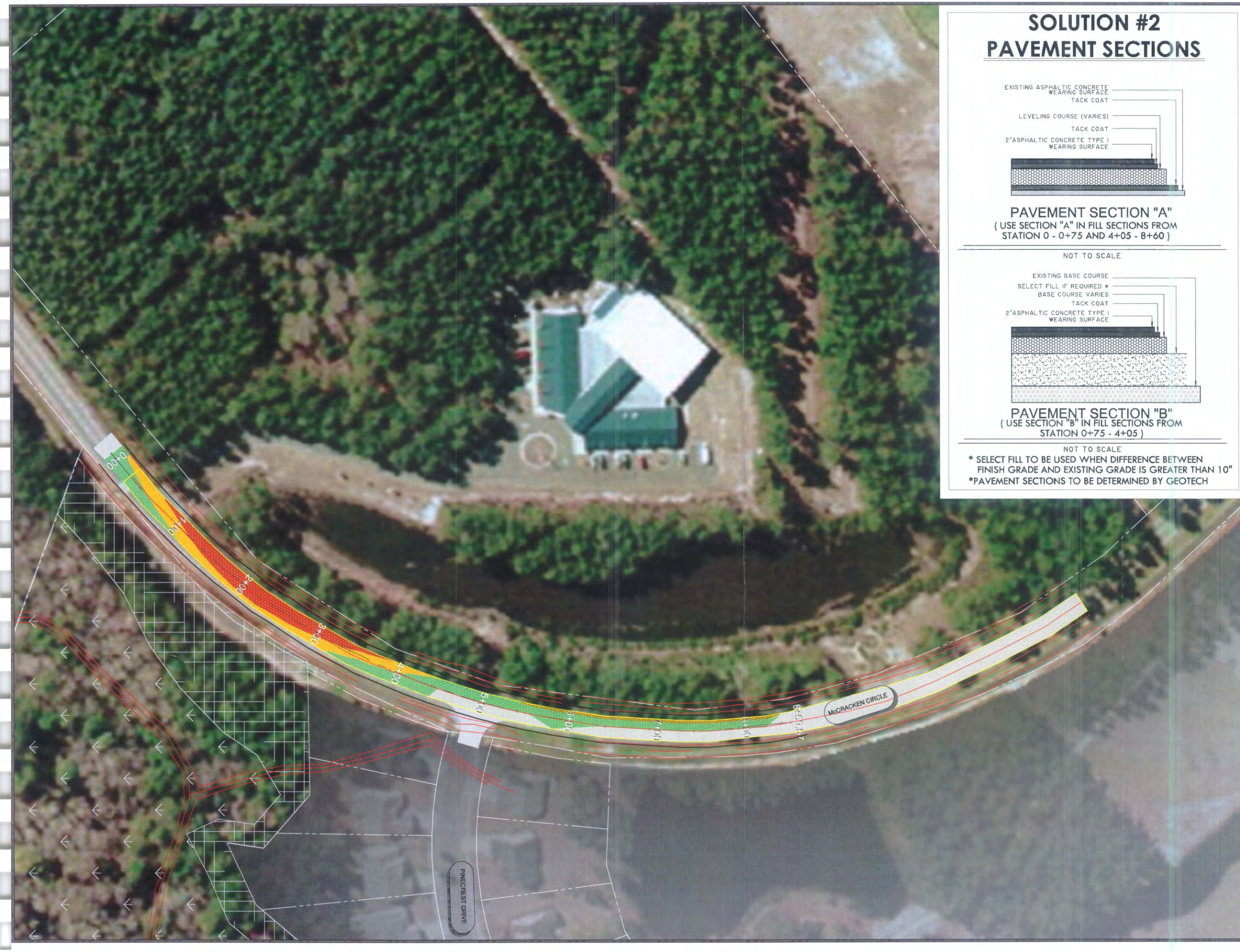
Aerial photography: 2008

Parcels shown: Beaufort County Tax Map Parcel Information  
- April 2009

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**MCCRACKEN CIRCLE  
DRAINAGE IMPROVEMENTS REPORT**

**EXHIBIT E**

**MCCRACKEN CIRCLE  
CROSS SECTIONS SOLUTION #2**

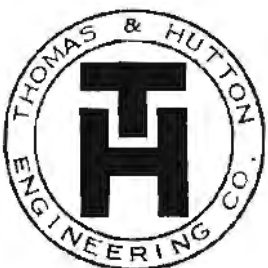
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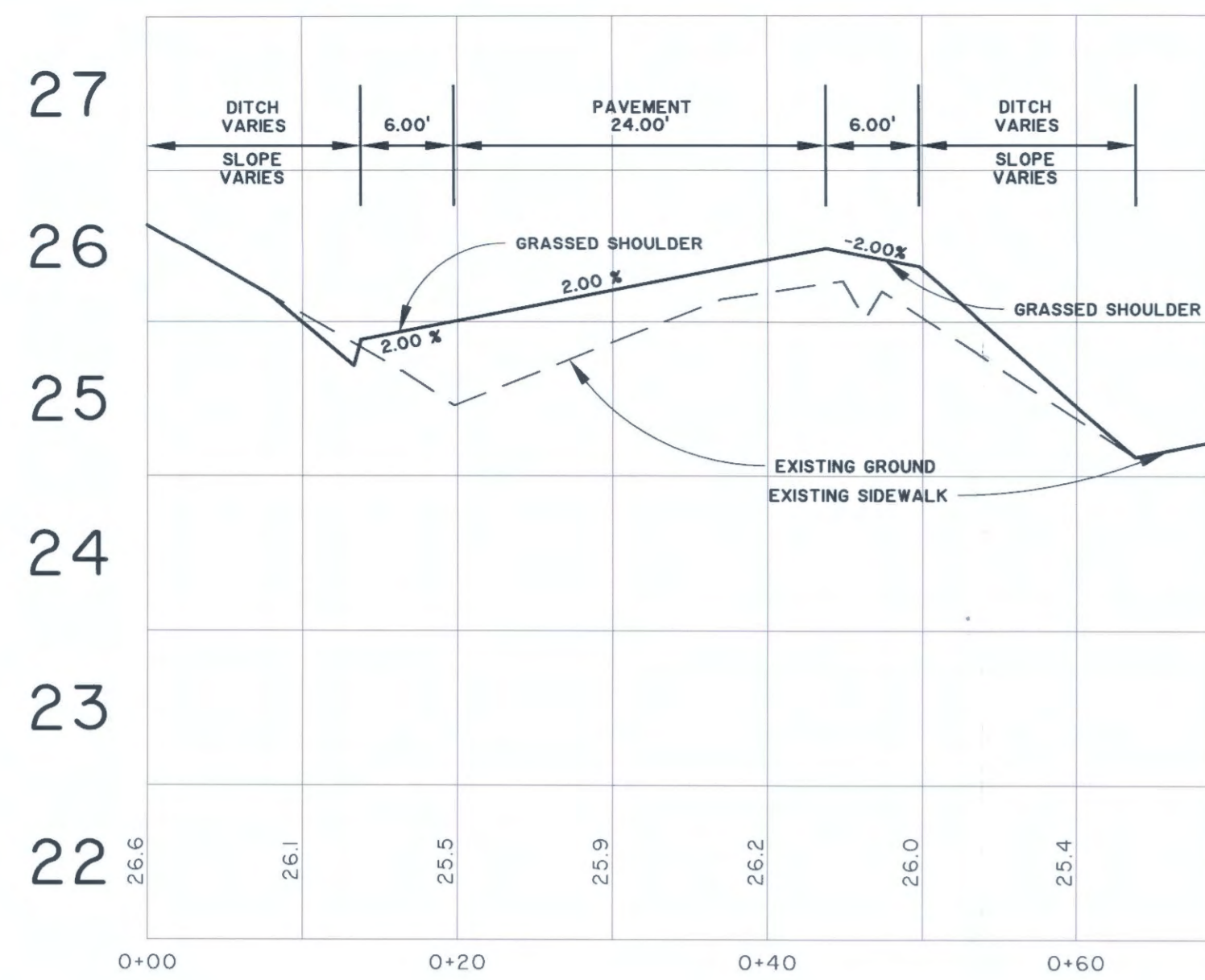
**FEBRUARY, 2010**

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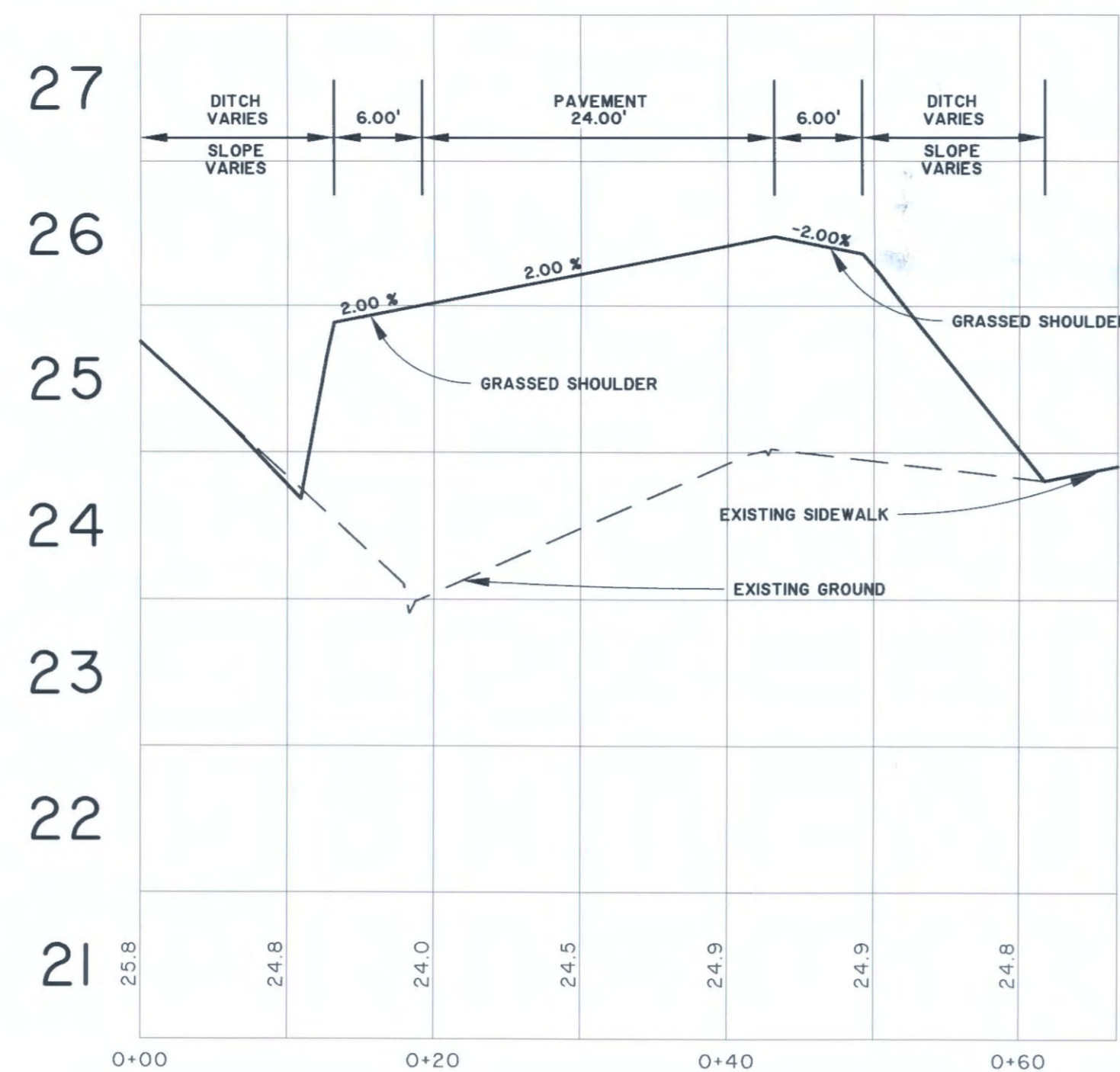
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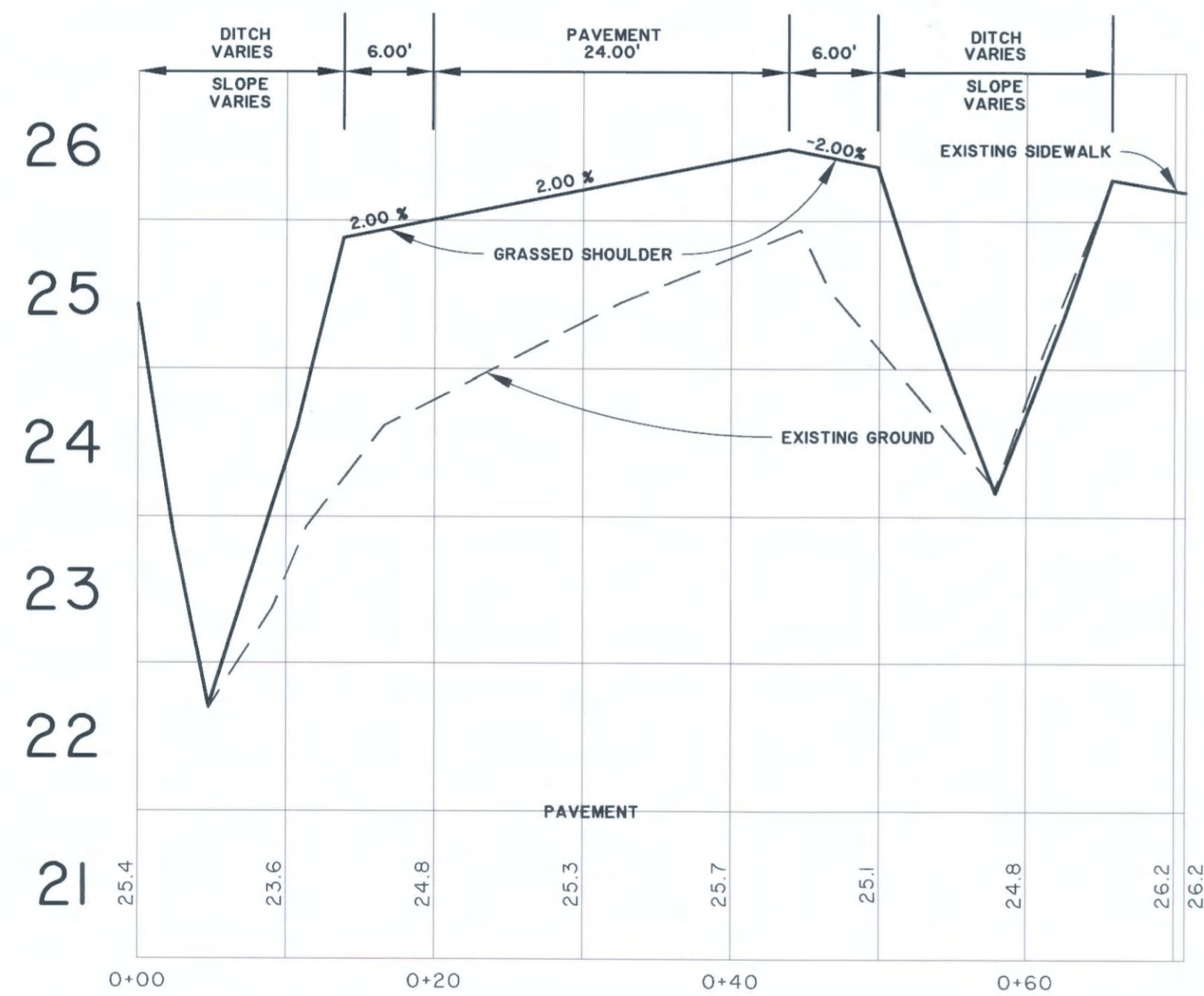




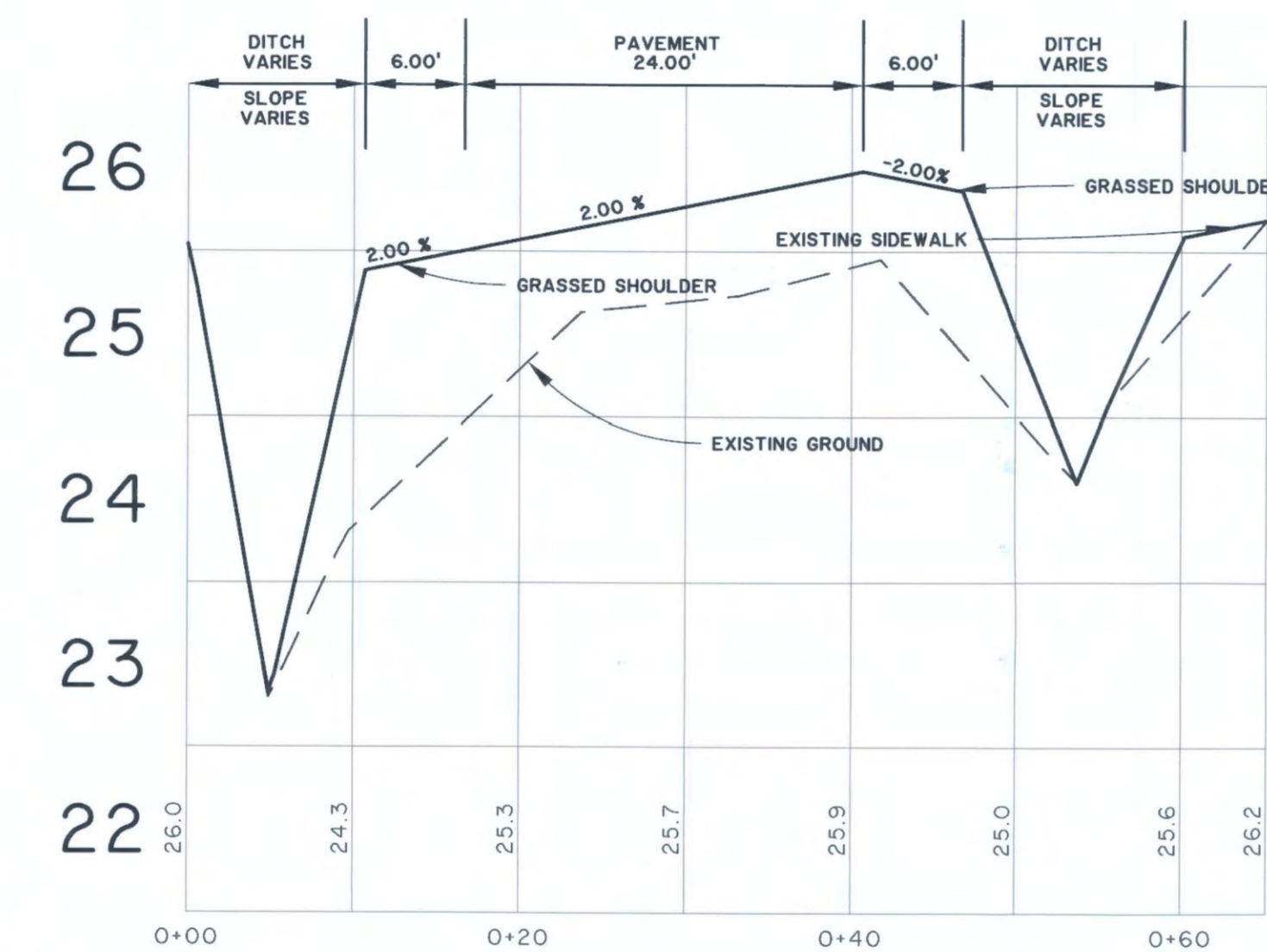
STATION 0+05



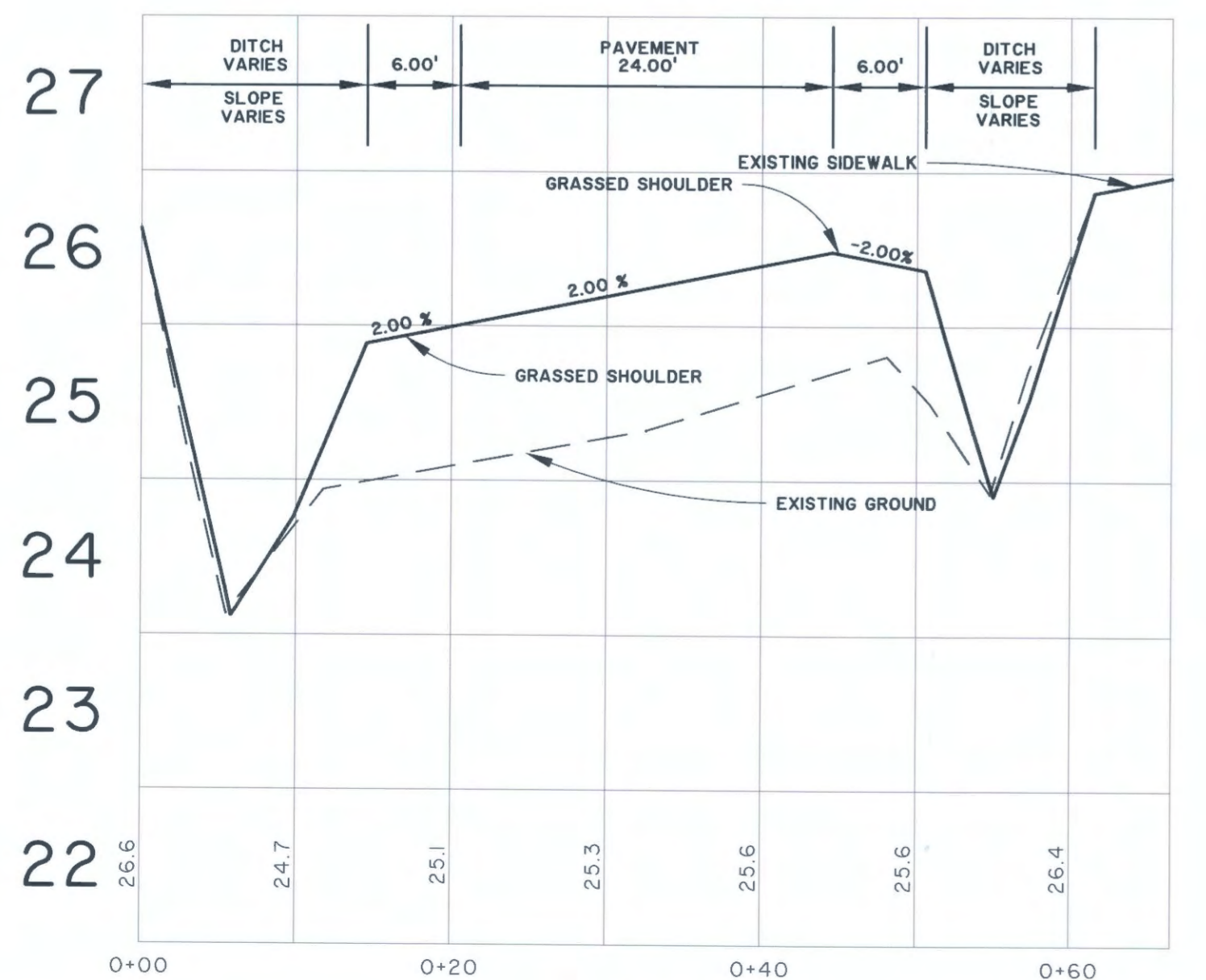
STATION 2+00



STATION 4+00



STATION 6+00



STATION 8+00

DISCLAIMER:

1. This exhibit illustrates a plan which is for discussion purposes only. It does not limit or bind the owner and is subject to change or revision without notice to the holder.
2. Property boundaries shown are approximate and have not been surveyed. Thomas & Hutton has used this data as is and have not verified the accuracy of the data.
3. Proposed grading is for illustrative purposes only and may or may not reflect final development.
4. Pavement sections not shown on cross-sections as contractor should determine means and methods of construction.

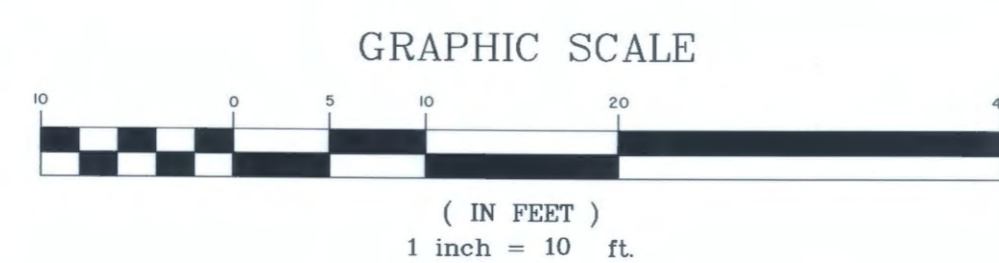


EXHIBIT "E"  
**McCRACKEN CIRCLE**  
 CROSS SECTIONS SOLUTION #2

PREPARED FOR:  
 BEAUFORT COUNTY &  
 THE TOWN OF BLUFFTON  
 SOUTH CAROLINA

PREPARED BY:

**THOMAS & HUTTON**  
 Engineering | Surveying | Planning | GIS | Consulting

50 Park of Commerce Way • PO Box 2727  
 Savannah, GA 31402-2727 • 912.234.5300  
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JOB NO: J-22171	DATE: March 15, 2010
DRAWN: DKC	SCALE: AS SHOWN
REVIEWED: RMS	SHEET: EX-D