Georgia Department of Transportation

SR 24 Washington County Georgia Landslide

Project Background

This project began as part of the Fall Line Freeway, which is a Governor's Road Improvement Program project.

- This program, also known as GRIP, is a set of proposed economic development highways that were adopted via legislation in 1989.
- These economic development highways are intended to provide rural Georgians better access to the Interstate System, provide opportunities for economic growth, and provide quality four-lane highways for efficient and safer transportation.
- The Fall Line Freeway is 215 miles long and extends from the Alabama State Line in Columbus to the South Carolina State Line in Augusta.

Project Background

The preliminary engineering for this section of the Fall Line Freeway began in 2004. The final soil survey for this project was generated in 2010 with the project letting for construction in 2011.

The project extended from Indian Trail Road (CR 10/CR 324) east to the Sandersville Bypass, in Washington County, Georgia.

The project was being constructed in GDOT's District 2, Area 1. The main District Office is in Tennille, GA which south of Sandersville.

GDOT
Georgia Department of Transportation

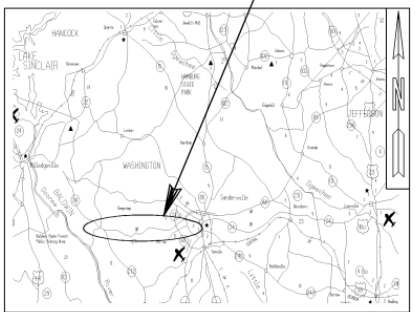
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	HPPNF-0540-00(029)	1	

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

PLAN AND PROFILE OF PROPOSED RECONSTRUCTION OF SR 24 WASHINGTON COUNTY

HPPNF-0540-00(029)

SITE LOCATION



LOCATION SKETCH

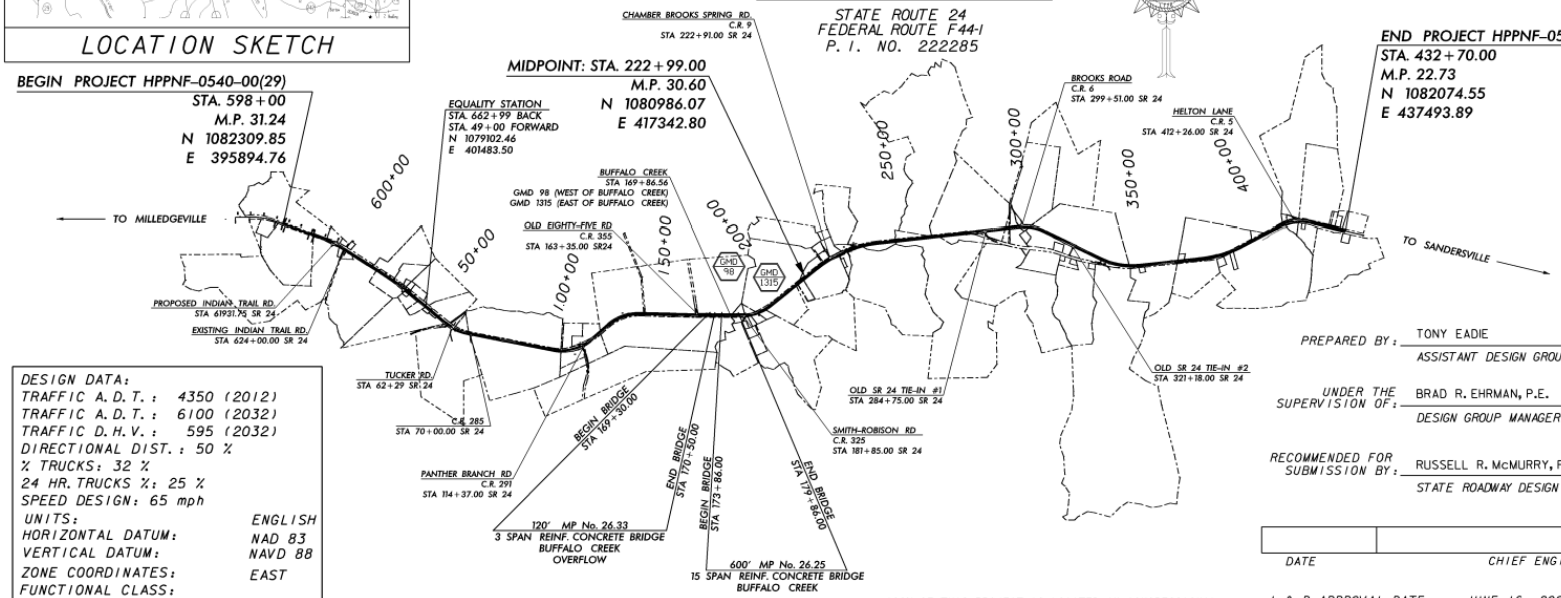
NOTE :
ALL REFERENCES IN THIS DOCUMENT, WHICH INCLUDES ALL PAPERS, WRITINGS, DOCUMENTS, DRAWINGS, OR PHOTOGRAPHS USED, OR TO BE USED IN CONNECTION WITH THIS DOCUMENT, TO " STATE HIGHWAY DEPARTMENT OF GEORGIA ", "STATE HIGHWAY DEPARTMENT ", GEORGIA STATE HIGHWAY DEPARTMENT ", " HIGHWAY DEPARTMENT ", OR " DEPARTMENT " WHEN THE CONTEXT THEREOF MEANS THE STATE HIGHWAY DEPARTMENT OF GEORGIA MEAN, AND SHALL BE DEEMED TO MEAN THE DEPARTMENT OF TRANSPORTATION.

BEGIN PROJECT HPPNF-0540-00(29)
STA. 598+00
M.P. 31.24
N 1082309.85
E 395894.76

MIDPOINT: STA. 222+99.00
M.P. 30.60
N 1080986.07
E 417342.80

END PROJECT HPPNF-0540-00(29)
STA. 432+70.00
M.P. 22.73
N 1082074.55
E 437493.89

STATE ROUTE 24
FEDERAL ROUTE F44-1
P. I. NO. 222285



DESIGN DATA:
TRAFFIC A.D.T.: 4350 (2012)
TRAFFIC A.D.T.: 6100 (2032)
TRAFFIC D.H.V.: 595 (2032)
DIRECTIONAL DIST.: 50 %
% TRUCKS: 32 %
24 HR. TRUCKS %: 25 %
SPEED DESIGN: 65 mph
UNITS: ENGLISH
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NAVD 88
ZONE COORDINATES: EAST
FUNCTIONAL CLASS:
RURAL PRINCIPAL ARTERIAL
PROJECT DESIGNATION: EXEMPT

THE DATA, TOGETHER WITH ALL OTHER INFORMATION SHOWN ON THESE PLANS OR IN ANYWAY INDICATED THEREBY, WHETHER BY DRAWINGS OR NOTES, OR IN ANY OTHER MANNER, ARE BASED UPON FIELD INVESTIGATIONS AND ARE BELIEVED TO BE INDICATIVE OF ACTUAL CONDITIONS. HOWEVER, THE SAME ARE SHOWN AS INFORMATION ONLY, ARE NOT GUARANTEED, AND DO NOT BIND THE DEPARTMENT OF TRANSPORTATION IN ANY WAY. THE ATTENTION OF THE BIDDER IS SPECIFICALLY DIRECTED TO SUBSECTION 102.04, 102.05, AND 104.03 OF THE SPECIFICATIONS.

SCALE IN FEET
0 2000 4000 8000

PREPARED BY: TONY EADIE
ASSISTANT DESIGN GROUP MANAGER

UNDER THE SUPERVISION OF: BRAD R. EHRMAN, P.E.
DESIGN GROUP MANAGER

RECOMMENDED FOR SUBMISSION BY: RUSSELL R. McMURRY, P.E.
STATE ROADWAY DESIGN ENGINEER

DATE CHIEF ENGINEER

100% OF THIS PROJECT IS LOCATED IN CONGRESSIONAL DISTRICT NO. 12.
100% OF THIS PROJECT IS LOCATED IN WASHINGTON COUNTY.

WASHINGTON COUNTY, COUNTY CODE 303
HPPNF-0540-00(029), P.I. NO. 222285

LENGTH OF PROJECT	MILES
NET LENGTH OF ROADWAY	8.361
NET LENGTH OF BRIDGES	0.136
NET LENGTH OF PROJECT	8.497
NET LENGTH OF EXCEPTIONS	0.000
GROSS LENGTH OF PROJECT	8.497

L & D APPROVAL DATE: JUNE 16, 2004

PLANS COMPLETED	- -
REVISIONS	

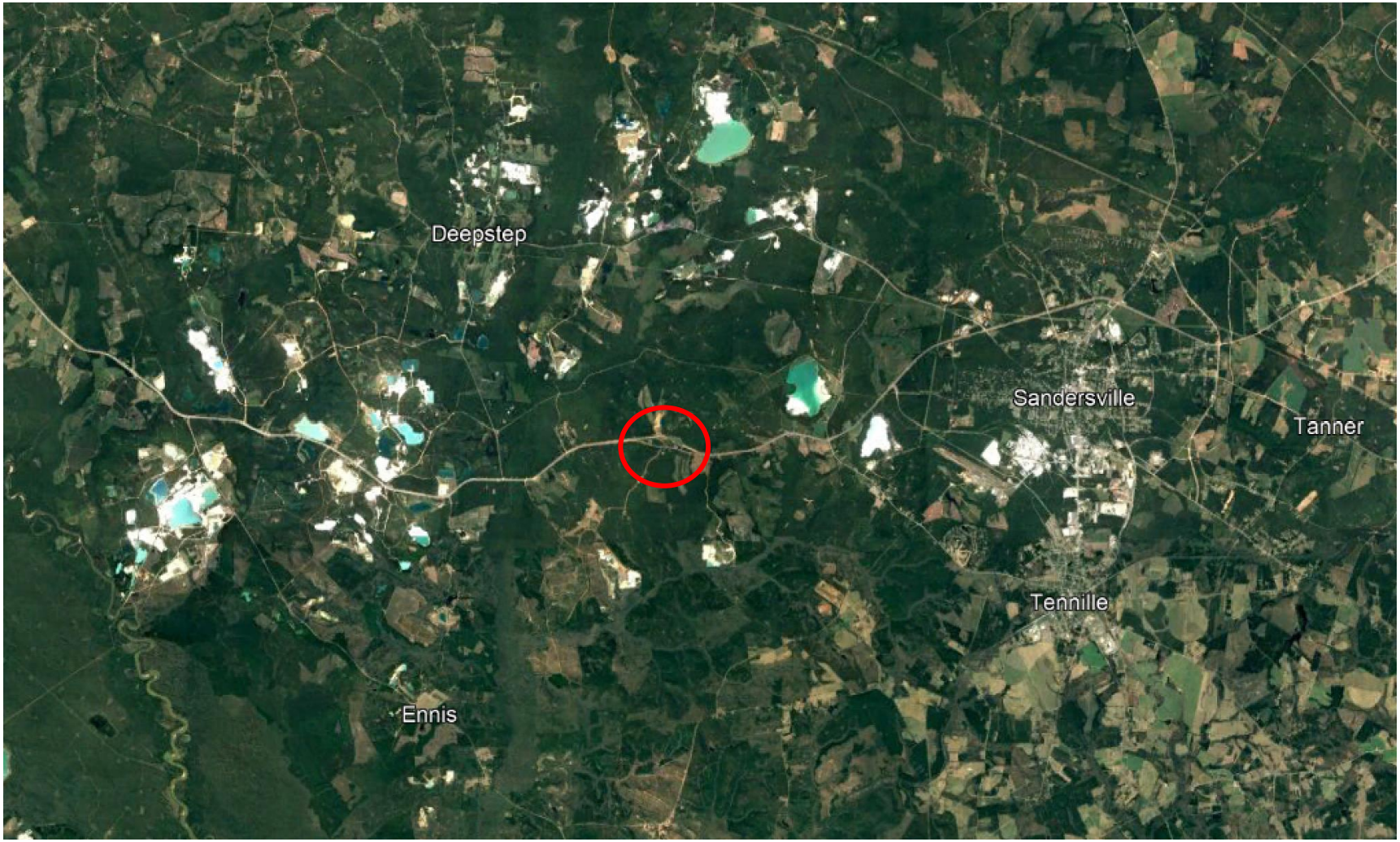
Wed Jan 13 11:08:43 2010
Wed Jan 13 11:08:43 2010

Location

The SR 24 corridor in Washington County has multiple, active kaolin mines. Kaolin was expected to be encountered during roadway construction based on the geotechnical investigation and past history in this area.

Numerous stability issues related to kaolin and other poor coastal plain soils have occurred in Washington County and neighboring Wilkinson County. Sections of the Fall Line Freeway on the US 441 alignment have had slope failures.

This project had numerous issues that the GDOT Geotechnical Bureau investigated prior to this fill section failure. Unstable subgrade and cut section stability were major issues during construction.



Reference: Aerial Photo from Google Earth

Location

The landslide occurred between Stations 308+00 to 320+00. This was a new, four-lane alignment section to replace the two-lane existing alignment. Embankment construction began in 2011 and paved in 2013.

The GDOT Geotechnical Bureau was contacted on March 15, 2016. Construction personnel in this District have dealt with multiple slope stability issues and immediately identified the tension cracks that formed in the pavement section as evidence of a potential slope failure. Because of their quick action, our Office was able to document the failure as it occurred.

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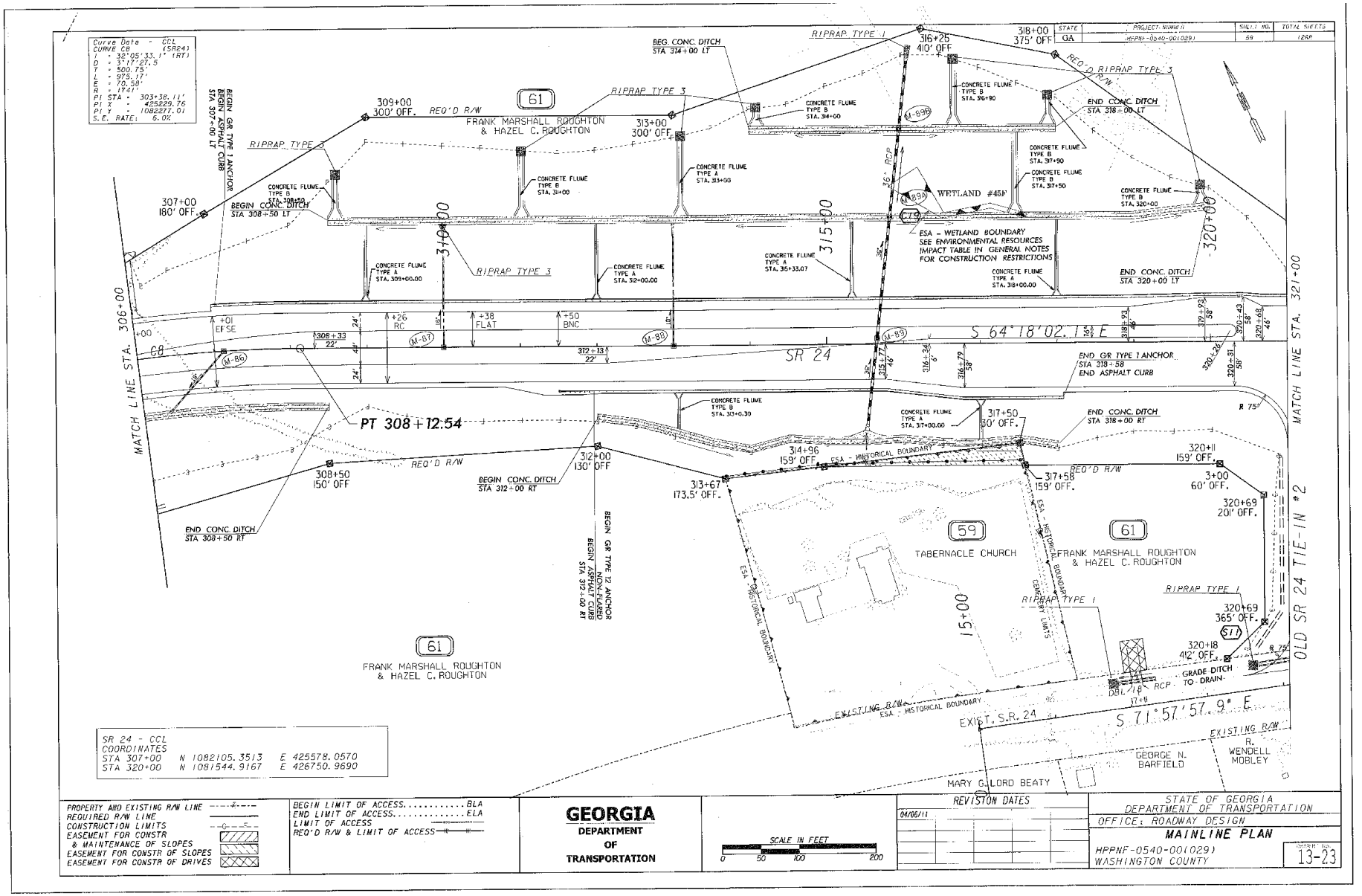

3/7/2011 Mon Mar 07 09:20:33 2011
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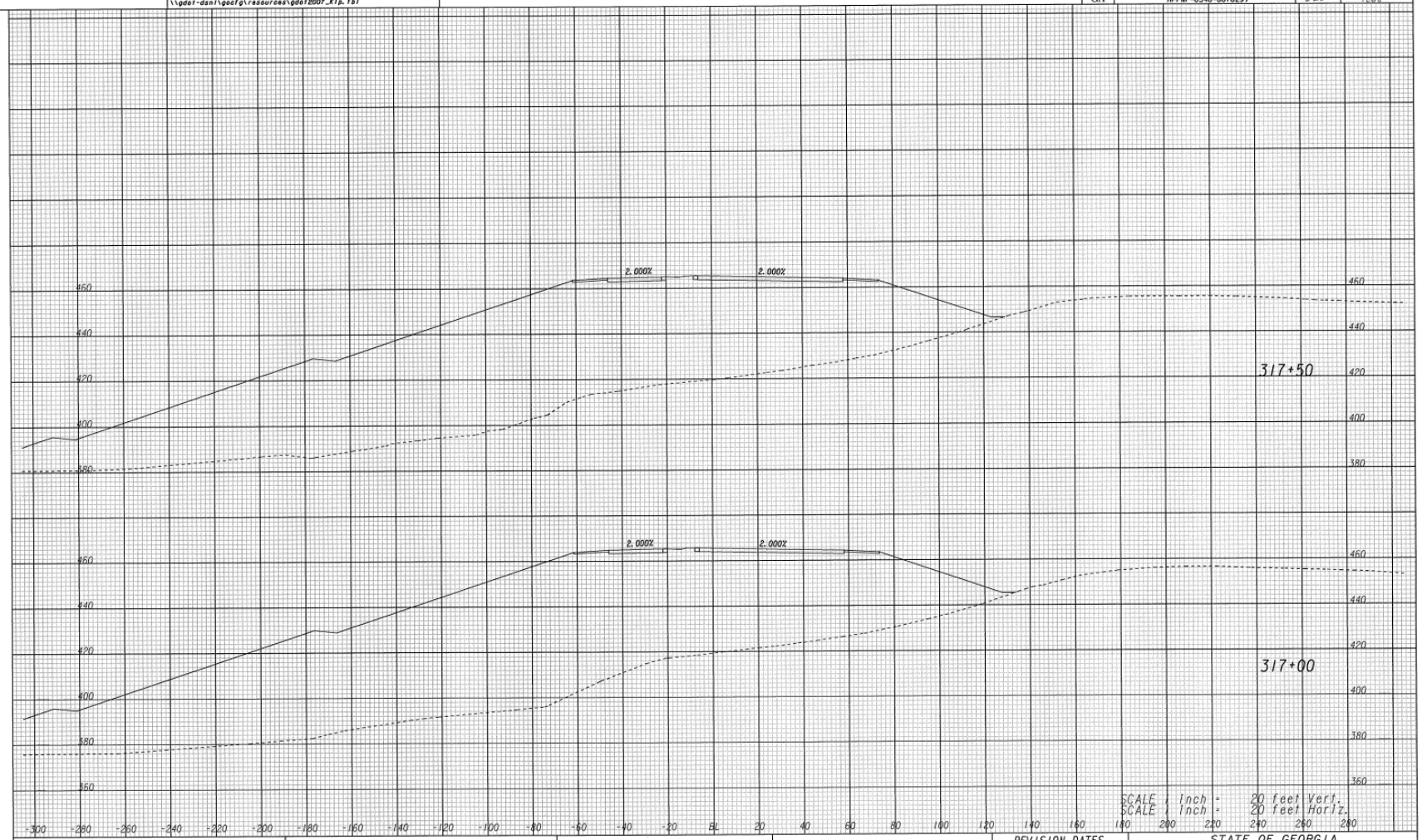
W:\222285\DGN\Staging Plans\TEMP ALIGNS\dsnle\STIKC53-P2.dgn
STATE GA
PROJECT NUMBER HPPHF-0540-00(029)
SHEET NO. 320
TOTAL SHEETS 1746



TEMPORARY PAVEMENT

GEORGIA
DEPARTMENT OF TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: ROADWAY DESIGN

CROSS SECTIONS CONSTRUCTION STAGING

STAGE I

DRAWING No. 19-192

3/7/2007 SUNSEW

Site Visits

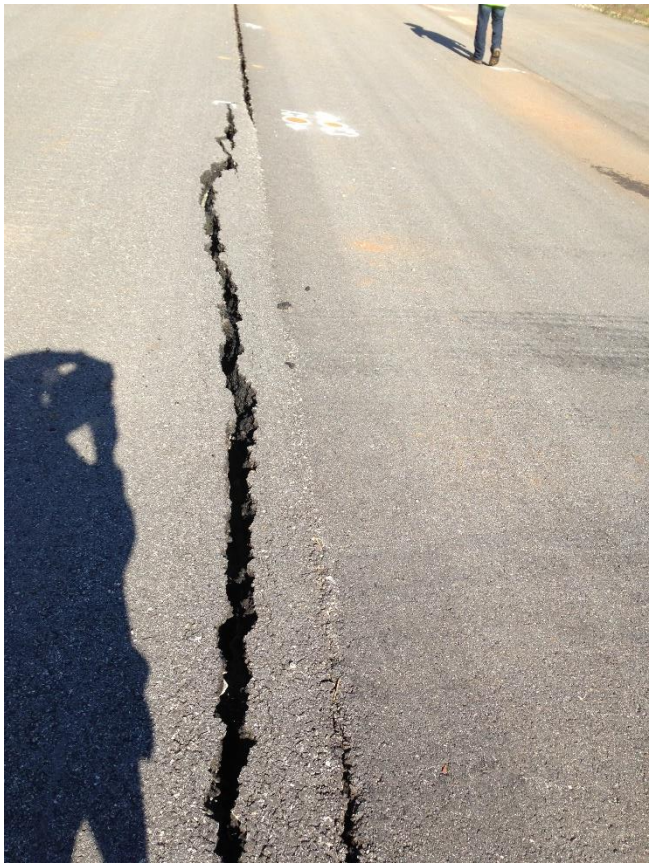
Photos were taken 3/21/2016

Site Visits

Photos were taken 3/21/2016

Site Visits

The failure progressed quickly, and our Office made multiple site visits to track the progress visually.



Failure

The slope completed its circular failure and began to drop around April 12, 2016. Approximately 6 inches of rain fell prior to this failure occurring which was a record based on the last 50 years of rainfall data.

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Investigation

After the failure, a deep dive into the previous geotechnical information and the construction decisions occurred. The research expanded to include any hydrologic changes that had occurred over time.

- One of the first things noted was additional, more extensive geotechnical drilling was going to be required to determine causes due to the borings not meeting current GDOT Geotechnical drilling guidelines.
- During the investigation of construction diaries and conversations with construction personnel, information about the changing hydraulic conditions during construction was uncovered. Local wells had been going dry and flowing water had been noted in places that had previously been dry.

Investigation

Based on past slope failures on projects in this District, close attention was paid to the construction methods and decisions made by the Contractor.

Diaries, official correspondence between the Contractor and the Department, and field logs were critical pieces of information to determine how this section had been built.

- Large pockets of kaolin were found mixed in with the fill placed on the slope. This would affect compaction in the fill.
- The source of the fill material was not entirely clear from the Construction documents. Borrow material would not have been approved with kaolin present. So, the source of the kaolin is likely from cut sections near this slope.

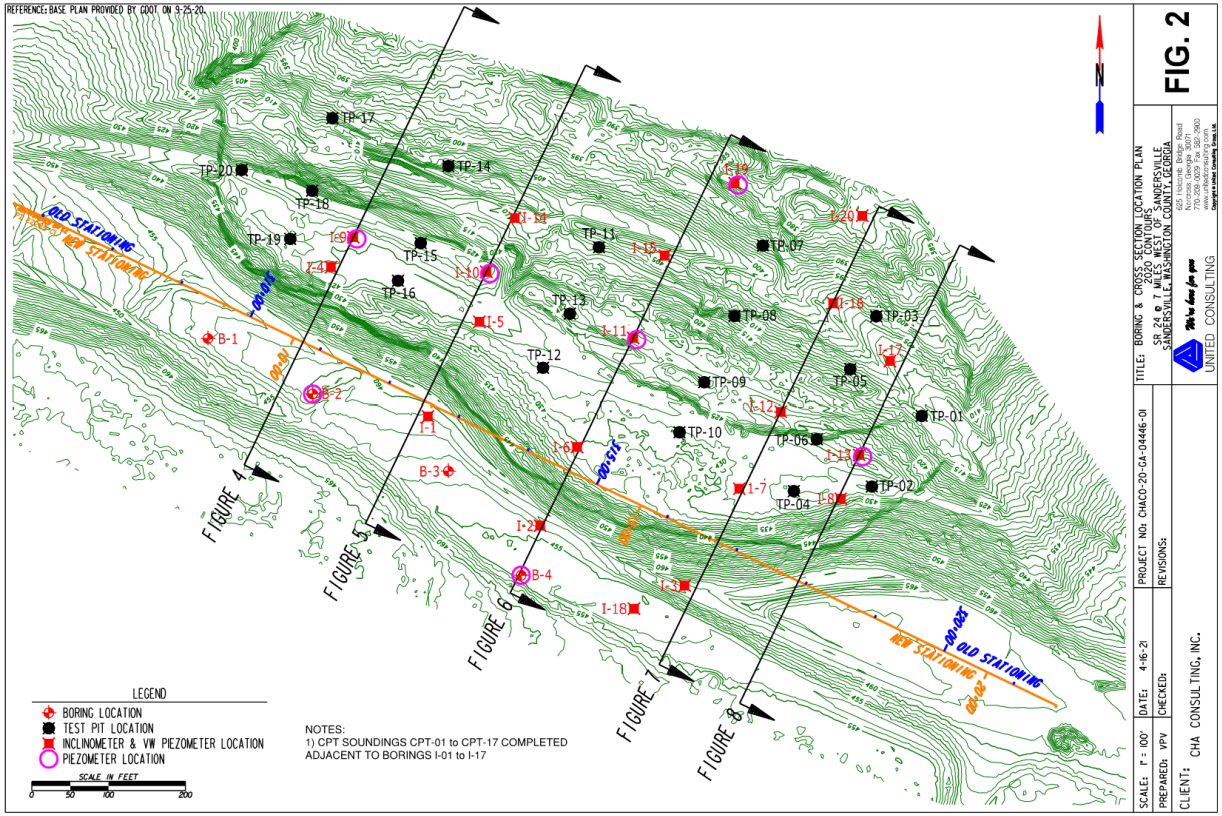
Investigation

GDOT's District 2 had an existing contract with CHA Consulting that was utilized to perform the geotechnical investigation and provide remediation options based on the results of that investigation. United Consulting was the geotechnical engineering firm working with CHA Consulting.

An extensive geotechnical drilling program was implemented to determine the causes of the failure and the current subsurface conditions.

Geotechnical Exploration

CPT borings, SPT borings, slope inclinometers, piezometers, and test pits were used to provide a complete subsurface investigation.



Reference: Geotechnical Exploration & Slope Stability Analysis (SSA) SR 24 @ 7 MI West of Sandersville Washington County, GA – United Consulting

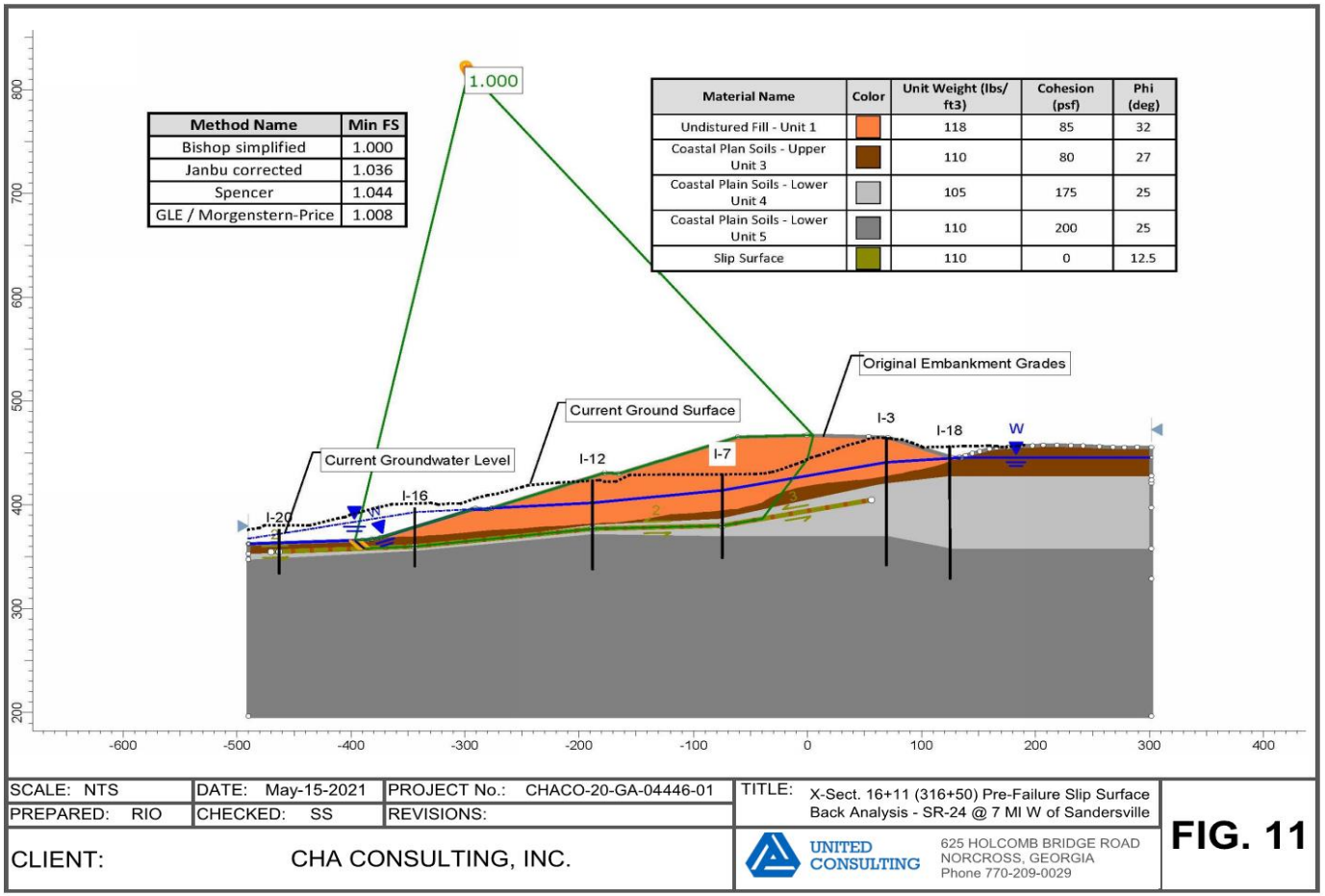
Geotechnical Exploration

Through this drilling program, information was gathered for a thorough back analysis of what the slope stability was at the time of failure and how to effectively remediate the slope at it's current stability.

It was also shown that the slide was still moving based on the last inclinometer readings in April 2021.

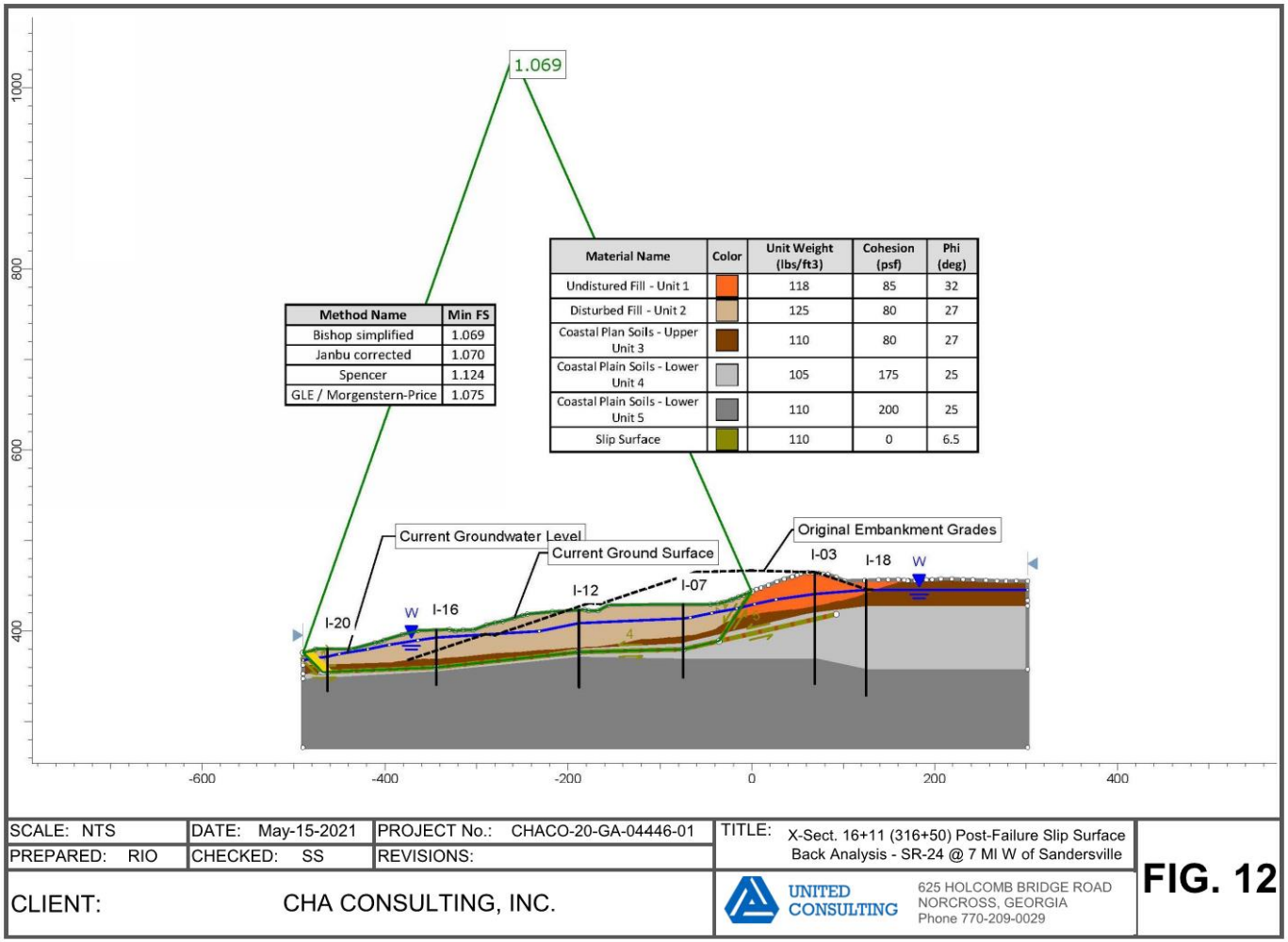
Groundwater and rainfall are the driving forces for this failure along the low shear strength subsurface soils.

Geotechnical Exploration



Reference: Geotechnical Exploration & Slope Stability Analysis (SSA) SR 24 @ 7 MI West of Sandersville Washington County, GA – United Consulting

Geotechnical Exploration



Reference: Geotechnical Exploration & Slope Stability Analysis (SSA) SR 24 @ 7 MI West of Sandersville Washington County, GA – United Consulting

Recommendations

The geotechnical report presented four (4) remediation options for GDOT.

- Groundwater Dewatering Collection Trench
- Anchor Stabilization Blocks
- Deep Soil Mixing Shear Panels
- Anchored Soldier Pile Walls

Recommendations

Groundwater Dewatering Collection Trench

This option would provide a passive method of increasing soil strength by dewatering the slip plane surface.

While this option provides a straightforward approach, having a collection trench would have maintenance issues due to the erodibility of the soils in the embankment and subsurface. Additionally providing a suitable groundwater outlet would be difficult because the surrounding properties are privately owned.

Recommendations

Anchor Stabilization Blocks

This option would provide an active method of resisting the failure forces.

GDOT has used this method of stabilization for failures in this area and the personnel in this District are familiar with managing projects with this option.

This was one of the preferred options by the GDOT Geotechnical Bureau.

Recommendations

Deep Soil Mixing Shear Panels

This option would provide a passive method of increasing soil shear strength through having underground soil-cement mixed panels.

GDOT has never used this method of stabilization, but our Office is familiar with the concept and implementation through FHWA literature and case studies.

Because this would be a pilot project for this method of stabilization, it was not considered a preferred option. However, if there were concerns with implementing the preferred options, our Office did note that this option should be considered.

Recommendations

Anchored Soldier Pile Wall

This option would provide an active method of resisting the failure forces.

GDOT has used anchored soldier pile walls for numerous failures across the state, these walls have low maintenance needs, and there are no concerns with managing projects with this option.

This was one of the preferred options by the GDOT Geotechnical Bureau.

Lessons Learned

GDOT's Geotechnical Bureau has recommended that soil surveys and other reports have a "shelf-life." If the report is more than 7 years old, the report should be reviewed to ensure it doesn't have any critical flaws that are addressed by current drilling and recommendation guidelines.

The scale of this failure has spurred the Geotechnical Bureau to work on developing a set of standard operating procedures for dealing with slope failure investigations and recommendations. These procedures are still being refined but the procedures used on this project have been successfully transferred to other slopes being remediated by GDOT.