*DECEMBER 22, 2000*

*FINAL DESIGN (100%) SUBMITTAL*

**CENTRAL AND SOUTHERN FLORIDA PROJECT**

# ENGINEERING APPENDIX FOR THE TAMIAMI TRAIL MODIFICATIONS

**GENERAL REEVALUATION REPORT/ SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (GRR/SEIS)**

# MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK


US Army Corps of Engineers

**Jacksonville District**


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# SYLLABUS

The Everglades National Park Protection and Expansion Act, December 1989, authorized the Secretary of the Army to undertake certain actions to improve water deliveries to the Everglades National Park (ENP) and to take steps to restore natural hydrologic conditions. The General Design Memorandum (GDM) called for in the Act was completed In June 1992. Under the provisions of this GDM and Environmental Impact Statement (EIS) for Modified Water Deliveries (MWD) to the ENP, water would be transferred from WCA-3B to the L-29 CanaI (Tamiami Canal) and through the existing culvert system south under U.S. Highway 41 (the Tamiami Trail) into Northeast Shark River Slough. When the GDM was completed in 1992 it was believed that existing culverts under the roadway would be adequate to convey the flow of water. Subsequent hydrological analyses, however, revealed that the head height In the L-29 Canal required for the culverts to convey the increased water could adversely affect the structure of Tamiami Trail and overtop low areas along the highway under certain conditions. The purpose of this project is to identify a technical solution to provide modifications to the Tamiami Trail to provide for the unimpeded conveyance of water from WCA 3B and the L-29 Canal to the Northeast Shark River Slough and the Everglades National Park south of the Tamiami Trail. The project must provide compliance with the Reasonable and Prudent Alternatives (RPA) of the February I9, 1999, U.S. Fish and Wildlife Service Final Biological Opinion on the Cape Sable seaside sparrow. This calls for at least 30% of the regulatory water discharges from WCA 3A to be re-routed Into Northeast Shark River Slough beginning on March 1, 2000. These waters would traverse WCA 3B and the Tamiami Trail, and enter the Everglades National Park instead of being discharged through the S-12 structures. This would rise to 45% and 60% in March 1, 2001 and March 1, 2002, respectively. it is also required that the project be compatible with hydrologic restorations provided by the Comprehensive Everglades Restoration Program.

Under the Modified Waters Program, authorized by the Everglades National Park Protection and Expansion Act of 1989, water deliveries to the Everglades National Park (ENP) will be improved as a step to restore natural hydrologic conditions increased flows to the Everglades National Park. Water from the South Florida Water Management District Water Control Area (WCA 3B) will enter the L-29 Canal (Tamiami Canal), pass under U.S. Highway 41 (the Tamiami Trail), and enter the Everglades National Park. Hydrologic studies, however, have indicated that the resulting water levels in the L-29 Canal will be sufficiently high to saturate the road base and potentially damage the structure of the road. Overtopping of the road may occur in low areas. Information found in this engineering appendix has been used to select the preferred alternative and evaluate the plans' ability to provide for unimpeded flow of water from the L-29 Canal to Everglades National Park.

# TAMIAMI TRAIL
# MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK

## PERTINENT DATA

US 41/TAMIAMI TRAIL

| | |
|---|---|
| West Project Limit | S-333<br>Sta. 580+46 on<br>Levee 29 |
| East Project Limit | S-334<br>Sta. 15+26 on<br>Levee 29 |
| Florida Dept. of Transportation State Route No. | S.R. 90 |
| Florida Dept. of Transportation Section No. | 870003 |
| Florida Dept. of Transportation Functional Classification | Rural Arterial |
| Roadway Design Speed | 60 mph |
| Roadway Posted Speed Limit | 55 mph |
| Number of Existing Travel Lanes | 2 |
| Number of Future Travel Lanes | 2 |
| Existing Average Daily Traffic (1999) | 5,200 vehicles |
| Projected Average Daily Traffic (2022) | 9,200 vehicles |
| Percent Heavy Trucks | 11.47% |
| Peak Hour to Daily Traffic Ratio | 9.29% |
| Directional Distribution Factor | 52.66% |
| Corridor Length | 56,520 feet/<br>10.7 miles |
| Datum | NGVD 29 |
| Design Stage Upstream of L-29 Borrow Canal | 10.5 feet |
| Design Stage at L-29 Borrow Canal | 9.3 feet |
| Design State Downstream of US 41/Tamiami Trail | 9.3 feet |
| Contract Price | |
| Alt. 1: Existing Alignment and Profile with Four New Bridges | $ 14,330,871 |
| Alt. 2: Existing Alignment with Raised Profile and Four New Bridges: Without Water Quality Treatment | $ 24,354,651 |
| With Water Quality Treatment | $ 58,550,658 |
| Alt. 3: New North Alignment with Raised Profile and Four New Bridges: Without Water Quality Treatment | $ 67,959,310 |
| With Water Quality Treatment | $ 73,457,368 |
| Alt. 4: New South Alignment with Raised Profile and Four New Bridges: Without Water Quality Treatment | $ 45,235,110 |
| With Water Quality Treatment | $ 47,128,438 |
| Alt. 5: New Alignment on Structure Without Water Quality Treatment | $ 135,915,000 |
| With Water Quality Treatment | $ 140,314,000 |

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# CENTRAL AND SOUTHERN FLORIDA PROJECT FOR FLOOD CONTROL AND OTHER PURPOSES

## TAMIAMI TRAIL
## MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK

## A. INTRODUCTION

### 1. Authorization

The Everglades National Park Protection and Expansion Act (PL101-229, Section 104, 16 U.S.C. Part 410r-5 *et seq.*, December 1989 (Annex A) authorized the Secretary of the Army to undertake certain actions to improve water deliveries to the Everglades National Park (ENP) and to take steps to restore natural hydrologic conditions. This act provides the underlying authority for this project. Section 104 of the Act stated:

- The Everglades National Park is a nationally and internationally significant resource and the park has been adversely affected and continues to be adversely affected by external factors, which have altered the ecosystem including the natural hydrologic conditions within the park. Wildlife resources and their associated habitats have been adversely impacted by the alteration of natural hydrologic conditions within the park, which has contributed to an overall decline in Fishery resources and a 90 percent population loss of wading birds.

The Act also provided direction for the U.S. Army Corps of Engineers to initiate corrective actions to alleviate deterioration in natural resources of ENP attributed to changes in water conditions associated with construction of the Central and Southern Florida (C&SF) water management system. The Act stated:

- Upon completion of a final report by the Chief of the Army Corps of Engineers, the Secretary of the Army, in consultation with the Secretary, is authorized and directed to construct modifications to the Central and Southern Florida Project to improve water deliveries into the park and shall, to the extent practicable, take steps to restore the natural hydrological conditions within the park.

- Such modifications shall be based upon the Findings of the Secretary's experimental program authorized in section 1302 of the 1984 Supplemental Appropriations Act (97 Stat. 1292) and generally as set forth in a General Design Memorandum to be prepared by the Jacksonville District entitled "Modified Water Deliveries to Everglades National Park." The Draft of such Memorandum and the Final Memorandum, as prepared by the Jacksonville District, shall be submitted as promptly as practicable to the Committee on Energy and Natural Resources and the Committee on Environment and Public Works of the United States Senate and the Committee on Natural Resources and the Committee on Public Works and Transportation of the United States House of Representatives.

The General Design Memorandum (GDM) called for in the Act was completed in June 1992. This GDM and Environmental Impact Statement (EIS) for Modified Water Deliveries (MWD) to the Everglades National Park is the authorizing document for structural modifications and additions to the existing C&SF Project required for the modification of water deliveries for ecosystem restoration in the ENP. The 1992 GDM stated, "The future without project condition will lead to the further deterioration of unique and outstanding ecological resources of the Everglades that are recognized and valued throughout the world." Therefore, based an the direction provided in the Everglades National Park Protection and Expansion Act of 1989, the goal is to restore natural hydrologic conditions in the Park to the extent practicable. Meeting this goal will lead to improvements in the abundance, diversity and ecological integrity of native plants and animals in the Park."

Section 528 of the Water Resources Development Act enacted October 1996 (Public Law [PL] 102-580) was entitled "Everglades and South Florida Ecosystem Restoration," This authorized a number of ecosystem restoration studies, now collectively known as the Comprehensive Everglades Restoration Plan (CERP). As a result of this Act, the Corps submitted a report to Congress on July 1. 1999, containing this comprehensive blueprint for Everglades restoration. Implementation of CERP will further increase the flow of water entering Northeast Shark River Slough. The plan has been approved as the Water Resources and Development Act of 2000.

## 2. Purpose and Scope

Under the current authorized and approved plan, water would be transferred from Water Conservation Area 3A (WCA 3A) to WCA 3B by constructing three new water control structures at Levee L-67A and three new water control structures at L-67C (Plate A0-0). Water would be passed from WCA-3B through S-355A and S-355B to the L-29 Canal and through the existing culvert system under U.S. Highway 41 (the Tamiami Trail) into Northeast Shark River Slough (ENP). When the GDM was completed in 1992 it was believed that existing culverts under the roadway would be adequate to convey the flow of water. Subsequent hydrological analyses, however, revealed that the hydraulic head in the L-29 Canal required for the culverts to convey the increased water could adversely affect the structure of Tamiami Trail and overtop the highway under certain conditions.

The purpose of this project is to identify a technical solution to provide requires modifications to the Tamiami Trail culvert system to provide for the unimpeded conveyance of water from Water Conservation Area 38 and the L-29 Canal north of the Tamiami Trail to the Northeast Shark River Slough and the Everglades National Park south of the Tamiami Trail, as provided by the 1992 General

In the eastern Everglades in the vicinity of Water Conservation Area 3B, the Modified Waters Delivery plan involves the construction of three gated culvert structures (S-345A, B, and C), three gated concrete headwall structures (S-349A, B, and C), and two spillway structures (S-355A and B). Also, the plan considers relocation of structure S-334, raising a portion of the Tamiami Trail (US 41), and degrading the existing Levee 67 Extension and filling the borrow canal. The recommended plan also includes flood mitigation in the residential area in the East Everglades. In addition, an airboat camp, and two Miccosukee Indian Camps were to be raised to prevent flood damages from occurring due to implementation of the project.

As an additional element of the overall project, it was recognized that modifications to the Tamiami Trail/US 41 corridor are required between spillway structures S-333 and S-334 to permit proper conveyance of the Modified Water Deliveries project maximum flows and to mitigate the impact of the resulting higher water surface elevations on the roadway and its subgrade.

To accomplish this objective, five alternatives were identified and analyzed with respect to their advantages and disadvantages. The results of this evaluation are documented in this Engineering Appendix, as part of the General Reevaluation Report/Supplemental Environmental Impact Statement (GRR/SEIS) for the Tamiami Trail Modified Water Deliveries Project.

# B. PROBLEM IDENTIFICATION

### 3. Basis for Objective

The basis for the project objective is to complement the other components of the Modified Waters Delivery Project by altering the Tamiami Trail between spillway structures S-333 and S-334 to convey the required movement of water and to do so in a way that conforms to the Florida Department of Transportation roadway design criteria which has jurisdiction over the Tamiami Trail roadway and right-of-way.

### 4. Objective

The primary objective of this project is to provide for the unimpeded conveyance of water from Water Conservation Area 3B to Everglades National Park between spillway structures S-333 and S-334, which are separated by a distance of approximately 11 miles. The water is to be conveyed under one or more roadway bridges along the existing or modified Tamiami Trail alignment, depending upon the alternative configuration which is selected. The location and configuration of the roadway bridges will conform to criteria resulting from the modeling of the water management and hydraulic system defined as part of the Modified Water Deliveries project. In satisfying the primary objective, this project must also mitigate the impact of higher Modified Water Deliveries project water elevations against the roadbed and roadway of the Tamiami Trail corridor, and satisfy Florida Department of Transportation criteria in this regard.

a. <u>Timing</u> - The planning, development, design and construction of a preferred solution for the Tamiami Trail objective has been incorporated into an overall master plan schedule for the Modified Water Deliveries project.

   Relative to the management of water deliveries, the proposed modifications to Tamiami Trail are consistent with the proposed water delivery and flow management regime that has been adopted for the Modified Water Deliveries project.

b. <u>Location</u> - The historic center of the Shark River Slough passed through what are now Water Conservation Areas 3A and 3B through the East Everglades into Everglades National Park. As part of the Modified Water Deliveries project, this historic flow path is to be restored hydrologically, and requires the modification of the

Tamiami Trail facility to properly convey the planned flows from Water Conservation Area 3B across the Tamiami Trail corridor into the expanded Everglades National Park. The modification of Tamiami Trail is needed to complete the location requirement for the modified flows.

c. Volume - Relative to the volume of water deliveries, the proposed modifications to Tamiami Trail are consistent with the proposed water delivery and flow management regime that has been adopted for the Modified Water Deliveries project.

## 5. Study Area

The study area for this investigation is the segment of Tamiami Trail/US 41 for an approximately 11-mile segment beginning 1 mile west of Krome Avenue in western Miami-Dade County, Florida. This includes a section beginning near structure S-334 on the L-29 Canal and extending westward to near structure S-333 on the L-29 Canal. This corridor location is shown on Plate A0-0.

## 6. Environmental Considerations

There are a variety of environmental considerations which must be incorporated in the definition and evaluation of alternatives. These elements are identified and discussed in Section F - Problems and Constraints. Specific environmental impacts, most significantly wetland impacts as well as others, are discussed in the narrative for each alternative.

# C. BASE CONDITION

## 7. History of the Tamiami Trail

The original Tamiami Trail appears to have been constructed in the late 1920's or early 1930's. The existing alignment was about 4 to 5 feet of peat and muck on top of limestone bedrock. The roadway embankment was constructed by dredging the bedrock, forming what is now the canal on the north side, and placing directly on top of the muck. The muck consolidated to a thickness of about 3 feet, and the granular embankment varies from 3 to 6 feet thick. A Rock Base Surface Treatment was applied as the driving surface.

In the mid-1940's, 20 timber bridges were added within the limits of this MWD project, as part of a larger 38 bridge project along the Tamiami Trail in Dade County. Each bridge was approximately 45 feet long and spaced about one-half mile apart. In the early 1950's, the bridges were replaced with the current culverts. In 1968, the shoulders were widened and guardrail was added along the north in 1970. Sometime in the 1970's or 1980's a nominal 4 inch asphalt overlay was placed and guardrail was added along the southern edge. The exact date is not known because there seems to be a missing record, but is inferred from drawings in 1993, which show those past improvements. Also in 1993 the trees along the north were removed, additional widening of the shoulders conducted, and the roadway received a nominal 2 inch mill with a 2.5 inch asphalt overlay. The construction method suggests that the embankment may contain muck and other organic pockets. The current roadway profile is variable, suggesting that the muck layer consolidated unevenly.

Several sets of plans were obtained from the Florida DOT archives in Tallahassee and reviewed. The plans pertinent to MWD include:

| State Job/Plan Set Number | Constructed | Scope |
| --- | --- | --- |
| 8711-109 | Near 1946 | Add 39 45-foot long bridges, 21 of which are in the MWD project area. |
| 8711-109 | Near 1951 | Remove 21 bridges in MWD area constructed in 1946 and replace them with culverts. |
| 8711-3501 | Near 1969 | Add 4 feet of additional pavement on the south side of the road. Shift centerline 2 feet to the south so that lanes go from 10 feet wide to 12 feet wide. |
| 8711-3901 | Near 1970 | Add guard rail on the north side of the north shoulder. |
| 87110-3506 | Designed in the late 1980's, and most likely constructed in 1993. | Widen left and right shoulder pavement with 5.5 inches of aggregate base, 4.2 inches of structural asphalt concrete, and 5/8 inches of friction course. A 2 inch mill and 2.5 inch resurfacing of the entire roadway. Removal of trees on the north side of road. Add asphalt concrete from the edge of structural shoulder to the outside of the guard rail on both the north and south sides of the road. |

## 8. Condition of the Existing Facility (Without the MWD Project)

### A. Existing Culvert Condition

The Florida DOT requires that culverts be designed for a projected maintenance-free time period or a design service life (DSL) appropriate for the culvert function and highway type. The projected service life of pipe material options shall provide as a minimum the DSL. The DSL for cross drains under U.S. 41 is 50 years based on the roadway classification, which in this case is considered a major facility because the traffic volume is greater than 1,600 vehicles per day Average Daily Traffic (ADT).

In estimating the projected service life of a pipe material, the performance of the material is based on environmental conditions, its theoretical corrosion rate, the potential for abrasion, and other appropriate site factors. Corrosion indicators include pH, resistivity , sulfates and chlorides. Those parameters were obtained at two different locations along the existing alignment and at two different depths at each boring. The parameters were obtained from a Florida Department of Environmental Protection (FDEP) certified laboratory, and their results are included in Appendix B-3.

The FDOT's Culvert Service Life Estimator Program (developed by FDOT's Corrosion Research Laboratory) was utilized with the aforementioned soil parameters and DSL's were determined for the four locations. The results indicated that the existing reinforced concrete pipe culverts under U.S. 41 have an estimated design service life in excess of 300 years. Given the fact that the existing culverts have been in operation approximately 50 years and the Service Life Program estimated the DSL's at 360 years, the existing culverts should continue to provide the required service to U.S. 41.

## B. Florida DOT Pavement Condition Analysis

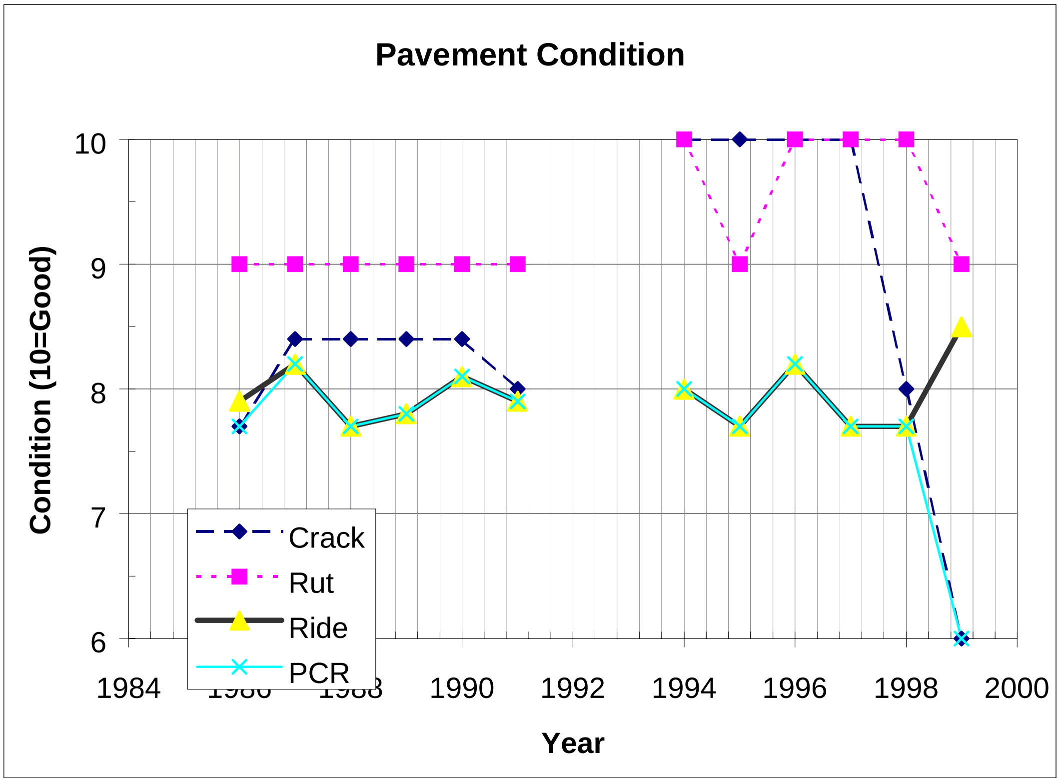
Available data from the existing pavement condition database from 1976 through 1999 was extracted from the Florida DOT database. The database was searched to find the particular section of interest, U.S. 41/Tamiami Trail. The Florida DOT roadway identification for the section of interest is 87110000, from Milepost 13.131 to Milepost 24.41. These milepost limits are within about 100 feet of the limits of this study corridor, and can be observed in the field as the termination of past resurfacings.

The following four condition rating categories were obtained from the Florida DOT pavement condition database. Note that these ratings are on a 0-10 scale, with 10 being excellent. These condition categories also form the basis for the pavement condition survey conducted by the subcontractor IMS, covered in the section entitled "Distress Survey." Also note that all of the ratings shown in Figure 1 are for the average of the 11-mile segment.

<u>Cracking</u>- rating that gives a measure of the amount of 3 different classes of cracking according to standard Florida DOT definitions. This is rated by the eye, and an overall rating is applied to the entire 11-mile section.

<u>Rutting</u>- rating that gives the amount of depression in the wheel path. A laser rut measurement device operated by the Florida DOT continuously measures this parameter.

***Figure 1***
***PAVEMENT CONDITION***



Ride- rating for the “smoothness” of the pavement. The road is driven using an automated device that measures longitudinal deflections. These deflections are converted to the International Roughness Index (IRI), a standard scale of roughness, and then converted to a 0-10 score.

Pavement Condition Rating (PCR)- the lowest of the 3 preceding ratings. The following chart summarizes the recent pavement condition ratings by the Florida DOT before and after the 1993 resurfacing.

The current Florida DOT condition rating is 6, which is the threshold at which a resurfacing project needs to be included into the Florida DOT 5 Year Work Program. A review of that Work Program indicates that this portion of the Tamiami Trail is scheduled for a pavement resurfacing in 2002, with a budget of $3.2 million. This status review indicates that the roadway is being managed within the Florida DOT policies and procedures.

Data outputs from the database are in Appendix C-1. As a note, there were no inspections made relevant to potential settlement or leaking joints associated with the existing culverts.

## C. Roadway Condition Investigations

As part of this analysis of conceptual road improvement alternatives in this corridor, further investigation beyond a review of historical or Florida DOT databases was needed. The additional investigations were performed to develop a general description of the existing roadway and levee (north of the canal), to evaluate the current pavement condition and how it would be impacted by raising the water elevation. The investigations conducted included a topographic survey, geotechnical investigation, and pavement-specific investigations of ground penetrating radar (GPR), distress survey and structural analysis using a Falling Weight Deflectometer (FWD).

## D. Topographic Survey

A conceptual level survey was conducted for this project. The survey consisted of a cross-section every mile and a centerline elevation every 500 feet. Plan and profiles are provided in Plates PP01-PP10. The centerline elevation varies from 10.06 to 11.92 feet along the majority of the project. At the west end, the roadway rises considerably to 15.0 feet to connect to the Tamiami Trail west of S-333. The average elevation for the study corridor, excluding the data above 12 feet (which is the rise at the west end), calculates to 10.95 feet. This figure was rounded to use a top of pavement centerline elevation of 11.0 feet for development of the concept alternatives.

Similarly, the top of the L-29 Levee varies from 15.1 to 21.0 feet, with an average of 17.12 feet. The top of levee elevation for concept development is rounded up to 17.4 feet because that is the ultimate height of the proposed Pump Station 356 (not part of this project) tieback levee.

## E. Geotechnical Investigation

### Overview

A geotechnical investigation was conducted by subconsultant LawGibb Group of Miami in July 2000. A copy of that report is provided in Section L of this report. Briefly, the purpose of that investigation was to obtain a general understanding of the embankment and the levee that is north of the canal. The investigations aided in the development of concept alternatives and were not intended to be complete and sufficient for final design.

The geotechnical embankment investigations are general in scope for two main reasons. First, a general understanding is needed so a better defined scope for quantity and locations of borings, test pits, types of materials expected to be encountered, and quantities and types of testing to be conducted can be developed. Second, it is possible that the selected option for MWD may be a different alignment than existing, or require complete reconstruction of the existing alignment. Therefore, it would not be prudent to invest in exhaustive final design level investigations for data that would not be used for the final design. Regardless of which option is ultimately selected, a further, detailed geotechnical investigation needs to be conducted, and the results of this investigation can and should be used as a guide.

The geotechnical investigation consisted of 16 borings: 10 were in the roadway embankment and 6 in the levee. The 10 in the roadway were located to have 6 in the outside wheel path and 4 in the shoulders. Plate B-1 shows the roadway borings. The levee borings were 3 in the lower maintenance road and 3 in the top of the levee. All borings were extended until the bedrock was reached.

The results are provided in Section K and are summarized as there is nominally a 6 inch thickness of asphalt pavement on an approximate 3 foot thick granular embankment over the muck. The muck is underlain by the limestone bedrock. The granular embankment gradation is classified as a coarse to fine limestone gravel with only some fine sand and little, if any silt. In the Unified system, it is a GP-GM. We do know from field observations that large boulders, perhaps 12 inches diameter, exist that were not extractable from the borings.

A key issue is the elevation of water in the embankment which varies from 5.6 to 9.4 feet, with most of the elevations at 7.4 feet. The elevations of the water in the levee itself varies from 6.1 to 9.4 feet, with most less than 7 feet. Considering the variability of measuring the water in the holes, and after conferring with the Corps of Engineers, it is conservative to use a nominal average water elevation of 7.5 feet for July 2000 in the L-29 Canal. Therefore 7.5 feet is used for the existing Design High Water elevation in the embankment and the levee for development of the concept alternatives.

Of interest in the geotechnical testing is the fact that the optimum moisture content of the embankment material is generally 9% at a dry density of 126 pcf. Moisture contents in the field are typically 7 to 9% in the top foot of the granular embankment (i.e. 2 to 3 feet above water table). Within about a foot above the water table, the natural moisture contents are 7 to 15%, and below the water table the moisture content is 20 to 23%. This essentially indicates the capillary rise in the embankment stops about 2 feet above the water table. As the water level in the canal is controlled by the Corps of Engineers, and they indicate that 7.5 feet is a conservative high elevation, it is reasonable to assume that these are worst-case situations without an increase in water elevation.

The muck thickness from the boring logs varies from zero to 3 feet thick with most thicknesses about 2 feet. It is noted that it was difficult to determine the precise thickness of the muck in the field because little or none was recovered from the hole. The sampling spoon often sank through the muck under its own weight. Therefore, it is recommended that for the purposes of these conceptual alternatives, the muck thickness be assumed to be 3 feet thick everywhere beneath the roadway and levee embankments. This amounts to a top of muck elevation of 5 feet and is used for development of the concept alternatives. Similarly, the thickness of the granular embankment is assumed to begin at the top of the muck.

As no borings were extended in the wetland areas, the elevation of the muck in its natural, undisturbed state is approximated from historical drawings. Using the Corps of Engineers drawings from the canal widening, the undisturbed top of muck elevation is about 6 to 6.3 feet. A conservative top of muck elevation of 6.5 feet is used.

The elevation of the bedrock varies from 1.7 to 6.1 feet, with most of the elevations slightly above 3 feet. For conservative estimation of embankment quantities and performance behaviors, the elevation of the bedrock is assumed to be 2 feet for development of the concept alternatives. Reviewing available geotechnical data, this appears to be a reasonable conservative elevation to utilize.

**Condition of the L-29 Levee**

One alternative alignment for this study involves relocating the roadway on the existing levee north of the canal. The geotechnical investigation extended three borings through the levee and three through the maintenance road. What is evidenced is the levee was built with the same construction technique as the roadway embankment, namely the limestone bedrock piled on top of the muck. By the mere nature of the consolidation potential of the muck, and the large amounts of fill required to provide a 2 lane roadway (existing levee top is only 10 feet wide), it is not prudent to build the majority of a roadway on an engineered embankment and allow part to be on an uncontrolled fill. Also of concern are the low SPT blow counts of the levee. They are typically 3 to 5 per foot; these are similar to the blow counts in the roadway embankment *that is submerged*.

This suggests that the levee is of a lower quality than the roadway embankment, and given the depth of additional fill and slope stability concerns, it is recommended the existing levee not be used, but rather removed to bedrock and rebuilt.

## F. Pavement Specific Investigations

### Ground Penetrating Radar –GPR

A GPR survey was used in the outside wheel path of each travel lane to identify the thickness of the asphalt pavement layer. A 1.0 GHz, air-coupled antenna pulsed the pavement 50 times per second to obtain subsurface information. The results of the survey were then used in the FWD back calculation process to obtain pavement layer modulus values. Subcontractor IMS performed this work and completed the testing in July 2000.

The pavement thickness data for each lane are provided in Appendix C-3. The pavement thicknesses for each lane are also included on Plates PP-1 to PP-10. It is seen that the thickness is highly variable along the length of the project. The statistical summary of the thickness data is included in the following table. To be conservative, an average asphalt thickness of 6 inches is used for development of concept alternatives.

| | EB | WB |
|---|---|---|
| Average (in) | 6.5 | 7.1 |
| Standard Deviation (in) | 2.1 | 1.4 |
| Maximum (in) | 11.8 | 12.9 |
| Minimum (in) | 2.6 | 2.9 |

### Pavement Distress Survey

To establish a baseline pavement condition rating, supplemental to the data provided by the Florida DOT, a detailed distress survey was conducted using automatic pavement condition collection equipment. In accordance with Florida DOT standards, the pavement evaluation and rating data was collected by lane and direction. The entire length of pavement was surveyed, allowing a 100% sampling and condition rating. The results were compiled in 1/70$^{th}$ mile segments, and then later reduced to 1/10$^{th}$ mile segments for inclusion in Appendix C. Using the Florida DOT inspection method, the following automated measurements were collected by IMS in July 2000:

| Distress | Measurement |
|---|---|
| IRI | Inside Wheelpath |
| | Outside Wheelpath |
| Alligator Cracking | Inside wheelpath, 1B, II, III |
| | Outside wheelpath. 1B,II, II |
| Block Cracking | Inside wheelpath, 1B, II, III |
| | Outside wheelpath. 1B,II, II |
| Combined Alligator & Block Cracking, | Inside wheelpath, 1B, II, III |
| | Outside wheelpath. 1B,II, II |
| Raveling | Light, Moderate, Severe |
| Rut Depths | 10 depth levels, each wheel path. |

The IMS Laser Road Surface Tester is an automated device used to collect pavement distress and roughness data at road speeds. It utilizes 11 lasers, several accelerometers, a distance-measuring device, and numerous on-board computers to measure information about the surface of the pavement.

Rutting data was collected in real time, while cracking and other distresses were post-processed using high-resolution video of the road surface. The distress items collected were the following:

Rutting - mean depth for each section.

> Rut depth is calculated using the entire array of 11 lasers on the RST. Each laser sends a measurement to a special computer board every 4 inches of distance traveled. The resulting elevation is analyzed to determine the left right and full

width rut depth as if a string line had been applied to the pavement and the ruts measured. As the RST travels these measures are accumulated and averaged to yield a total for the section.

Cracking – FDOT Cracking

The RST collects both a forward and downward high-resolution video image of the pavement. Each frame of video is time coded to relate the video to station information. The tapes are viewed in an office environment at slow speed to extract crack information. The Florida DOT condition survey methods for crack determination were used to extract the data.

### Analysis of Pavement Condition Data

The basis for the analysis of the pavement condition data collected by IMS is the Florida Department of Transportation Flexible Pavement Condition Survey Handbook, April 1994. Each set of data, including longitudinal cracking, rutting, and alligator cracking were examined along with the results of the GPR data to determine if any trends exist.

- **Ride**

Roughness or ride was measured in both wheelpaths of each direction. The roughness was measured and reported using the common International Roughness Index (IRI) scale. The scale ranges from 0 to 1267 inches/mile with larger values indicating greater roughness. The approximate break point between rough and smooth pavements is 125 inches/mile, with older pavements being in the range of 110 to 230 inches/mile.

The data was then converted to Florida DOT Ride ratings according to the procedure outlined in the Flexible Pavement Condition Survey Handbook (1994). The official ride rating is taken from the outside (right) wheelpath. A ride rating score of 10 indicates a pavement that is perfectly smooth.

Using those guidelines and the averages presented in the following table, the pavement is beginning to be considered rough. It is slightly higher than the 2000 Florida DOT ride rating of 8.3. Since the IRI tends to measure shorter wavelengths, the long-wave surface undulations evident on the Tamiami Trail do not affect the IRI greatly.

The outside wheelpaths have a slightly lower rating than the inside wheelpaths. Also, there are no significant areas or unique sections that have a larger IRI than others. Consequently, the IRI score is truly reflective of the entire roadway.

| | Florida DOT Ride Rating | | IRI Value | |
|---|---|---|---|---|
| | Average Ride | STD Ride | Average (in/mi) | STD (in/mi) |
| WB Outside | **8.8** | **0.2** | 72 | 12 |
| WB Inside | 8.5 | 0.3 | 93 | 17 |
| EB Outside | **8.9** | **0.2** | 67 | 14 |
| EB Inside | 8.5 | 0.3 | 92 | 19 |

- **Alligator Cracking**

Alligator cracking was measured in the wheelpath and outside of the wheelpath. Both alligator cracking values were about the same for each direction. There was slightly more cracking in the EB direction outside of the wheelpath. The values are summarized in the following table:

| Alligator Cracking (ALL) Summary | | |
|---|---|---|
| | Average (sf) | STD (sf) |
| WB ALL-NWP-II | 51 | 83 |
| WB ALL-WP-II | 304 | 378 |
| EB ALL-NWP-II | 139 | 218 |
| EB ALL-WP-II | 284 | 218 |

Some alligator cracked areas on the WB lanes had significant amounts of cracking (on the order of 20% of the area) on areas were nearly twice as thick and had double the amount of cracking as the adjacent (EB) lane. The WB sections from 1235 to 1260 had a larger amount of alligator cracking than surrounding pavement of equivalent thickness, but appeared to be on a minor sag curve portion of the road.

On the EB lanes, the only trend that was evident was an area of alligator cracking in the wheelpath from station 746 to 769. In this area, the asphalt is an average of 4.3 inches thick, which is well below the average of 6.5 inches. Other areas along the road had isolated instances of alligator cracking, but were not unusually thin or thick compared to the surrounding pavement.

There was very little class III alligator cracking reported in or out of the wheelpaths (less than 3% for each direction and whether in or out of the wheelpath). The results of all of the alligator cracking for each class are combined with the other cracking types in the same class to obtain an overall rating.

- **Block Cracking**

There was no block cracking recorded or reported for any of the roadway segments.

- **Longitudinal Cracking**

The longitudinal cracking data was consistent, with essentially all of the data in Class IB and II cracking. Average amounts of class II cracking were about double that for Class IB cracking, with low standard deviations for both classes. The predominant type of longitudinal cracking was Class II, and there was a very minimal amount of Class III longitudinal cracking in either direction (less than 4 sf). Average values are included in the following table:

| Longitudinal (LONG) Cracking Summary | | |
|---|---|---|
| | Average (sf) | STD (sf) |
| WB LONG-IB | 452 | 282 |
| WB LONG-II | 839 | 227 |
| EB LONG-IB | 343 | 273 |
| EB LONG-II | 737 | 234 |

The amount of longitudinal cracking over the varied thicknesses of asphalt is consistent along the entire length of the project and in both directions. This shows that the longitudinal cracking is independent of the asphalt thickness and is more dependent on the age and environmental exposure, which is a cause of asphalt hardening and consequent pattern cracking. Therefore, the longitudinal cracking is uniform because the age and exposure of the current asphalt surface is the same for the entire length of the project.

- **Raveling**

There was no significant raveling recorded or reported for any of the roadway segments.

- **Rutting**

The rutting data was also consistent along the length of the project. Average rutting values are shown in the following table:

| Rutting (RUT) Summary | | |
|---|---|---|
| | Average (in) | STD (in) |
| WB Rut Right | .22 | .05 |
| WB Rut Left | .14 | .04 |
| WB Rut Full Lane | .23 | .05 |
| EB Rut Right | .20 | .05 |
| EB Rut Left | .19 | .06 |
| EB Rut Center | .24 | .05 |

The average rutting value on the right wheelpath on the WB lane is greater than the left lane. This is the closest wheelpath to the canal. The rutting values for the EB lanes are very consistent.

The latest Florida DOT rutting score for the roadway section is 9, with the range for a rutting score of 9 being 0.07 to 0.19. Using the recently collected IMS data, the section is on the borderline, and the rutting is apparently increasing from the last Florida DOT survey. Consequently, the section would receive a Rut rating of 8.

- **Summary: Overall Rating**

The final step in the rating process was combining the amount of cracking (longitudinal, alligator in and out of wheelpath, block) in each class and assigning a rating based on the percentage of area cracked. Table 1 in the Florida DOT Pavement Condition Manual was used as a guideline to obtain a deduct value and corresponding score for the section. Achieving the rating score was slightly different from the manual method in that all of the data for a class, regardless of whether it is in the wheelpath or outside the wheelpath, was summarized to obtain a percentage. The Florida DOT method combines data separately for in and outside wheelpath, assigns deduct value, and then sums the deducts. This was not possible, however, because using the Florida DOT method, average values for the entire section were used. These values are summarized in the following table.

| Cracking Percentage by Class | | |
|---|---|---|
| | Average (%) | STD (%) |
| WB Class IB | 7.1 | 4.4 |
| WB Class II | 18.8 | 8.1 |
| EB Class IB | 5.4 | 4.3 |
| EB Class II | 18.3 | 10.7 |

Because of the relatively uniform nature of the results, no subdivision of the current pavement management section (as defined by the Florida DOT survey crews) into sub-sections is necessary. Using these results, the following ratings are obtained:

- Rut: 8
- Cracking: 8
- Ride: 8.8

In comparison to the Florida DOT ratings, the IMS rut rating is 1 point lower, the Crack rating is 2 points higher, and the Ride rating is 0.5 points higher. Note that the Florida DOT method is a windshield type of survey and contains more subjectivity than an automated method. This indicates that the Florida DOT overall rating of 6 is less than the automated overall rating of 8.

### Falling Weight Deflectometer (FWD) Testing

FWD testing was conducted to determine the in-place structural characteristics of the pavement. The FWD simulates the effect of a moving wheel load (9,000 pounds) by delivering an impact to the pavement and measuring the resulting surface deflections. With knowledge of the pavement layer thicknesses (from GPR and geotechnical testing) the structural properties of the pavement are determined. The FWD testing was conducted by ERES Consultants in July 2000, with the complete details in Appendix C-2.

The structural characteristics of interest for this project are the modulus value of the granular embankment and the effective AASHTO structural number of the entire pavement/embankment structure. In the backcalculation of the FWD data, the existing pavement is modeled as an asphalt layer on a granular base on a granular embankment. The granular base is reasonable to include in the analysis because the borings indicated that the moisture content for the top foot of embankment is near optimum, and the SPT blow counts are generally higher than the deeper elevations. The granular base was modeled as a 10 inch layer; again, note that the borings did not reveal the presence of a typical 10 inch limerock base, but for analysis, there is a denser layer of the granular embankment in the top foot. The asphalt thicknesses used were those at the FWD station, as determined from the GPR testing.

The modulus of the granular embankment material for Tamiami Trail varies from 3,000 psi to 40,000 psi, with an average of 7,500 psi. The majority of the values are in the 6,000 to 8,000 psi range. For a granular material, these values are considerably lower than would be expected. A value that would have been expected would be in the range of 15,000 to 20,000 psi. Another example, the Florida DOT has recently conducted research on A-3 type soils (similar but slightly better than the granular embankment) that were completely submerged below the water table, and a modulus of 29,000 psi was obtained.

The resilient modulus can be converted to the California Bearing Ratio (CBR), which is an indication of the strength of granular material with a maximum of 100. Using a rule of thumb that the modulus is 1,500 times the CBR, a 7,500 modulus back calculates to a CBR of 5. This is a value representative of silt or clay, not a granular material. As another indication that the embankment modulus is less than expected for a granular material, the laboratory CBR tests conducted show CBRs in the range of 35 to 60 after soaking.

These low values for a granular material suggest that the granular embankment modulus is being strongly influenced by the muck, and there may be muck mixed in with the embankment. As a point of interest, the modulus values in the vicinity of the borings are all about 7,000 psi. Considering the uncontrolled nature of construction and that the muck is beneath the embankment, the modulus value of the embankment is being largely influenced by the presence of muck. In essence, regardless of the granular embankment, the muck is controlling the response. This is a typical response found in pavement structures built on very soft materials. If an alternative is selected to utilize the existing embankment, then several exploratory trenches across the roadway and to the bedrock are needed to better characterize the embankment.

In utilizing the FWD data for design, there are a few methods. First is the Florida DOT method which is to use the mean plus two standard deviations. This provides a design modulus of 15,000 psi. Alternatively, a more conservative method would be to use the $10^{th}$ percentile value (90% values are greater than) which is 5000 psi. Appendix C shows the calculations in both methods, and although the Florida DOT standard would require less pavement thickness, we recommend using the more conservative value of 5,000 psi, for a Design High Water of 7.5 feet, until further exploration is conducted.

In the case where the Design High Water elevation will raise to 9.3 feet, reducing the 5,000 psi may be conservative. This is because the controlling material is probably the muck layer, which is already submerged. Nevertheless, to at least represent some localized impacts of the higher water, we recommend a modest reduction in the design resilient modulus to 4,000 psi, which is lowest value in the Florida DOT manual and would be a CBR of less than 3 (which is extremely low and typical of silts/clays beneath the water table). Again, if an option is selected to use the existing embankment, then test trenches need to be excavated, preferably beneath the FWD test stations.

For the effective AASHTO structural number, SNeff, of the existing pavement, it is recommended to use the $10^{th}$ percentile value of 3.5. For the case where the water elevation is raised to 9.3 feet, the 3.5 value should still be used but account for a greater thickness requirement by using the reduced embankment modulus of 4,000 psi.

### Parameters Used for Concept Development

The following parameters are used for development of the alternatives:

| | |
|---|---|
| Existing asphalt thickness | 6 inches |
| Granular thickness | 5.5 feet |
| Top of asphalt, centerline elevation | 11.0 feet |
| Top of consolidated muck elevation | 5.0 feet |
| Top of natural muck elevation | 6.5 feet |
| Top of bedrock elevation | 2.0 feet |
| Top of levee elevation | 17.4 feet |
| Existing water elevation | 7.5 feet |
| Proposed MWD Design High Water elevation | 9.3 feet |
| Proposed MWD Low Control Elevation | 6.5 feet |

| | |
|---|---|
| Proposed MWD High Control Elevation | 8.5 feet |
| Proposed MWD Water Quality Treatment Elevation | 9.5 feet |
| | |
| 50 year projected ESALs | 11.7 million |
| 20 year projected ESALs | 3.3 million |
| Existing pavement SNeff | 3.5 |
| Existing embankment modulus (DHW= 7.5) | 5,000 psi |
| Existing embankment modulus (DHW = 9.3) | 4,000 psi |

**Need for Additional Testing**

As noted in the prior sections, the 16 borings and other tests provide a general description of the existing embankment and levee, but there are details that would need to be further explored if a design alternative to use the existing embankment were selected. These would largely be geotechnical field and laboratory studies.

In particular, the presence of boulders and muck made it very difficult to extract samples and define the layer thicknesses. It is recommended that several test trenches be excavated across the entire roadway and embankment, down to the bedrock. At a minimum at least 1 per mile, which would be 11 trenches, should be excavated. This type of work will need to be done by a roadway contractor, with a geotechnical firm on site. It is recommended that an experienced construction manager oversee and coordinate the activities. The information to observe and obtain would include at least: observance of intermixing of muck with granular fill, thickness of granular fill, thickness of muck, in-place moisture/density of granular embankment, excavation stability of consolidated muck, visual gradation, large bulk samples, and condition of bedrock.

The large bulk samples would be used for gradation, more CBR testing, more density testing, Atterberg Limits, and triaxial resilient modulus testing at various degrees of saturation. The resilient modulus will give the best indication of how the granular material will behave when submerged. Additional testing to evaluate the consolidation effects of the muck and the slope stability of the embankment needs to be conducted.

Outside of the embankment, the stability of the natural muck should be tested. This is to determine how well the muck will stand up when excavated, namely to enable enough time for a granular fill to be placed.

Additional pavement cores are needed to determine the depth of cracks in the asphalt. The Florida DOT requires 3 cores per lane per mile, which would be 66 cores at a minimum. These cores are used to determine the depth of pavement cracks, for which milling may remove the asphalt to the bottom of the cracks, creating a crack-free layer to overlay. The test trenches and additional testing might cost on the order of $500,000.

### G. Current Annual Maintenance Activities and Costs

The Florida DOT budgets its maintenance based upon annual or periodic occurrence. Annual maintenance address items such as damaged guardrail, small pavement patching, mowing, litter removal. Periodic maintenance items are programmed in the Work Program and would include a resurfacing or complete guardrail replacement. Florida DOT District 6 is responsible for this section of the Tamiami Trail, and has provided a historical annual maintenance cost. The amount District 6 has spent, on average over the past three years for the 11 mile section is $39,537. Details of those amounts are provided in a letter from District 6 in Appendix C-1. The District has been maintaining the roadway in accordance with their policies and procedures.

For projecting future funding for maintenance, the Florida DOT has formulas to calculate the amount of annual maintenance funding a district would need. These formulas are based on the roadway type (e.g., 2-lane highway, interstate, etc.) and the particular section. The particular section has an inventory of items such as quantity of guardrail, amount of mowing, number of signs. Based on the roadway type and the inventory, a district receives a funding amount for all annual maintenance needs in that district. It is not expected or intended that the district spend all the maintenance dollars for a segment or road on that particular segment, but rather the districts are expected to manage their entire system appropriately. The annual amount funded for the 11 miles of Tamiami Trail in this study, reflective of the current inventory, is $99,981. Details are provided in Appendix C-1.

If an agency other than District 6 were to manage the maintenance, and presumably that would be through a contractual relationship with independent contractors, it would be advisable to allocate an amount of 10% for contract management and 40% contingency. The contingency would cover normal contingency (15%), surcharge for a small quantity maintenance contract (10%), and maintenance of traffic a contractor would have to provide (15%). The annual amount recommended is $150,000.

### H. Programmed Improvements and Costs

Periodic maintenance costs are the major work efforts that the state would design and let to a contractor. According to District 6, the 11 miles in the study corridor are scheduled to be resurfaced sometime in 2002 for $3.2 million.

## I. Estimated Cost to Rebuild to Current Standards

While the general condition of the existing road would not be considered unsafe, there are maintenance and improvement needs to prudently preserve the roadway. First, there are many profile variations along the roadway, presumably from consolidation of the muck, as shown by the plan and profile plates. Although a detailed analysis would be required of every settlement to precisely determine which settlements exceed vertical grade criteria, it is reasonable that the settlements need to be leveled. Similarly, the consolidation has also resulted in variability in cross-slope, as shown in the cross-section plates and from visible observation. Cross-slopes in excess of 2% could be considered a liability to the owner. Again, a more detailed survey is needed to precisely define which areas need cross-slope correction.

There is also sufficient cracking to lower the pavement rating to a 6, and it is known that at least some of the cracks are structural fatigue cracks, based on one of the cores. Therefore, a resurfacing should incorporate structural life of the pavement. From a visual inspection, the existing guardrail has shifted position as the embankment has settled. As guardrail positioning is very strict and without tolerance, it would have to be replaced not only because of its current condition but also from the structural overlay grade change. Note that none of these upgrades are considering reconstruction of the embankment, therefore the upgrades could be considered as a maintenance project.

The recommended improvement, which is described in the following sections, is to level the existing roadway to a uniform elevation of 11 feet, place a 6 inch asphalt overlay, replace the guardrail, and provide additional fill and sod behind the guardrail for grade transitions. The estimate developed does not include nor provide water quality treatment for roadway drainage. The estimated cost to bring the roadway up to standard, including elevating the subgrade above the existing design high water condition, is $10,172,097, summarized as follows:

| ***Existing Facility Improved to Standards*** | |
|---|---|
| *Without Water Quality Control* | |
| Roadway | $10,172,097 |
| Bridge | $0 |
| Total | $10,172,097 |

## Overlay Pavement Design With No Change in Design High Water Elevation

This initial alternative is what would be required to upgrade the existing roadway, without raising the water elevation. The Design High Water would remain at 7.5 feet.

For the pavement design, the Florida DOT would typically use a 20 year design period. However, because the remaining alternatives developed for MWD were requested by the Corps of Engineers to be for a 50 year design (i.e. 50 year traffic projection), that approach is used for this upgrade calculation. The overlay design needs to consider the surface variations as well as the separation from the design high water elevation. The calculations are provided in Appendix C for both 20 and 50 year designs.

In particular, the Florida DOT requires that for a *new* or *reconstructed* (i.e. not a maintenance project) roadway, that the bottom of the aggregate base course be 2 feet above the design high water elevation. The purpose for this separation requirement is to provide a stable platform during construction of the aggregate base and the asphalt pavement, and to provide a long-term support for the pavement. From discussions with the Corps of Engineers, the water elevation in the canal is controlled and will vary over time due to predominant weather conditions. However, for purposes of concept development, an elevation of 7.5 feet for the existing case and assuming no increase due to the MWD project is reasonable.

For the existing roadway, using the average elevation of 11 feet, with a 6 inch asphalt thickness, there is 3 feet of separation from the bottom of asphalt to the design high water level. The Tamiami trail was not built with a modern limerock base course (which is typically 10 inches for this type of roadway). If a hypothetical 10 inch limerock base were present, the 2 feet of separation to the design high water is still provided. So even if the roadway improvements were considered a reconstruction, it would meet the criteria.

However, we do realize that the roadway profiles dip as low as elevation 10 feet, which would provide only a gross clearance of 2 feet to the design high water so the hypothetical base could not exist. There are two approaches to provide the separation, either reclassify the project and reconstruct the pavement, or use a black base. If reconstruction were chosen, that would be limited to removing the existing asphalt pavement and adding additional granular embankment, most likely an A-3 type of soil (Unified Classification).

There is a significant construction concern with removing the existing asphalt pavement. From the FWD testing, the resilient modulus of the existing granular embankment below the asphalt pavement is calculated as about 5,000 psi. The resilient modulus can be converted to the California Bearing Ratio (CBR), which is an indication of the strength of granular material with a maximum of 100. The conversion, which is reasonable for this level of analysis, is the modulus is 1500 times the CBR. Backcalculation from the modulus gives a CBR of about 4. The paving industry considers a CBR of 6 the minimum that can be constructed upon to provide support for equipment and compaction of subsequent layers. Therefore, it is not recommended the existing asphalt pavement be removed for this option.

A more reasonable approach would be level all of the low spots to an elevation of 11 feet with asphalt overbuild. All of the structural overlays will be calculated to begin at elevation 11. The existing 6 inch asphalt pavement (in some case 18 inches where the low areas are leveled) could remain in place and be considered as a Florida DOT Black Base.

A variety of methods were used to prepare the overlay thickness design. First is using the 50-year projected traffic and using the effective AASHTO structural number, SNeff, of 3.5 with an embankment resilient modulus of 5000 psi for reasons discussed previously. This provides an asphalt overlay thickness of 6 inches, without any credit afforded to the 12 inches of overbuild to level the low areas. If a standard 20 year design were conducted, only a 3 inch asphalt overlay is required.

Alternatively the Florida DOT method, when used in strict adherence to the guidelines, uses an embankment modulus of 15,000 psi. The existing 6 inch asphalt pavement is modeled using reduced layer coefficients (rather than SNeff), which are 0.15 for a pavement of a condition rating of 6. The 50 year thickness is 6 inches and the 20 year is 4 inches. For the purposes of this concept development, an asphalt pavement overlay of 6 inches is recommended.

# D. FUTURE WITHOUT PROJECT CONDITION

## 9. Condition of the Existing Facility (No Improvements, with the MWD Project)

### A. Relation of MWD Project to Existing Facility

This scenario considers impacts on the existing roadway if the water elevation is raised to a Design High Water of 9.3 feet and the roadway is not improved. The existing roadway is asphalt on an uncontrolled granular fill on muck. The condition score of the asphalt pavement, a 6, is sufficient to require a resurfacing even without raising the water elevations. Raising the water requires consideration of the impact on the embankment and the asphalt pavement. The roadway has low spots that are at or near elevation 10 feet, so overtopping may also be a concern.

The first topic is the embankment. The peat and part of the uncontrolled granular fill embankment are already submerged due to the existing water elevation of 7.5 feet. Any deterioration of either would have already occurred over its 80-year history. The only damage to the pavement over time attributable to the water is the longitudinal surface variations and depressions, a result of the muck consolidation. Raising the water elevation to the proposed 9.3 feet (design high water) is not expected to damage the uncontrolled granular fill nor further impact the muck.

However, the asphalt paving must also be considered. Although the average pavement elevation is currently 11.0 feet, there are low spots measured at 10.0 feet. In addition, when a high water test was conducted by the USACE in the spring of 2000, areas of overtopping were observed, presumably at the low elevations (see plan and profile sheets). By subtracting the 6-inch asphalt thickness, the bottom of asphalt would vary from 9.5 feet at the low, to 10.5 feet at the average. Therefore, the new Design High Water elevation of 9.5 feet will essentially be at the bottom of asphalt in low areas.

The impact is that the support for the asphalt pavement will decrease, the existing cracks will deteriorate and additional cracks will develop. As the pavement is already at a condition of 6, which it dropped to in the past 7 years, the higher water is expected to accelerate deterioration of the existing pavement. The deterioration is expected to be the worst in the low areas, as the water table will be essentially at the bottom of the asphalt.

Furthermore, the localized low spots that allow overtopping need to be corrected. The occurrence of overtopping would require deployment of traffic control devices to warn motorists, and in the worst case, close the highway to traffic. It also could likely cause erosion of the embankment slopes, which could then cause structural pavement problems. This could have adverse implications for emergency vehicles and possibly hurricane evacuation.

It is not recommended that the Design High Water elevation be raised without improving the roadway. The current low elevation is 10 feet, with a bottom of asphalt at 9.5 feet, which provides for a 2 foot clearance to the current Design High Water elevation of 7.5 feet. It is known that the embankment can become wetter with capillary rise 2 feet above the water table, so the low elevations are already exceeding a design criteria. However, if the roadway were overlayed, the existing pavement could be considered a Black Base and then the separation criteria are met.

## B. Estimated Impact Upon Annual Maintenance Activities and Costs

If the water is raised and the pavement is not improved, the low areas will require more localized repair than the other parts of the pavement. In addition, the entire roadway will soon require a significant resurfacing. Considering the roadway has deteriorated to a condition of 6 in the past 7 years, a 7 year resurfacing cycle is recommended. Although it could be argued that an even more frequent resurfacing cycle may be warranted, 7 years is probably the most that is reasonably feasible and publicly tolerable. It is noted that a better solution would be to level the roadway and place a 6 inch overlay, as discussed in the prior section. Table 1 shows the life cycle costs of the 7 year resurfacing.

For the annual maintenance, it was previously noted that currently an owner should consider a budget of $150,000. If the water elevation is raised, the current funding of $6,900 for asphalt patching contained in that budget should be increased by $25,000. This would require an annual maintenance budget of $175,000.

# E. DESIGN CRITERIA

## 10. Design Criteria

This section provides a description of the relevant design criteria to be incorporated into the definition and depiction of the study alternatives:

### A. Roadway

The following narrative presents roadway design criteria:

*General*

The proposed reconstruction of Tamiami Trail is to be designed in accordance with Chapter 2 of the Florida Department of Transportation (FDOT) Plans Preparation Manual (PPM), AASHTO's Policy on Geometric Design of Highways and Streets, and FDOT Roadway and Traffic Design Standards. The road has a functional classification of Rural Arterial and a design speed of 60 mph. Existing (Year 2000) traffic is 5,200 vehicles per day, projected by FDOT to be 9,200 in the year 2022.

Additionally, there are existing features that must remain undisturbed. A memorial is located north of the canal near the western limits of the project. Two businesses will remain that currently have access from Tamiami Trail. The Osceola Indian Reserve is located on the south side near the western limits, and the Airboat Association of Florida is located on the south side near the center of the project limits. Their access must be maintained.

*Horizontal Alignment*

a. Maximum Horizontal Curvature

Table 2.8.3 of the FDOT Plans Preparation Manual (PPM), indicates that for a rural environment ($e_{max}$ = 0.10) and at design speed of 60 mph, the maximum curvature allowed by State Highway System (SHS) criteria is $5^0$15'00". The curve data for all horizontal curves for each alignment alternative have been set to satisfy the SHS maximum horizontal curvature requirement.

b. Maximum Deflections Without Horizontal Curves

For the design speed of 60 mph, Table 2.8.1a of the PPM indicates a maximum deflection without horizontal curves for arterials without curb and gutter of $0^0$45'00". The conceptual design for all alternatives satisfies this criterion.

c. Lane Width

Table 2.1.1 indicates a minimum through lane width of 12 feet for 2-lane rural roadways. The conceptual design for all alternatives satisfies this criterion.

d. Shoulder Width

For 2-lane arterials without shoulder gutter, Table 2.3.3 of the PPM indicates a minimum full shoulder width of 8 feet and a minimum paved shoulder width of 5 feet for low volume highways. The conceptual design for all alternatives satisfies this criterion.

e. Border Width

For arterials with design speeds greater than 45 mph and flush shoulders, Table 2.5.1 of the PPM indicates a minimum border width of 40 feet. This criterion will not be satisfied, as the existing right-of-way is minimal. Guardrail will be used.

*Horizontal Clearances*

The following horizontal clearance requirements for roadways with flush shoulders are outlined in Section 2.11 of the PPM.

| Object | Clearance Requirement | Additional Notes |
|---|---|---|
| Light Poles | 20 Feet from Travel Lane | No lighting included |
| Utility Installations | Not within the Clear Zone | Existing utilities |
| Trees | Outside the Clear Zone | Behind guardrail |
| Bridge Piers and Abutments | Outside the Clear Zone | Will be protected |
| Guardrail | 12’ for Shoulders 10’ and Wider Shoulder Width Plus 2’ for All Other Shoulders | 5’ paved shoulders |

If the design speed is greater than 55 mph and there are more than 1,500 vehicles AADT, Table 2.11.9 of the PPM indicates that the required clear zone width is 36 feet adjacent to the outside travel lane.

*Vertical Alignment*

a. Maximum Grade

The maximum grade permitted for a rural arterial with a 60 mph design speed is 3% according to Table 2.6.1 of the PPM. The maximum grade criterion will be satisfied for all alternatives.

b. Maximum Change in Grade Without Vertical Curves

The maximum allowable change in the gradient is 0.4% for a design speed of 60 mph according to Table 2.6.2 of the PPM. The maximum change in grade criterion will be satisfied for all alternatives.

c. Grade Datum

The required roadway base clearance above the design high water elevation for rural two-lane roadways with Design Year ADT greater than 1,500 daily vehicles is 2 feet according to Table 2.6.3 of the PPM. The grade datum criterion will be satisfied for all alternatives.

d. Stopping Sight Distance

For a design speed of 60 mph and grades of 2% or less, Table 2.7.1 of the PPM indicates a minimum stopping distance of 550 feet. Because of the "flat" grades along Tamiami Trail, vertical stopping sight distance will exceed the minimum value of 550 feet in all cases.

e. Cross Slope

The 2% pavement cross slope design in all alternatives complies with Figure 2.1.1 of the PPM, Standard Pavement Cross Slopes.

## B. Structures

The following narrative describes structural design criteria:

*Design Specifications*

1. AASHTO Standard Specifications for Highway Bridges (16th Edition - dated 1996) as amended by interim specifications through 1999.
2. Corps of Engineers Engineering Manuals for the analysis and design of the hydraulic structures, including the following EMs:

| | |
|---|---|
| EM 1110-2-2104 | Strength Design for Reinforced Concrete |
| EM 1110-2-2906 | Design of Pile Foundations |
| EM 1110-2-2594 | Sheet Pile Design |
| EM 1110-2-2502 | Retaining/Floor Walls |

3. Florida Department of Transportation Structures Design Guidelines, 2000 Edition for the Load Factor Design (LFD) Method.

*Construction Specifications:*

1. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2000 Edition and supplements thereto.

*Design Loads*

| | | |
|---|---|---|
| Dead Loads: | Unit weight of reinforced concrete | - 150 pcf |
| | Traffic railing barrier | - 418 plf |
| | Future wearing surface allowance | - 15 psf over traffic surface |
| | S.I.P. Forms | - 20 psf applied between beams |

Live Loads: AASHTO HS20-44 with impact

Wind Loads: Wind loads are in accordance with AASHTO, Section 3.15, modified for a design wind velocity of 110 mph.

*Hydraulic Design Criteria*

| | |
|---|---|
| Design high water elevation (DHW) | - 9.30 ft. (S. side of L-29 Levee)<br>- 10.50 ft. (N. side of L-29 Levee) |
| Control water elevation | - 6.50 ft. (Low control) (South side of L-29 Levee)<br>- 8.50 ft. (High control) (South side of L-29 Levee)<br>- 7.50 ft. (Average control) (South side of L-29 Levee)<br>- 1.50 ft. Higher than south side (North side of L-29 Levee) |
| Free board above DHW | - 2.00 ft. (Not critical) |
| Maintenance clearance above DHW | - 6.00 ft. Above average control water elevation normal (October) elevation |
| Navigation clearance (for structures over the L-29 Borrow Canal) | - 6.00 ft. Above high control water elevation. |

*Material Properties*

| | | |
|---|---|---|
| Concrete: | Substructure | - f'c = 3,400 psi |
| | Deck and approach slabs | - f'c = 4,500 psi |
| | Prestressed beams | - f'c = 6,000 psi short span beams |
| | | - f'c = 8,500 psi long span beams |

f'c = Unit ultimate compressive strength of concrete as determined by cylinder test at 28 days of curing.

Concrete shall be in accordance with FDOT Standard Specifications, Section 346.

Reinforcing Steel:
In accordance with ASTM A615 - Grade 60

Prestressing Strands:
In accordance with ASTM A416 - Grade 270

Steel Sheet Piles:
In accordance with ASTM A328 - Grade 36 and A709 - Grade 50

*Environment* The environment classification for bridges on this project is:

Superstructure: Non-Corrosive, Slightly Aggressive
Substructure: Non-Corrosive, Slightly Aggressive(assumed)

*Design Method* Load Factor Design is used in proportioning all elements of the superstructure and substructure with the exception of the following:

1. Prestressed concrete precast beams are designed by the Service Load Method. Ultimate capacity is checked by the Load Factor Method.
2. Service Load Method is used for pile/drilled shaft loads.

*Allowable Stresses / Loads*
Allowable stresses shall be in full compliance with the AASHTO Specifications as amended by the FDOT Structures Design Guidelines.

## C. Drainage

This section outlines the Federal, State, and local stormwater quality and quantity criteria applicable to the proposed Tamiami Trail / US 41 project. This section also outlines the Federal, State and local permitting requirements. The criteria and parameters outlined in this section are derived from the applicable published regulations, permit design manuals and design standards.

### *Project Drainage Overview*

The existing roadway does not have any collection or conveyance system. Runoff from the roadway presently discharges off the road and discharges into adjacent canal on the north side of the roadway or into the wetlands on the south side. No water quality or attenuation presently takes place. There are 55 cross drains under this segment of US 41 conveying runoff from the canal on the north side of the roadway to the wetlands on the south.

Maintaining the existing roadway and providing the new bridges would not require the retrofit of the existing roadway with new water quality and quantity requirements, but the new construction could be determined to require treatment. However, the reconstruction of the roadway, in its present alignment or new alignments, may require the facility to meet all current regulatory requirements for water quality as outlined in the Florida Department of Environmental Protection's (FDEP's) Regulation of Stormwater Discharge or 62-25, Florida Administrative Code (FAC). Since South Florida Water Management District is the local sponsor of the project, regulatory review must be delegated to FDEP.

Consideration of wetland impacts may be a factor in providing or not providing water quality treatment. The discussion of each alternative summarizes potential stormwater quality options and the corresponding wetland impacts.

In addition, a copy of the plans and permit package will be submitted to the Miami-Dade County Department of Environmental Resources Management (DERM) for their review and comment, but a permit may not be required from DERM depending upon a determination of applicability. In addition, the roadway must meet all current design guidelines of FDOT.

The following subsections outline the requirements of FDEP Chapter 62-25, FAC:

A permit under this chapter will be required only for a new stormwater discharge facility. The phrase “new stormwater discharge facility” means a stormwater discharge facility which was not in existence on or before February 1, 1982. As such, FDEP requires that all new stormwater runoff be collected and directed to treatment facilities that meet specific design and performance standards. These treatment facilities pertain to water quality requirements and not attenuation issues. Facilities must provide retention, or detention with filtration, of the runoff from the first 1 inch of rainfall; or, as an option, for projects or project subunits with drainage areas less than 100 acres, facilities must provide retention, or detention with filtration, of the first one-half inch of runoff. However, facilities which directly discharge to Outstanding Florida Waters (OFW) shall provide additional treatment pursuant to Section 62-25.025(9), FAC. Stormwater discharge facilities which directly discharge to OFWs shall include an additional level of treatment equal to 50% of the previous stated treatment volume.

In addition, retention or detention basins shall provide the capacity for the given volume of stormwater within 72 hours following the storm event. The additional storage volume must be provided by a decrease of stored water caused only by percolation through soil, evaporation or evapotranspiration.

Erosion and sediment control best management practices shall be used as necessary during construction to retain sediment on-site. Sediment controls shall be designed to specific site conditions and shall be shown or noted on the plans of the stormwater management system.

*Stormwater Quantity Criteria*

FDOT has jurisdiction over the stormwater quantity criteria for the project. The following subsection outlines these requirements: FDOT requires that new drainage systems discharging into FDOT drainage systems must not exceed pre-development critical storm peak discharge rate during post-development conditions. Critical storm frequency analysis includes storm events with 2- to 100-year frequency and 1-hour to 10-days duration. This criteria is outlined in Chapter 14-86 FAC, Stormwater Management System Design Criteria.

The following subsections describe the design criteria for the available best management practices (BMPs) to meet the required stormwater quality and quantity criteria.

*Wetland Areas*

The FDEP and USACOE will have jurisdiction over the wetland areas to be impacted by the project and may require mitigation for these impacts. However, the project may be considered self-mitigating, in that the project provides increased water levels into Everglades National Park. The requirements of those agencies are outlined in the Federal Regulations and the FDEP's Chapter 62-312, FAC and Chapter 373, FS.

*Permit Requirements*

γ Florida Department of Environmental Protection (FDEP)

FDEP requires a joint-permit application that addresses both dredge and fill impacts and corresponding wetland mitigation, if required. This application is submitted to both the FDEP and USACOE. Other federal and state agencies are also copied on the permit application for their review and comment. In regards to the stormwater permit, FDEP requires a construction permit application, using forms provided by the Department, prior to commencement of the construction of the stormwater discharge facility.

γ Florida Department of Transportation (FDOT)

Drainage systems discharging into an FDOT system require a Drainage Connection Permit. Chapter 14-86 FAC outlines the criteria and requirements of an FDOT Drainage Connection permit. Improvements within the project corridor will not require this type of permit.

γ USEPA General Construction NPDES Permit

The U.S. Environmental Protection Agency (USEPA) under the Federal Clean Water Act (CWA) requires that construction projects that disturb 5 acres or more require a General Construction National Pollutant Discharge Elimination System (NPDES) Permit. Procedures for complying with the General Construction NPDES include submitting a Notice of Intent (NOI), developing and implementing a Stormwater Pollution Prevention Plan (SWPPP) and submitting a Notice of Termination (NOT).
The NOI must be submitted to the USEPA at least two (2) days in advance of the start of construction and should include the following information:

1. SFWMD ERP cover page.
2. A certification that the SWPPP has been prepared in accordance with Part IV of the General Construction NPDES Permit criteria.
3. A narrative statement certifying that the SWPPP provides compliance with approved State of Florida issued permits, erosion sediment control plans, and stormwater management plans.

The SWPPP must specify the mechanisms for managing stormwater, including control of soil erosion and sediment control, and inspection and maintaining the effectiveness of the specified controls. The SWPPP consists of six phases as follows:

1. Site Evaluation and Design Development
2. Assessment
3. Control Selection and Erosion Control Plans Design
4. Certification and Notification
5. Construction/Implementation

6. Final Stabilization/Termination

The SWPPP must include erosion and sediment control BMPs. These controls will depend on site-specific characteristics and the construction schedule as follows:

1. Areas that will not be redisturbed for a period of time must be stabilized by temporary seeding or mulching.
2. Off-site vehicle tracking of sediments and generation of dust shall be minimized.
3. Structural controls must be specified for diverting runoff flow from disturbed areas, storing flows or limiting the discharge of pollutants from exposed areas. Examples of such control may include the following:
   a. Earth dikes
   b. Silt fences
   c. Sediment traps
   d. Sediment basins
   e. Drainage swales
   f. Check dams
   g. Subsurface drains
   h. Storm drain inlet protection
   i. Reinforced soil
   j. Retaining systems
   k. Gabions
   l. Turbidity barriers

After the SWPPP is executed and the project is stabilized and terminated, a NOT is submitted to the USEPA and project records should be retained for a minimum of three (3) years.

## D. Pavement

The main guidance for the new and overlay pavement design and analysis of the existing roadway is the Florida Department of Transportation Flexible Pavement Design Guide (2000) and the Flexible Pavement Evaluation Guide (1999).

# F. PROBLEMS AND CONSTRAINTS

## 11. Problems and Constraints

During the course of formulating alternative plans to meet the project objective, several problems and constraints were identified. These issues influenced the types of measures that were considered, led to new measures that would resolve problems caused by a plan, or resulted in some measures being rejected. The problems and constraints are explained as follows:

a. Modified Water Delivery Program Facilities - There are several facilities that have been installed or are planned to be installed in the immediate vicinity of Tamiami Trail as part of the Modified Water Deliveries project. In addition, there are other previously installed facilities. All of these should be avoided by any proposed roadway modifications if possible, because conflict would necessitate replacement of the facilities, increasing project costs. It is recognized that any alternative along the L-29 levee would be more likely to impact these structures. These facilities are summarized as follows:

| ***Facility*** | ***Type*** | ***Status*** | ***Location (L-29 Stationing)*** | ***Comment*** |
|---|---|---|---|---|
| S-333 | Spillway | Existing | 580+46 | |
| S-334 | Spillway | Existing | 15+26 | Planned for modification, including a portion of Tamiami Trail. (See S-536 below) |
| S-336 | Culvert | Existing | East of L-31W | Could be affected by Tamiami Trail alignment transition. |
| S-355A | Spillway | Existing | 307+00 | |
| S-355B | Spillway | Existing | 183+00 | |
| L-29 Borrow Canal | Canal | Existing | N/A | Modifications not included in authorization; hydraulic capacity must be maintained. |
| L-29 | Levee | Existing | N/A | Modifications not included in authorization. |
| Weir A | Weir | Planned | 490+00 | |
| Weir B | Weir | Planned | 400+00 | |
| Weir C | Weir | Planned | 100+00 | |
| S-356 | Pump Station | Planned | 15+26 | Located next to S-334. |

b. Structure 334 and Tamiami Trail - The Modified Water Deliveries project includes modifications to S-334 and the adjustment of Tamiami Trail in the vicinity of S-334. The Tamiami Trail modifications under this project will need to consider the S-334 and related Tamiami Trail changes.

c. L-29 Levee and L-29 Borrow Canal - The L-29 Levee and the adjacent L-29 Canal are important elements in the management of water flows in the eastern Everglades. Relative to this task assignment, they are significant factors in the definition of roadway improvement alternatives and assessment of resulting impacts. For the purposes of this conceptual study, the L-29 Canal cross-section, including its maintenance road, must be maintained as it serves a role in the movement of waters in the east-west direction. The L-29 Levee has a significant role in the Modified Waters Delivery Program as the control stage to its north will be increased. The functionality of the levee in terms of its protection elevation must be maintained.

d. Comprehensive Everglades Restoration Plan - This ongoing project, referred to as the "restudy" is anticipated to require greater peak flows across the Tamiami Trail corridor of approximately 5,500 cubic feet per second in comparison to the 4,000 cfs under the Modified Water Deliveries project. While there is presently no authorization for the anticipated "restudy" recommendations, it is useful to be aware of these requirements, and to avoid precluding reasonable accommodation of those needs, provided that there is no cost to do so and that no other feature of this project is compromised by doing so.

However, the requirements developed under the current authorization for the Modified Waters Delivery Program provide criteria for this project. As such, there is no authorization for the removal of the Tamiami Trail embankment, the L-29 Levee or other improvements, unless such action would be necessary to accomplish an alternative or be essential from the standpoint of maintenance of traffic, or some other integral reason.

e. Indian Camps - Two villages occupied by members of the Miccosukee Tribe of Indians of Florida were anticipated to be affected by higher water elevations under the Modified Water Deliveries project.

The Tiger Tail Indian Camp is located north of US 41 between the L-29 borrow canal and L-29, and between S-355A and S-355B. This camp was mitigated by raising the camp above the critical water elevation.

The Osceola Camp is located on the south side of Tamiami Trail, approximately 0.6 miles east of S-333. This site would also be subject to inundation under the Modified Water Deliveries Project. It appears that the camp operates at the site under a lease which will be maintained. Discussions with the affected parties identified the preferred mitigation to raise the site; however, this action has not yet occurred.

Because of the recent investment in raising the Tiger Tail Indian Camp, any Tamiami Trail modifications should avoid this site. There is a boat access point adjacent to Tamiami Trail for reaching the camp, and this capability should be preserved with any road modifications. The Osceola Indian Camp might be affected by an alignment south of the existing Tamiami Trail, but since mitigation of the site elevation has not yet occurred, a modified site plan could be considered if there is an impact from the road alignment.

f. Business Facilities - Only one active business site is to remain. That is the Airboat Association of Florida site located approximately 3 miles east of S-333. Reasonable access to this parcel during and following construction will be required. There are also 3 active sites on the south side of the Tamiami Trail where there are communications tower, with connecting access roads from Tamiami Trail. If these installations remain in place, reasonable access will be required to be maintained during and after construction.

g. Flight 592 Memorial - This memorial and its parking lot are situated on top of the L-29 levee approximately 0.1 mile east of the S-333 structure. Out of deference to the victims and casualties of the accident, it would be preferable to avoid any impact to this site. Reasonable access to this site will need to be maintained during and after construction.

h. Recreational Access - The canals and other features on either side of Tamiami Trail constitute a significant recreational resource, primarily for fishing and airboating. Primary access points are at the S-333 and S-334 structures, which connect to the unpaved road on the L-29 levee which runs the entire length of the levee, there is also limited access to the L-31N canal on the east and the L-67 Extension canal to the west. Reasonable access to these waterways will need to be maintained during and after construction.

i. Utilities - Initial reconnaissance has identified several utilities in the Tamiami Trail corridor. These will need to be a consideration in the alignment alternatives process. The utilities are summarized as follows:

- X Electric - Overhead lines between L-29 and borrow canal.
- X Gas - Underground gas line on south side of Tamiami Trail.
- X Fiberoptic - Underground conduit adjacent to electric line.
  Fiberoptic - Underground conduit on south side of Tamiami Trail.

j. Hurricane Evacuation Route Designation - The US 41/Tamiami Trail corridor is a designated hurricane evacuation route (Route U-41) according to mapping available from the Florida Department of Community Affairs. Such a designation is typically determined by the Department of Community Affairs (DCA), Division of Emergency Management with the concurrence of the Florida Department of Transportation, and the Emergency Management offices of the affected counties, in this case Miami-Dade and Collier Counties. Collier County has designated the road as an evacuation route, while Miami-Dade County has not due to consensus over flooding. District 6 of FDOT has also advised COE that at the local level, the road is not recognized as an evacuation route. However, DCA, with the concurrence of the FDOT Central Office, has published maps recognizing Tamiami Trail as a hurricane evacuation route.

Under hurricane evacuation conditions, evacuation movements would occur either in the westbound or eastbound direction depending upon the storm track, but using only the one available directional lane. No single flow direction plan using both lanes has been proposed.

The implied significance of this designation is that the evacuation route capability of this corridor would need to be maintained during the June-November hurricane season, which may influence construction phasing and maintenance of traffic during construction.

k. Jurisdictional Wetlands - Nearly all lands to the north of the L-29 levee and to the south of the existing Tamiami Trail except already disturbed parcels are classified as jurisdictional wetlands. Any encroachment into these areas would constitute an adverse impact which would likely necessitate mitigation, except in those situations where the encroachment constitutes the lesser impact of the alternatives.

l. Everglades National Park - The park is being expanded through ongoing land acquisition on the south side of Tamiami Trail. All parcels along the road are being or have been acquired. There are presently the Osceola Indian Camp, four souvenir and/or airboat ride businesses, an airboat club, two abandoned commercial sites, three communication tower sites and one vacant communications site. Only the airboat club and the Indian camp are to remain. All of the preceding sites represent some disturbance of the original topography due to site filling.

Besides these disturbed sites, the balance of the lands appear to be wetlands vegetated predominantly by sawgrass. The south slope of the roadway embankment between the roadway and the parallel ditch is vegetated mostly by invasive exotics, dominated by Brazilian pepper.

Also being acquired is a narrow strip of land lying between the relocated US 41 and the original Tamiami Trail alignment some 500 feet to the south, for a distance of approximately 1.5 miles west of the L-67 Extension borrow canal.

Avoidance of existing or programmed Everglades National Park lands would be preferable, but could be considered in the situation where this represents a better overall solution within the corridor.

m. Water Conservation Area 3B - This area which lies to the north of Tamiami Trail in the study segment is under the management of the South Florida Water Management District. North of the L-29 Levee in proximity to Tamiami Trail, there are generally physical improvements or structures. The area consists mostly of wetlands dominated by sawgrass. This area is ringed by levees and historically the basin has been utilized to assist in the management of water levels and flow quantities. Any encroachment to the north of the L-29 Levee would impact on the wetland habitat contained within Water Conservation Area 3B.

n. Wood Stork Rookery - This nesting and roosting area for the wood stork is located on the south side of the roadway at the east end of the corridor. The boundary description for this site is being refined. The limits are reported to be approximately 1,000 feet of frontage along Tamiami Trail, and extending for about 1,000 feet south of Tamiami Trail. Impact on this area should be avoided if at all possible.

# G. ALTERNATIVES

**12. Basic Alternatives Considered**

The process of alternatives analysis proceeded through a series of steps, as follows:

1. Identification of alternatives.
2. Review and refinement of alternatives [adjustments in alignment and typical section in relation to cost and impact issues].
3. Development of practical alternatives in greater detail.
4. Comparative evaluation.

The alternatives considered in this analysis were the following:

a. Alternative 1: Existing Alignment and Profile with Four New Bridges.

b. Alternative 2: Existing Alignment with Raised Profile and Four New Bridges.

c. Alternative 3: New North Alignment with Raised Profile and Eight New Bridges.

d. Alternative 4: New South Alignment with Raised Profile and Four New Bridges.

e. Alternative 5: New Alignment on Structure.

For all but Alternative 1, a configuration was developed for each alternative which did not provide for roadway runoff water quality treatment (for example, Alt. 2A) and a second configuration which did provide for water quality treatment (for example, Alt. 2B). In addition, an assessment of the existing roadway under existing conditions was prepared (see Paragraph 9), as well as an assessment of the existing roadway, unmodified, under the Modified Water Deliveries project water elevation conditions (see Paragraph 10).

Cost estimates were developed for each alternative and variation, using the USCOE MCASES package and the FDOT historical bid price database. The base cost estimate considered typical construction schedules, alternative-specific construction phasing, standard siltation curtain provisions, and other assumptions. The costs should be considered conceptual in nature, and special requirements or provisions not discussed are not included. Construction activity may be affected seasonally by habitat considerations for certain species; any resulting restrictions and their effect on construction costs are not known at this time.

## 13. Alternative 1: Existing Alignment and Profile with Four New Bridges

## A. Description

This alternative is defined as retaining the existing Tamiami Trail alignment, profile and typical section, except where modifications are necessary for the construction of 4 new bridges to convey MWP flows from the L-29 Canal to Everglades National Park. The only changes from the existing facility are the four new structures and their approaches, since the profile must be raised to meet bridge vertical clearance criteria. The project as defined also includes an overlay of the existing pavement. Two of the bridges will be aligned with S-355A and S-355B, and the other two will be situated approximately midway between these structures and the east and west ends of the project, respectively. The two middle bridges would have a hydraulic width of 300 feet each, while the two outer bridges would have a hydraulic width of 425 feet each.

The construction of the bridges could be accomplished three ways (refer to Plates A1-7, A2-7, and A2-7A):

Option 1: New bridges built to the south of the existing road: Analysis showed this option to be the least cost, but introduces two reverse curves in the alignment at every bridge.

Option 2: New bridges built on the existing alignment, with temporary detour to the south: This option is somewhat more costly than the previous option, but avoids alignment curvatures and permanent wetland disruption.

Option 3. New bridges built on the existing alignment, with temporary detour to the north (in the L-29 Canal): This option avoids even temporary impact to wetlands south of the road but requires a costly detour on structure north of the existing road using a temporary structure along the north bank of the L-29 Canal. This option adds over $52 million to the project cost.

For the purposes of comparison of alternatives and life-cycle cost analysis, Option 2 is utilized.

The existing Tamiami Trail profile and typical section will be modified only in the vicinity of the new bridges and only to the extent necessary to match existing roadway profile and typical section. The typical section, key sheet, and plan views of a portion of this alternative are depicted in Plates A1-1 through A1-6. The typical section and details for the structures are depicted in Plates A1-7 and A1-8. The pavement typical section is shown on Plate A1-9.

As this alignment retains the centerline of the existing facility, no alignment transitions are required at either end of the segment, nor are there any impacts to parcels of concern along the corridor.

## B. Typical Sections and Pavement Design

Roadway

The existing typical section consists of two 12-foot wide travel lanes, a 12-foot wide shoulder on the north side of the roadway, and an 8-foot wide shoulder on the south side of the roadway. There is guardrail located at the outside edges of these shoulders.

Pavement Design

Alternative 1 provides construction for only the new bridges and short segments of the existing roadway to be reconstructed as transitions to the new bridges. The balance of the roadway will remain as existing, presumably being maintained under normal Florida DOT practices. The pavement will have a grade transition from the nominal average 11 foot elevation to about elevation 17 feet at the bridge deck.

The amount of fill required to match grades will cause a settlement in the existing embankment. Considering this settlement will occur at the bridge approaches, it is not desirable. Also, with the expense to build the transitions with engineered fill, it does not seem prudent to place an engineered embankment on top of uncontrolled material. Therefore it is recommended that the embankment for the bridge transitions be reconstructed. This also is in accordance with Florida DOT guidelines.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness for the bridge approaches is designed using Florida DOT procedures and are in Appendix C-3. Although the Florida DOT typically only requires a 20 year design, the Corps of Engineers has requested a 50 year design. Since a new embankment will be built at a higher elevation, the design will be most economical if conventional granular materials can be used with the 2 foot separation from the Design High Water elevation of 9.3 feet.

For 50 year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The pavement design is summarized as follows:

| |
|---|
| ***Alternative 1 – Bridge Transition Pavement*** |
| ¾ inch friction course |
| 4 inch structural asphalt |
| 10 inch limerock base course |
| 12 inch LBR stabilized subbase |
| A-1 or A-3 embankment |

To meet the separation criteria, the bottom of the limerock base will need to be at elevation 11.3 feet or above. This is easily accommodated with a proposed roadway elevation rising up to 17 feet. At the transition to the existing roadway, where the top of asphalt is at 11 feet, a thick asphalt wedge will have to be placed until the separation criteria is achieved. The typical section of these bridge transitions is very similar to other alternatives, in particular Plate A2-9 (although water quality treatment is by definition not included as part of this alternative). The typical section of the roadway beyond the transition limits is that of the existing roadway (see Plate A0-1).

Temporary Bypass Pavement Design

Since the new bridges will be constructed on the same alignment as the rest of the roadway, a pavement design was completed for the temporary roadways that will be used during the construction of the bridges. The pavement section consists of 2" asphalt concrete structural course, 12" limerock, variable depth recycled fill (asphalt concrete millings or crushed portland cement concrete), and 8" geocell on top of the muck (See Figure 2). Since differential settlement is expected throughout the life of the detour, it is expected that the temporary pavement may need frequent patching and overlays to maintain a serviceable condition. Since the design speed will most likely be lower through the work zone, this is considered acceptable.

## C. Plan and Profile

The profile is to remain unchanged, except where modifications are necessary for the construction of the four new bridges. These bridges are located as follows:

- Directly south of the S-355A drainage structure
- Directly south of the S-355B drainage structure
- Directly south of the proposed Weir B location
- Directly south of the proposed Weir C location

# TEMPORARY ROAD SECTION

## Figure 2

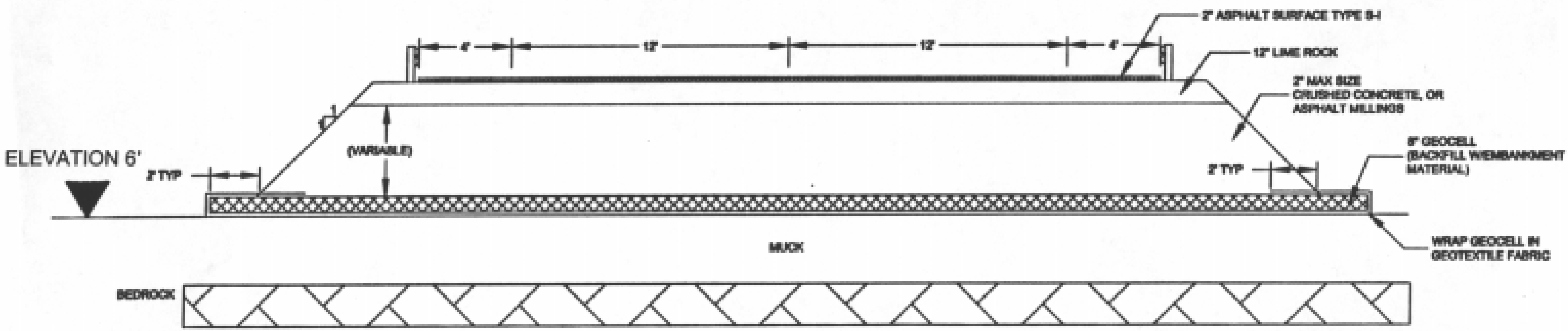
**NOTES**

1. 8" GEOCELL OR EQUAL
   SOIL STAB. PRODUCTS
   1-800-523-9992
   209-383-3298

2. GEOTEXTILE FABRIC:
   AMOCO #4553 OR EQUAL

3. ASSUME PLACE ADDITIONAL
   2" OVERLAY AT MIDPOINT CONTRUCTION

4. ALLOW 2 WEEKS AFTER PLACING EMBANKMENT
   PRIOR TO PLACING EMBANKMENT.



These new bridges can be constructed in three ways as discussed below under maintenance of traffic options.

## D. Structures

The proposed 43'-1'' wide bridge typical section for the four bridges within this alternative provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. Refer to Plate A1-8 for a description of the bridge lengths and the associated hydraulic openings. The bridges are of identical length for both maintenance of traffic alternatives.

Several superstructure and substructure alternatives were evaluated to determine the most cost effective bridge structure for these crossings. These systems include:

| Superstructure Alternatives | Substructure Alternatives |
|---|---|
| Transversely Post-Tensioned Slab Units<br><br>FDOT Precast Prestressed Double Tee System<br><br>AASHTO Beams Types II, III & IV with Cast-in-Place Concrete Deck | 18 and 24 inch square Prestressed Concrete Piles (with pre-drilling)<br><br>3 foot diameter Drilled Shafts |

The most cost-effective bridge structural system for all four bridges uses AASHTO Type II Beams with a composite cast-in-place concrete deck. The superstructure is supported on pile bents using 18 inch square prestressed concrete piles installed and driven in holes predrilled to El. –10.00 into the limerock.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructibility of the bridges for both maintenance of traffic alternatives. One approach requires a temporary haul road approximately 30 feet wide to be constructed south of the proposed bridges to allow for crane placement and precast beam delivery. Another approach requires a temporary haul road approximately 20 feet wide between the proposed bridge construction and the temporary detour road. Precast beams would be brought to the site along the temporary detour road. This scheme is preferred.

## E. Drainage

This alternative does not require the existing roadway to be reconstructed, except in the vicinity of the new bridges. By definition, no water quality treatment is proposed for this alternative. However, proper “best management practices” for erosion and sedimentation controls must be provided during construction.

The existing 55 culverts do not need to be replaced at this time. Based on soil parameters obtained during the geotechnical investigation, the existing culverts have an expected remaining life of approximately 300 years. This expected life utilized the FDOT's Culvert Service Life Estimator Program and accounted for the 50 years of service the culverts have been in operation. The result of this analysis is included in Appendix B.

## F. Utilities

There are existing utilities within the existing roadway corridor; these may be affected by the construction. There is a buried telephone facility running behind the guardrail on the south side of the roadway. There is also a 23 kv overhead electric line running along the south side, located about 100 feet south of the existing guardrail. Just behind the guardrail on the north side of the roadway is an additional buried telephone facility.

## G. Environmental Factors

As this alignment utilizes the existing facility, except for reconstruction near bridges, it has somewhat limited environmental impacts. These include the temporary detour roads at each of the new bridges which will impact wetlands to the south, an area of 18.5 acres for the four bridge sites. These areas would be restored after construction of the bridges is completed. At additional cost, temporary bridges could be built into the L-29 Canal. There is no permanent encroachment into Water Conservation Area 3B, Everglades National Park or the wood stork rookery.

## H. Maintenance of Traffic During Construction

Traffic is to be maintained as it exists today. The milling and resurfacing of the existing roadway will be accomplished using a moving operation. Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

There are three options for the horizontal layout of the proposed bridges. The first option is offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway (11.0 average elevation) to the proposed bridge deck (17.0 PGL elevation), shifting the alignment to locate the structures outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they are opened to traffic flow, and the existing roadway is removed at the bridge openings.

The second option involves the construction of a temporary roadway in the vicinity of the proposed bridges that is offset to the south from the existing roadway. Once completed, the traffic is shifted onto this temporary alignment and the new structures and approaches are constructed along the existing alignment.

The third option involves the construction of a temporary bridge running parallel to the existing roadway over the L-25 Canal. Transitions would be constructed out to the temporary structure. When completed, traffic is shifted onto the temporary alignment and the ultimate alignment is constructed.

The three options for the horizontal layout of the proposed bridges are discussed below:

**Option 1: Offset Final Alignment to the South**

The first option is permanently offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway (±10.4 feet) to the proposed bridge deck (±17 feet), shifting the alignment to locate the structure outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they can be opened up to traffic flow, and the existing roadway will be removed at the bridge opening. These breaches will allow for the flow of water under the bridge. Because this option involves permanent wetland encroachment and introduces undesirable roadway geometry, it is not considered further.

For the purposes of this analysis, the temporary detour option was selected because it for comparison. This option is more costly since it requires the construction of a temporary roadway, reconstruction of the existing roadway on the approach to the new bridge, and removal of the temporary roadway.

**Option 2: Offset Temporary Detour to South**

The second option involves the construction of a temporary roadway that is offset to the south from the existing roadway. Once this detour is built, traffic is then shifted onto this temporary alignment, and the new structure and its approaches are constructed along the existing alignment. The shift in traffic will allow for the de-mucking operation that will be required along the new raised profile.

**Option 3: Offset Temporary Detour North into L-29 Canal**

O Structures

The detour on the north side of the existing roadway for the construction of 4 bridges requires two 1,200-foot long approach bridges and a 1,500-foot long temporary steel truss bridge (Bailey bridge) per each bridge site. The width of the temporary bridge is 32 feet, which provides two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. The gap between the existing roadway and the detour is kept to minimum (10 feet) to minimize the length and width of approach bridges. The required width of the approach bridges is 42 feet.

The construction method and the superstructure system proposed for the permanent bridges are dictated by limited construction area available. Post-tensioned precast slab units with top-down construction are proposed as a viable alternative. The optimum span length for this type of superstructure was determined to be around 30 feet. The most cost-effective substructure system for these bridges is 18-in. square prestressed concrete piles.

The cost analysis is based on the construction of two bridges simultaneously and reuse of superstructure of temporary and approach bridges at other two bridge locations.

O Approach Bridges

One line of 36-inch diameter drilled shafts at every 30 feet is proposed in the L-29 canal to minimize the interruption of flow with another line of 36-inch diameter drilled shafts along the bank. This type of substructure configuration will require a superstructure system spanning along the width of the bridge. The best-suited superstructure system for this bridge is post-tensioned precast slab units. Precast slab units will be reused at other bridge sites.

O Temporary Bridge

The proposed temporary bridge is a 1,500-foot long, two lane Bailey bridge with 30-foot spans. The bridge will be supported on piers with two 36-inch diameter drilled shafts. Drilled shafts in the L-29 canal will line up with the drilled shafts of the approach bridges to minimize the interruption of flow. Temporary bridges will be reused at other bridge sites.

## I. Construction and Life Cycle Costs

The construction costs for this alternative are summarized as follows:

| ***Alternative 1*** | |
|---|---|
| Description | With Temporary Road at New Bridges |
| *Without Water Quality Control* | |
| Roadway | $9,948,172 |
| Bridge | $4,382,699 |
| | |
| Total | $14,330,871 |

The life cycle costs for this alternative were developed for two cases for the roadway alone, and for the total project. Pavement life cycle costs were calculated at $13,646,872 while the total project life cycle costs were estimated to be $21,189,677. Paragraph 20 later in this section discusses the life cycle cost analysis.

## J. Other Aspects

There are existing features that must remain undisturbed. The Flight 592 Memorial is located north of the L-29 borrow canal near the western limits of the project. This will not be impacted with this alternative. Access will remain at the S-333, S-334, and S-336 structures. Access to Tiger Tail Camp, located on the north side of the canal, will remain as it is today. The Osceola Indian Reserve and Florida Airboat Association are both located on the south side of the existing roadway near the western limits. The existing access points to these sites will remain.

## 14. Alternative 2: Existing Alignment with Raised Profile and Four New Bridges

## A. Description

This alternative is defined as modifying the existing Tamiami Trail alignment, profile and typical section, throughout the length of the study segment, including the construction of 4 new bridges to convey Modified Water Deliveries project flows from the L-29 borrow canal to Everglades National Park. Two of the bridges will be aligned with S-355A and B, and the other two will be situated approximately midpoint between these structures and the east and west ends of the project, respectively. The two middle bridges would have a hydraulic width of 300 feet each, while the two outer bridges would have a hydraulic width of 425 feet each.

The construction of the bridges could be accomplished three ways (refer to Plates A1-7, A2-7, and A2-7A):

Option 1: New bridges built to the south of the existing road: Analysis showed this option to be the least cost, but introduces two reverse curves in the alignment at every bridge.

Option 2: New bridges built on the existing alignment, with temporary detour to the south: This option is somewhat more costly than the previous option, but avoids alignment curvatures and permanent wetland disruption.

Option 3. New bridges built on the existing alignment, with temporary detour to the north (in the L-29 Canal): This option avoids even temporary impact to wetlands south of the road but requires a costly detour on structure north of the existing road using a temporary structure along the north bank of the L-29 Canal. This option adds over $52 million to the project cost.

For the purposes of comparison of alternatives and life-cycle cost analysis, Option 2 is utilized.

The existing Tamiami Trail profile and typical section will be modified for the length of the project and the centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Borrow Canal. The typical section, key sheet, plan views of a portion of this alternative, and construction phasing are depicted in Plates A2-1 through A2-7A; the typical section of the structures is depicted in Plate A2-8 and the pavement typical sections are found on Plates A2-9 and A2-10.
.
For the condition where there would be no water quality treatment, the centerline of this alignment will fall very close to the centerline of the existing facility. In this case, the existing roadway embankment will be retained and built up within asphalt pavement. For the condition where there would be water quality treatment, the centerline of the alignment will fall approximately 27 feet to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. In this case, the roadway embankment is to be reconstructed. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

## B. Typical Sections and Pavement Design

Roadway Typical Section

This typical section consists of two 12-foot wide travel lanes, and 8-foot wide shoulders on each side of the roadway. Five feet of this shoulder will be paved. There is guardrail located at the outside edges of these shoulders. The section with water quality treatment has a much wider footprint.

Pavement Design: Alternative 2A - Without Water Quality Treatment

This alternative is upgrading the existing roadway to accommodate a Design High Water elevation of 9.3 feet and traffic for 50 years. This is achieved through placing a thick structural overlay. The upgrade needs to consider the impact of the design high water elevation, overtopping, and grade variations.

The recommended approach is to leave the existing asphalt pavement in-place as a construction platform and serve as a black base. The low areas shall all be leveled to minimum elevation of 11.0 feet throughout the project. Then a 6 inch asphalt overlay will be placed. The calculations are in Appendix C-4 and summarized again below.

First, by considering the project a maintenance effort, thick structural overlays can be used and reconstruction is not necessary. For the existing roadway, using the average elevation of 11 feet, with a 6 inch asphalt thickness, there is slightly more than 1 foot of clearance to the 9.3 foot design high water elevation. In areas where the roadway profiles dip as low as 10 feet, the bottom of the existing 6 inch asphalt is essentially at the Design High Water level.

A reasonable approach is that after leveling to elevation of 11.0 feet with asphalt overbuild, the top 6 inches below elevation 11.0 feet be considered black base. This is quite reasonable because elevation 11.0 feet provides for a foot of clearance from the bottom of the declared black base (elevation 10.5 feet) using either existing granular embankment or asphalt overbuild. In many cases, the asphalt overbuild will be 12 inches thick, providing a total asphalt thickness of 18 inches for over a mile; note this is even before the structural overlay is placed.

Recall that the FWD testing conservatively estimated the embankment modulus at 5,000 psi (the Florida DOT method would predict it at 15,000 psi), and that to account somewhat for the higher water level, we reduced the modulus to 4,000 psi. Using the 50-year projected traffic and an embankment resilient modulus of 4,000 psi, the required structural number is 6.17 inches. Using the effective AASHTO structural number of the existing pavement structure, SNeff, of 3.5, a 6 inch asphalt overlay provides a structural number of 6.14. This is slightly less than the 6.17 required, which equates to 0.15 inches of asphalt. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. Plate A2-10 shows the schematic of the pavement section.

A key issue is that the roadway will be close to the Design High Water table, and that more frequent resurfacings are anticipated than a normal roadway. This is in part due to potential localized failures and some settlement of the muck. The geotechnical subconsultant did a simple settlement calculation of placing a foot of asphalt on top of the existing pavement. The buoyant force of the raised water elevation almost counteracts the weight of the additional asphalt. However, in areas where more than 12 inches of asphalt are placed, settlements are expected. Similarly, if the water elevation seldom reaches 9.3 feet, then there is less buoyant force and additional settlement is expected.

Considering that the existing roadway was resurfaced 7 years ago, and by its cracking condition of 6 is technically ready for a resurfacing, a 7 year resurfacing interval for this option appears warranted. This is considerably more frequent than a 10 to 15 year interval common in Florida; however, the Tamiami Trail is surrounded by the Everglades and exposed to water throughout the year. The recommended pavement section follows:

***Alternative 2A - Without Water Quality Treatment***

Proposed centerline elevation = 11.5 feet
¾ inch friction course
6 inch structural asphalt
0-12 inch asphalt overbuild
Existing 6 inch asphalt pavement
Existing embankment

Pavement Design: Alternative 2B - With Water Quality Treatment

This alternative requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway. After designing the necessary slopes for the treatment facilities, it became obvious that one-half of the roadway would be on new embankment and one-half on the existing embankment. This is illustrated in Plate A2-9, and is an undesirable condition because of differential settlement across the joint. The differential would cause a safety threat to motorists and be a persistent maintenance concern. Therefore, the entire existing embankment is recommend to be removed down to the bedrock, and any additional footprint needed also have the muck removed to the bedrock. A new embankment of A-1 or A-3 material needs to be built.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness is designed using Florida DOT procedures and are in Appendix C-3. The design will be most economical if conventional granular materials can be used with the 2 foot separation from the Design High Water elevation of 9.3 feet. Therefore, to provide sufficient clearance to accommodate fluctuations in the water elevation, a new top of asphalt centerline elevation of 14 feet is recommended. Plate A2-9 is the pavement schematic.

For 50 year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The recommended pavement section follows:

***Alternative 2B – with Water Quality Treatment***

Proposed centerline elevation = 14 feet
¾ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment
4 inch drainage layer
A-1 or A-3 embankment

To illustrate the clearances, if the top of pavement is at elevation 14 feet, the bottom of the limerock base is at elevation 12.75 feet, providing about 3.5 feet of clearance above the Design High Water elevation of 9.3 feet. This exceeds the 2 foot minimum.

As an added precaution against capillary rise from the water table, a 4 inch granular drainage layer is placed beneath the LBR 40 subbase. The drainage layer will be designed to have no material smaller than the No. 8 sieve, which will inhibit the capillary rise into the base layers and still have construction stability. The drainage layer will need to be wrapped in filter fabric to prevent intrusion of the embankment soils into the layer.

The periodic resurfacing interval recommended for this alternative is 12 years. This is the lower end of the typical 10 to 15 year interval in Florida. This is because even with the precautions of the drainage layer and additional high water clearance, the roadway is still in the Everglades and has ample access to water and maybe even unforeseen high water events.

## C. Plan and Profile

The proposed profile is to be raised to provide a set clearance from the controlled high water elevation to the bottom of the proposed roadway subgrade. The set clearance is to meet FDOT design criteria, as well as drainage criteria. The proposed elevation at the crown of the roadway is 14.0 feet. The profile will be raised significantly in the areas of the proposed bridges. These bridges are located as follows:

Directly south of the S-355A drainage structure
Directly south of the S-355B drainage structure
Directly south of the proposed Weir B location
Directly south of the proposed Weir C location

These new bridges can be constructed in three ways. These are discussed under maintenance of traffic options below.

## D. Structures

The proposed 43'-1'' wide bridge typical section for the four bridges within this alternative provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. Refer to Plate A2-8 for a description of the bridge lengths and the associated hydraulic openings. The bridges are of identical length for both maintenance of traffic alternatives.

Several superstructure and substructure alternatives were evaluated to determine the most cost-effective bridge structure for these crossings. These systems include:

| Superstructure Alternatives | Substructure Alternatives |
|---|---|
| Transversely Post-Tensioned Slab Units<br><br>FDOT Precast Prestressed Double Tee System<br><br>AASHTO Beams Types II, III & IV with Cast-in-Place Concrete Deck | 18 and 24 inch square Prestressed Concrete Piles (with pre-drilling)<br><br>3 foot diameter Drilled Shafts |

The most cost-effective bridge structural system for all four bridges uses AASHTO Type II Beams with a composite cast-in-place concrete deck. The superstructure is supported on pile bents using 18 inch square prestressed concrete piles installed and driven in holes predrilled to El. –10.00 feet into the limerock.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructibility of the bridges for both maintenance of traffic alternatives. One approach requires a temporary haul road approximately 30 feet wide to be constructed south of the proposed bridges to allow for crane placement and precast beam delivery. A second approach requires a temporary haul road approximately 20 feet wide between the proposed bridge construction and the temporary detour road. Precast beams would be brought to the site along the temporary detour road. This latter scheme is preferred.

## E. Drainage

Two drainage alternatives are being considered for the proposed reconstruction. Due to potential wetland impacts resulting from the construction of water quality treatment facilities, a detailed analysis has been performed, estimating wetland impacts both with and without water quality treatment facilities. In doing so, the permitting agencies will have a chance to determine whether wetland impacts offset the required water quality treatment.

Water quality treatment requirements are being met in dry linear retention facilities adjacent to the proposed roadway. The invert elevations are set 1 foot above the new high control elevation of Canal L-29, which is 8.5 feet. As such the treatment facilities will have a control elevation of 9.5 feet and an overall depth of 1 foot. Based on water quality requirements by FDEP (including Outstanding Florida Water (OFW) considerations), the depth of the water quality volume provided is estimated at 0.5 feet deep.

Regardless of the stormwater treatment scenarios, the existing system of culverts will not be replaced for the reconstruction alternative. The MWD project did not include the culverts to pass the required discharge south into the park. For this alternative, both options encroach on the south headwalls of the culverts. Consequently, the south end of the culverts will be plugged with flowable fill to prevent water from flowing south towards the new embankment.

## F. Utilities

There are existing utilities within the corridor that will be affected by the new construction. There is a buried telephone facility running behind the guardrail on the south side of the roadway. There is also a 23 kv overhead electric line running along the south side, located about 100 feet south of the existing guardrail. Just behind the guardrail on the north side of the roadway is an additional buried telephone facility.

All utilities within the proposed typical section will need to be relocated. Utility relocations will be coordinated with each utility owner. As the underground utilities appear to fall within the right-of-way, their relocation costs are not included in the cost estimates.

## G. Environmental Factors

As this alternative without water quality treatment preserves the existing facility, it has limited environmental impacts and there is no permanent encroachment into Water Conservation Area 3B. As much of the footprint of this alternative with water quality treatment is located to the south of the existing facility, it has more significant environmental impacts, but likewise does not affect Water Conservation Area 3B.

The alignment without water quality treatment encroaches approximately 16 feet to the south, while the option with water quality treatment encroaches approximately 59 feet to the south. These permanent encroachments are 30 and 84 acres, respectively.

For both options regarding water quality treatment, there are also the detour roads at each of the new bridges which would temporarily impact wetlands to the south, an area of 18.5 acres for the four bridge sites. These areas would be restored after construction of the bridges is completed. Alternatively, at significant additional cost, a detour into the L-29 Canal could be used instead, thus avoiding temporary encroachments into wetlands.

## H. Maintenance of Traffic During Construction

### Alternative 2A

Traffic is to be maintained as it exists today. The overlay of the existing roadway will be accomplished using a moving operation. Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

There are three options for the horizontal layout of the proposed bridges. The first option is offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway (11.0 feet average elevation) to the proposed bridge deck (17.0 feet profile grade line elevation), shifting the alignment to locate the structures outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they are opened to traffic flow, and the existing roadway is removed at the bridge openings.

The second option involves the construction of a temporary roadway in the vicinity of the proposed bridges that is offset to the south from the existing roadway. Once completed, the traffic is shifted onto this temporary alignment and the new structures and approaches are constructed along the existing alignment.

The third option involves the construction of a temporary bridge running parallel to the existing roadway over the L-25 Canal. Transitions would be constructed out to the temporary structure. When completed, traffic is shifted onto the temporary alignment and the ultimate alignment is constructed.

**Alternative 2B**

Temporary barricades spaced every 50 feet are placed at the north edge of the westbound travel lane line. In ¼ mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the north, utilizing the new pavement. A ten-foot wide strip of temporary pavement is placed south of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed one foot north of the south edge of the temporary pavement.

Unsuitable material is excavated and embankment is placed and compacted along the proposed alignment. The southern guardrail, eastbound shoulder and both travel lanes are constructed. A temporary barrier wall is placed adjacent to the westbound travel lane and traffic is shifted to the new pavement. The westbound shoulder and guardrail are constructed and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time” basis at the work site.

There are three options for the horizontal layout of the proposed bridges.

**Offset Final Alignment to the South**

The first option is permanently offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway

(±10.4 feet) to the proposed bridge deck (±17 feet), shifting the alignment to locate the structure outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they can be opened up to traffic flow, and the existing roadway will be removed at the bridge opening. These breaches will allow for the flow of water under the bridge. Because this option involves permanent wetland encroachment and introduces undesirable roadway geometry, it is not considered further.

For the purposes of this analysis, the temporary detour option was selected because it for comparison. This option is more costly since it requires the construction of a temporary roadway, reconstruction of the existing roadway on the approach to the new bridge, and removal of the temporary roadway.

**Offset Temporary Detour to South**

The second option involves the construction of a temporary roadway that is offset to the south from the existing roadway. Once this detour is built, traffic is then shifted onto this temporary alignment, and the new structure and its approaches are constructed along the existing alignment. The shift in traffic will allow for the de-mucking operation that will be required along the new raised profile.

**Offset Temporary Detour North into L-29 Canal**

Structures

The detour on the north side of the existing roadway for the construction of 4 bridges requires two 1,200-foot long approach bridges and a 1,500-foot long temporary steel truss bridge (Bailey bridge) per each bridge site. The width of the temporary bridge is 32 feet, which provides two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. The gap between the existing roadway and the detour is kept to minimum (10 feet) to minimize the length and width of approach bridges. The required width of the approach bridges is 42 feet.

The construction method and the superstructure system proposed for the permanent bridges are dictated by limited construction area available. Post-tensioned precast slab units with top-down construction are proposed as a viable alternative. The optimum span length for this type of superstructure was determined to be around 30 feet. The most cost-effective substructure system for these bridges is 18-in. square prestressed concrete piles.

The cost analysis is based on the construction of two bridges simultaneously and reuse of superstructure of temporary and approach bridges at other two bridge locations.

### Approach Bridges

One line of 36-inch diameter drilled shafts at every 30 feet is proposed in the L-29 Canal to minimize the interruption of flow with another line of 36-inch diameter drilled shafts along the bank. This type of substructure configuration will require a superstructure system spanning along the width of the bridge. The best-suited superstructure system for this bridge is post-tensioned precast slab units. Precast slab units will be reused at other bridge sites.

### Temporary Bridge

The proposed temporary bridge is a 1,500-foot long, two-lane Bailey bridge with 30-foot spans. The bridge will be supported on piers with two 36-inch diameter drilled shafts. Drilled shafts in the L-29 Canal will line up with the drilled shafts of the approach bridges to minimize the interruption of flow. Temporary bridges will be reused at other bridge sites.

## I. Construction and Life Cycle Costs

The cost of this alternative without water quality treatment is $24,354,651 and with water quality treatment is $58,550,650. Most of the cost is related to the roadway elements, and is slightly greater with water quality control because of the additional fill required.

| ***Alternative 2*** | |
|---|---|
| Description | With Temporary Road at New Bridges |
| *Alt. 2A - Without Water Quality Control* | |
| Roadway | $19,949,427 |
| Bridge | $4,405,224 |
| | |
| Total | $24,387,038 |
| | |
| *Alt. 2B – With Water Quality Control* | |
| Roadway | $54,145,434 |
| Bridge | $4,405,224 |
| | |
| Total | $58,550,658 |

The life cycle costs for this alternative were developed for two cases: for the roadway alone, and for the total project. For the case without water quality treatment, pavement life cycle costs were calculated at $19,153,047 while the total project life cycle costs were estimated to be $32,530,077. For the case with water quality treatment, pavement life cycle costs were calculated at $32,778,010 while the total project life cycle costs were estimated to be $50,126,440. Paragraph 20 later in this section discusses the life cycle cost analysis.

## J. Other Aspects

There are existing features that must remain undisturbed. The Flight 592 Memorial is located north of the L-29 borrow canal near the western limits of the project. This will not be impacted with this alternative. Access will remain at the S-333, S-334, and S-336 structures. Access to Tiger Tail Camp, located on the north side of the canal, will remain as it is today. The Osceola Indian Reserve and Florida Airboat Association are both located on the south side of the existing roadway near the western limits. The existing access points to these sites will remain.

## 15. Alternative 3: New North Alignment with Raised Profile and Eight New Bridges

## A. Description

This alternative is defined as relocating the Tamiami Trail alignment to a location north of the L-29 Borrow Canal. This would include the construction of 8 new bridges along the relocated roadway to convey MWP flows from Water Conservation Area 3B across the L-29 levee to the L-29 Borrow Canal. The bridges would be aligned with existing S-355A and B (each with flow channel bottom widths of 60 feet), and with proposed Weirs A, B, and C, which are to be 200 feet, 150 feet, and 200 feet in length, respectively. There would also need to be a bridge near either end of the corridor to carry the relocated roadway over the L-29 Borrow Canal and a bridge over the L-29 Borrow Canal for access to the Airboat Association of Florida site.

The proposed alignment is to be shifted to the north side of the L-29 borrow canal. The alignment will allow for a 15 feet wide canal maintenance berm. Construction activities involve eliminating the existing levee, and allowing for the proposed roadway to act as the new levee. Materials from the existing levee will be utilized in constructing the new alignment.

The existing Tamiami Trail embankment would need to be breached at locations similar to the bridge locations for Alternatives 1 and 2. The typical section, key sheet, plan views of the selected portions of this alternative, and construction sketches are depicted in Plates A3-1 through A3-11; the structures are depicted in Plates A3-13A and A3-13B. The pavement typical sections are shown on Plates A3-14 and A3-15.

As this alignment does not retain the centerline of the existing facility, alignment transitions are required at either end of the segment. The presence of various water control structures, memorial and recreational sites, adjacent wetlands, and the width and orientation of canals together with geometric design criteria and bridge structure layout considerations present significant constraints to the location and configuration of these transitions. At the east end of the corridor, the proposed S-356 pump station and adjacent S-334 spillway replacement and adjustments to levees and Tamiami Trail are additional factors affecting the transition. In addition, the location and configuration of the two existing spillways and three proposed weirs, as well as the Tiger Tail Indian Camp present additional alignment considerations.

## B. Typical Sections and Pavement Design

Roadway Typical Section

This typical section consists of two 12-foot wide travel lanes, and 8-foot wide shoulders on each side of the roadway. Five feet of this shoulder will be paved. There is guardrail located at the outside edges of these shoulders. The proposed roadway will act as the levee under the definition of this alternative. The typical section with water quality treatment is much wider.

Pavement Summary

The first item of interest for this alternative relative to subgrade requirements is whether or not the levee is suitable for widening and supporting a roadway. The geotechnical investigation extended 3 borings through the levee and 3 through the maintenance road. What is evidenced is the levee was built with the same construction technique as the roadway embankment, namely the limestone bedrock placed on top of the muck. By mere nature of the consolidation potential of the muck, and the large amounts of fill required to provide a 2 lane roadway (existing levee top is only 10 feet wide), it is not prudent to build the majority of a roadway on an engineered embankment and allow part to be on an uncontrolled fill. Also of concern are the low SPT blow counts of the levee. They are typically 3 to 5 per foot; these are similar to the blow counts in the roadway embankment *that is submerged*. This suggests that the levee is of a lower quality than the roadway embankment, and given the depth of additional fill and slope stability concerns, it is recommended the existing levee not be used, but rather removed to bedrock and rebuilt.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness is designed using Florida DOT procedures and are in Appendix C-3. For rebuilding, the proposed roadway elevation is 17.4 feet because that is the elevation of the future Pump Station 356 tieback levee. With a nominal 4 foot pavement envelope required (including a high water separation), there is ample clearance above the 9.3 feet Design High Water elevation. Plates A3-14 and A3-15 are the pavement schematics for the options with and without water quality treatment.

For 50 year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The periodic resurfacing interval recommended for this alternative is 12 years. The proposed pavement section is as follows:

***Alternative 3 – with and without Water Quality Treatment***

Proposed centerline elevation = 17.4 feet
¾ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment

## C. Plan and Profile

The profile will be raised to provide a set clearance from the controlled high water elevation to the bottom of the proposed roadway subgrade. The set clearance is to meet FDOT design criteria, as well as SFWMD criteria. The proposed elevation at the crown of the roadway is 17.4 feet. The profile will be raised significantly in the areas of the proposed bridges. These bridges are located as follows:

Transition over the L-29 borrow canal at the west end of the project
Transition over the L-29 borrow canal at the east end of the project
At the S-355A drainage structure
At the S-355B drainage structure
Access bridge to the Airboat Association of Florida site
At the proposed Weir A location
At the proposed Weir B location
At the proposed Weir C location

## D. Structures

The proposed 43'-1'' wide bridge typical section applies to eight bridges within this alternative and provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. A proposed 35'-1'' wide bridge typical section applies to the access bridge to the Airboat Association of Florida site and provides sufficient deck area for two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. Refer to Plates A3-13A and A3-13B for a description of the bridge lengths and the associated hydraulic openings.

Several superstructure and substructure alternatives were evaluated to determine the most cost effective bridge structure for these crossings. These systems include:

| Superstructure Alternatives | Substructure Alternatives |
|---|---|
| Transversely Post-Tensioned Slab Units<br><br>FDOT Precast Prestressed Double Tee System<br><br>AASHTO Beams Types II to VI with Cast-in-Place Concrete Deck<br><br>Florida Bulb Tees 72 and 78 with Cast-in-Place Concrete Deck | 18 and 24 inch square Prestressed Concrete Piles (with pre-drilling)<br><br>3 foot diameter Drilled Shafts |

The most cost-effective bridge structural systems vary for the eight bridges within this alternative and is presented in Plate A3-13A.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructibility of the bridges for this alternative. The bridges for Alternative 3 present the most challenges regarding constructibility.

Installation of the drilled shafts, prestressed piles and precast beams for the bridges over the L-29 Borrow Canal will most likely be performed from barge-mounted cranes. Crane size and lifting capability may be limited based on the size of barge that can be transported to and placed within the canal. Materials delivery for the roadway embankment and the other bridges on the north side of the L-29 Borrow Canal will require the completion of at least one of the transition bridges inasmuch as the existing access roads will be insufficient to handle the quantity of materials required for more than ten miles of construction.

## E. Drainage

As discussed in Alternative 2, an analysis of wetland impacts associated for both with and without stormwater quality treatment has been performed. However, wetland impacts are associated with only the north side of the levee.

Water quality treatment requirements are being met in dry linear retention facilities adjacent to the proposed roadway. The invert elevation for the north treatment area is set 1 foot above the DHW of 10.5 feet. As such the treatment facilities will have a control elevation of 11.5 and an overall depth of 1 foot. The invert elevation for the south treatment area is set 1 foot above the control elevation of Canal L-29 of 8.5 feet. As such the treatment facilities will have a control elevation of 9.5 and an overall depth of 1 foot. Based on water quality requirements by FDEP, the depth of the water quality volume, including OFW considerations provided is estimated at 0.5 feet deep.

In addition, the existing US 41 roadway will be breached in appropriate locations to account for the new bridges proposed in this alternative. The lengths of the breaches will approximate the length of the new bridges. The depth of the breaches will match natural ground on the south side of the roadway. For this alternative, the culverts under existing Tamiami Trail will not be filled with flowable fill as they are unaffected by the new construction, except for the breaches.

## F. Utilities

There are existing utilities within this alignment corridor that will be affected by the new construction. There is a buried telephone utility running at the base of the existing levee on the south side. There is also power poles running on the canal maintenance berm on the north side of the canal. Other utilities along the existing road embankment may be affected by the transition sections. Utility relocations will be coordinated with each utility owner. Relocation of the two utilities along the levee have been included in the estimate.

## G. Environmental Factors

The basic alignment without water quality treatment has encroachment to the north of the levee in the form of two short segments at S-355A and at S-355B/Tiger Tail Camp where it encroaches approximately 30 feet to the north. The option with water quality treatment encroaches a similar distance at the same locations, but also has a continuous basic encroachment of approximately 40 feet to the north. These permanent encroachments are 3 acres and 56 acres, respectively. There are no temporary encroachments into wetlands. There is permanent encroachment into Water Conservation Area 3B.

## H. Maintenance of Traffic During Construction

The proposed alignment for this alternative does not impact the existing alignment, except at the transitions on each end of the project limits. Therefore, traffic is to be maintained as it exists today. The proposed roadway is constructed on the existing levee, north of the existing alignment. A temporary roadway is constructed south of the existing alignment in the transition areas. Once the temporary roadway is completed, traffic is shifted onto it and the transitions are constructed to the new roadway. Traffic is then shifted to the new alignment, and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time” basis at the work site.

Maintenance of traffic will be an issue primarily at the beginning and end transitions. Access to the Flight 592 Memorial and S-333 will be maintained at all times. Access to the Tiger Tail Camp will be maintained from the new alignment.

## I. Construction and Life Cycle Costs

The cost of this alternative without water quality treatment is $67,959,312 and with water quality treatment is $73,457,368. Most of the cost is related to the roadway elements, and is slightly greater with water quality control because of the additional fill required.

| Alternative 3 | |
|---|---|
| Description | |
| *Alt. 3A - Without Water Quality Control* | |
| Roadway | $54,707,691 |
| Bridge | $13,251,619 |
| | |
| Total | $67,959,312 |
| *Alt. 3B - With Water Quality Control* | |
| Roadway | $60,1212,374 |
| Bridge | $13,244,994 |
| | |
| Total | $73,457,368 |

The life cycle costs for this alternative were developed for two cases: for the roadway alone, and for the total project. For the case without water quality treatment, pavement life cycle costs were calculated at $32,881,601 while the total project life cycle costs were estimated to be $70,751,666. For the case with water quality treatment, pavement life cycle costs were calculated at $35,909,171 while the total project life cycle costs were estimated to be $76,249,766. Paragraph 20 later in this section discusses the life cycle cost analysis.

## J. Other Aspects

There are several locations along the alignment that have been closely analyzed. The Flight 592 Memorial, located north of the L-29 borrow canal near the western limits of the project should remain undisturbed if possible. It will not be impacted by this alignment and access will remain at the S-333 structure. The alignment will need to transition to the north to avoid conflict with Tiger Tail Camp, S-355A, and S-355B. This shift will create a larger impact to the existing wetlands north of the existing levee.

The Osceola Indian Camp and Airboat Association of Florida sites are both located on the south side of the existing roadway near the western limits. A portion of the existing roadway must remain intact to provide access to the Osceola Indian Camp. A bridge will be required to provide access to the Airboat Association of Florida site from the proposed alignment on the north side of the canal.

A pump station is proposed on the north side of the canal near the eastern limits. The roadway will need to be located south of the pump station.

## 16. Alternative 4: New South Alignment with Raised Profile and Four New Bridges

### A. Description

This alternative is defined as relocating the Tamiami Trail alignment to a location south of the existing Tamiami Trail embankment. This alternative would include the construction of 4 new bridges along the relocated roadway to convey MWP flows from the L-29 borrow canal to Everglades National Park. The bridges would be aligned with existing S-355A and B (each with flow channel bottom widths of 60 feet), and the other two will be situated approximately midpoint between these structures and the east and west ends of the project. The two middle bridges would have a hydraulic width of 300 feet each, while the two outer bridges would have a hydraulic width of 425 feet each.

The existing Tamiami Trail embankment would need to be breached at locations similar to the bridge locations for Alternatives 1 and 2. Access to the Airboat Association of Florida site and the Osceola Indian Camp would be maintained. If any other parcels, in particular the communication tower sites, require access maintenance, other access connections might be needed. The typical section, key sheet, plan views of a portion of this alternative, and construction phasing are depicted in Plates A4-1 through A4-11; the structures are depicted in Plate A4-12. The pavement typical sections are shown on Plates A4-13 and A4-14.

As this alignment does not retain the centerline of the existing facility, alignment transitions are required at either end of the segment. At the east end of the corridor, the proposed S-356 pump station and adjacent S-334 spillway replacement and adjustments to levees and Tamiami Trail are additional factors affecting the transition.

### B. Typical Sections and Pavement Design

Roadway Typical Section

This typical section consists of two 12-foot wide travel lanes, and 8-foot wide shoulders on each side of the roadway. Five feet of this shoulder will be paved. There is guardrail located at the outside edges of these shoulders. The typical section with water quality treatment is much wider.

Pavement Design

This alternative is constructing a new alignment south of the existing roadway. This will require muck removal down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness is designed using Florida DOT procedures and are in Appendix C-3. The design will be most economical if conventional granular materials can be used with the 2 foot separation from the Design High Water elevation of 9.3 feet. Therefore, to provide sufficient clearance to accommodate fluctuations in the water elevation, a new top of asphalt centerline elevation of 14 feet is recommended. Plates A4-13 and A4-14 are the pavement schematics for the options with and without water treatment.

For 50 year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material, which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The proposed pavement section is as follows:

***Alternative 4 – with and without Water Quality Treatment***

Proposed centerline elevation = 14 feet
¾ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment
4 inch drainage layer
A-1 or A-3 embankment

To illustrate the clearances, if the top of pavement is at elevation 14 feet, the bottom of the limerock base is at elevation 12.75 feet, providing about 3.5 feet of clearance above the Design High Water elevation of 9.3 feet. This exceeds the 2 foot minimum. As an added precaution against capillary rise from the water table, the 4 inch granular drainage layer is placed beneath the LBR 40 subbase.

The periodic resurfacing interval recommended for this alternative is 12 years. This is the lower end of the typical 10 to 15 year interval in Florida. This is because even with the precautions of the drainage layer and additional high water clearance, the roadway is still in the Everglades and has ample access to water and maybe even unforeseen high water events.

## C. Plan and Profile

The proposed profile will provide a set clearance from the controlled high water elevation to the bottom of the proposed roadway subgrade. The set clearance is to meet FDOT design criteria, as well as SFWMD criteria. The proposed elevation at the crown of the roadway is 14.0 feet. The profile will be raised significantly in the areas of the proposed bridges. These bridges are located as follows:

Directly south of the S-355A drainage structure
Directly south of the S-355B drainage structure
Directly south of the proposed Weir B location
Directly south of the proposed Weir C location

At all bridge locations, the existing roadway will need to be breached. These breaches allow for the flow of water under the bridge.

## D. Structures

The proposed 43'-1'' wide bridge typical section for the four bridges within this alternative provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. Refer to Plate A4-12 for a description of the bridge lengths and the associated hydraulic openings. The bridges are of identical length for both Maintenance of Traffic alternatives.

Several superstructure and substructure alternatives were evaluated to determine the most cost effective bridge structure for these crossings. These systems include:

| Superstructure Alternatives | Substructure Alternatives |
|---|---|
| Transversely Post-Tensioned Slab Units<br><br>FDOT Precast Prestressed Double Tee System<br><br>AASHTO Beams Types II, III & IV with Cast-in-Place Concrete Deck | 18 and 24 inch square Prestressed Concrete Piles (with pre-drilling)<br><br>3 foot diameter Drilled Shafts |

The most cost-effective bridge structural system for all four bridges uses AASHTO Type II Beams with a composite cast-in-place concrete deck. The superstructure is supported on pile bents using 18 inch square prestressed concrete piles installed and driven in holes predrilled to El. –10.00 into the limerock.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructibility of the bridges for both Maintenance of

Traffic alternatives. One approach requires a temporary haul road approximately 30 feet wide to be constructed south of the proposed bridges to allow for crane placement and precast beam delivery. A second approach requires a temporary haul road approximately 20 feet wide between the proposed bridge construction and the temporary detour road. Precast beams would be brought to the site along the temporary detour road. The latter approach is preferred.

## E. Drainage

As discussed in Alternative 2, an analysis of wetland impacts associated for both with and without stormwater quality treatment has been performed. However, wetland impacts associated with providing stormwater treatment are only on the south side of the new roadway alignment. Due to the proximity of the new alignment to the existing roadway, the proposed treatment facilities on the north side of the new alignment will be constructed in the existing embankment.

Water quality treatment requirements are being met in dry linear retention facilities adjacent to the proposed roadway. The invert elevations are set 1 foot above the new high control elevation of Canal L-29, which is 8.5. As such the treatment facilities will have a control elevation of 9.5 and an overall depth of 1 foot. Based on water quality requirements by FDEP, the depth of the water quality volume provided, including OFW considerations, is estimated at 0.5 feet deep.

Regardless of the stormwater treatment scenarios, the existing system of culverts will not be replaced for the reconstruction alternative. The MWD project did not require the culverts to move the required discharge south into the park. For this alternative, both options encroach on the south headwalls of the culverts. Consequently, the culverts will be plugged with flowable fill to prevent water from flowing south towards the new embankment.

## F. Utilities

There are existing utilities within the corridor that will be affected by the new construction. There is a buried telephone facility running behind the guardrail on the south side of the roadway. There is also a 23 kv overhead electric line running along the south side, located about 100 feet south of the existing guardrail.

All utilities within the proposed typical section will need to be relocated. Utility relocations will be coordinated with each utility owner.

## G. Environmental Factors

As this alignment is located nearly entirely to the south of the existing facility, it has significant environmental impacts. The alignment without water quality treatment encroaches approximately 45 feet to the south, while the option with water quality treatment encroaches approximately 70 feet to the south. These permanent encroachments are 62 and 95 acres in area, respectively. There are no temporary encroachments into wetlands. There is permanent encroachment into Everglades National Park and the wood stork rookery.

## H. Maintenance of Traffic During Construction

Maintenance of traffic will be a factor primarily at the beginning and end transitions to the existing roadway. Access to the Osceola Indian Camp and the Airboat Association of Florida sites will be maintained at all times.

Temporary barricades spaced every 50 feet are to be placed at the south edge of the westbound travel lane line. In ¼ mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the north, utilizing the new pavement. A 10-foot wide strip of temporary pavement is placed south of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed one foot north of the south edge of the temporary pavement.

Unsuitable material is excavated and embankment is placed and compacted along the proposed alignment. The southern guardrail, eastbound shoulder and both travel lanes are constructed. A temporary barrier wall is placed adjacent to the westbound travel lane and traffic is shifted to the new pavement. The westbound shoulder and guardrail are constructed and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time” basis at the work site.

## I. Construction and Life Cycle Costs

The cost of this alternative without water quality treatment is $45,235,110 and with water quality treatment is $47,128,438. Most of the cost is related to the roadway elements, and is slightly greater with water quality control because of the additional fill required.

| ***Alternative 4*** | |
|---|---|
| *Alt. 4A - Without Water Quality Control* | |
| Roadway | $40,844,178 |
| Bridge | $4,390,932 |
| | |
| Total | $45,235,110 |
| *Alt 4B - With Water Quality Control* | |
| Roadway | $42,390,932 |
| Bridge | $4,390,932 |
| | |
| Total | $47,128,438 |

The life cycle costs for this alternative were developed for two cases: for the roadway alone, and for the total project. For the case without water quality treatment, pavement life cycle costs were calculated at $25,462,350 while the total project life cycle costs were estimated to be $48,233,140. For the case with water quality treatment, pavement life cycle costs were calculated at $26,503,665 while the total project life cycle costs were estimated to be $50,126,440. Paragraph 20 later in this section discusses the life cycle cost analysis.

### J. Other Aspects

There are existing features that must remain undisturbed. The Flight 592 Memorial is located north of the L-29 borrow canal near the western limits of the project. This will not be impacted with this alternative. Access will remain at the S-333, S-334, and S-336 structures. Access to Tiger Tail Camp, located on the north side of the canal, will remain as it is today. The Osceola Indian Camp and Airboat Association of Florida are both located on the south side of the existing roadway near the western limits. It may be necessary to acquire right-of-way from these facilities to construct the roadway with this alignment.

## 17. Alternative 5: New Alignment on Structure

### A. Description

This alternative is expected to be defined as reconstruction of the Tamiami Trail alignment between S-333 and S-334 as an elevated structure for the entire length of the segment. A key map depicting the basic features of this alternative is found on Plate A5-2. The alignment would be positioned to minimize impact and construction cost, and to facilitate maintenance of traffic during construction. The profile would be established per the applicable drift, maintenance and navigation bridge clearances that would be applicable for a particular alignment, although excessive “up and down” profiling would be avoided. This alternative requires only a modest alignment transition at either end of the segment.

The existing Tamiami Trail embankment would need to be breached at locations similar to the bridge locations for Alternatives 1 and 2. The typical section would be standard the entire length, with two travel lanes of 12 feet, two shoulders of 8 feet, and outside barrier shapes. Exceptions would occur where a surface connection for access or other reasons might be required; at these locations turning lanes might be needed. The typical section is depicted in Plate A5-1, and plan views of key locations along this alternative are depicted in Plates A5-3, A5-3A, A5-4 and A5-5. Construction phasing is shown on Plates A5-6 and A5-6A, and bridge details on Plate A5-7.

As for Alternatives 2 to 4, this alternative is presented in configurations with and without water quality treatment. For the instance without water quality treatment, the new bridge deck would be equipped with drain scuppers that would discharge directly to the area below. For the instance with water quality treatment, piping would convey runoff to dry retention facilities constructed on adjacent segments of the abandoned existing roadway embankment. These facilities would be approximately 600 feet long and spaced at ½ mile intervals, such that there would be approximately 22 of them in the corridor. These would require maintenance to be provided by workers using lightweight equipment transported by boat.

## B. Typical Sections and Pavement Design

Roadway Typical Section

The roadway typical section shall provide two 12-foot travel lanes with 8-foot shoulders and outside barriers.

Pavement Design

Alternative 5 is a bridge for the entire 11 mile length of the MWD project. At each end there will be short reconstruction segments of the roadway to transition to the new bridges. The pavement will have a grade transition from the nominal average 11 foot elevation to about elevation 17 feet at the bridge deck.

The amount of fill required to match grades will cause a settlement in the existing embankment. Considering this settlement will occur at the bridge approaches, it is not desirable. Also, with the expense to build the transitions with engineered fill, it does not seem prudent to build good material on top of uncontrolled material. Therefore, it is recommended that the embankment for the bridge transitions be reconstructed. This also is in accordance with Florida DOT guidelines.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness for the bridge approaches is designed using Florida DOT procedures, and are in Appendix C-3. Although the Florida DOT typically only requires a 20 year design, the Corps of Engineers has requested a 50 year design. Since a new embankment will be built at a higher elevation, the design will be most economical if conventional granular materials can be used with the 2 foot separation from the Design High Water elevation of 9.3 feet.

For 50 year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material, which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The proposed pavement section is as follows:

***Alternative 5 – Bridge Transition Pavement***

¾ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment

To meet the separation criteria, the bottom of the limerock base will need to be at elevation 11.3 feet or above. This is easily accommodated with a proposed roadway elevation of 17 feet. At the transition to the existing roadway, where the top of asphalt is at 11 feet, a thick asphalt wedge will have to be placed until the separation criteria is achieved. The typical section of these bridge transitions is very similar to other alternatives, in particular Plate A2-9 (except water quality treatment may or may not be provided).

## C. Plan and Profile

The profile will be established per applicable drift, maintenance and navigation bridge clearances, while minimizing humps in the profile.

## D. Structures

The proposed 43'-1'' wide bridge typical section provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. A proposed 35'-1'' wide bridge typical section applies to the access bridge to the Airboat Association of Florida site and provides sufficient deck area for two 12-foot wide travel lanes, and 4-foot shoulders on the both sides of the travel lanes. Refer to Plate A5-8 for a description of the bridge length. Refer to Plate A5-3A for a description of the access bridge to the Airport Association of Florida site.

Several superstructure and substructure alternatives were evaluated to determine the most cost effective bridge structure. These systems include:

| Superstructure Alternatives | Substructure Alternatives |
|---|---|
| Transversely Post-Tensioned Slab Units<br><br>FDOT Precast Prestressed Double Tee System<br><br>AASHTO Beams Types II, III & IV with Cast-in-Place Concrete Deck<br><br>Florida Bulb Tees 72 and 78 with Cast-in-Place Concrete Deck | 18 and 24 inch square Prestressed Concrete Piles (with pre-drilling)<br><br>3 foot diameter Drilled Shafts |

The most cost-effective bridge structural system for the bridge uses AASHTO Type V Beams with a composite cast-in-place concrete deck. The superstructure is supported on pile bents using two 3-foot diameter drilled shafts.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructibility of the bridges for this alternative. Installation of the drilled shafts and erection of the precast beams for the bridges over the L-29 Borrow Canal will most likely be performed from barge-mounted cranes. Crane size and lifting capability may be limited based on the size of barge that can be transported to and placed within the canal.

The minimum offset of the centerline of the bridge from the centerline of the roadway was established as 36 feet to allow a minimum buffer area of 5 feet from the temporary barrier to the edge of bridge, to allow the construction of temporary pavement without impacting the wetlands (see Maintenance of Traffic section), and to allow a minimum of 50 feet of canal width for barge operations. This offset could be increased by 10 feet to allow for a pullout lane for precast beam delivery. This offset cannot by increased sufficiently to allow for crane placement on the south bank of the canal without either filling part of the canal or impacting the wetlands by shifting the traffic farther south.

## E. Drainage

Two drainage alternatives are being considered for this alternative. One alternative does not include water quality treatment of stormwater runoff from the new structure or its approach roadways. As such, runoff from the bridge would be discharged through scuppers at regular spacings on both sides of the bridge deck. The other variation with water quality treatment would be requires catchment of the runoff through a piping system to a system of dry linear retention facilities constructed on the remaining existing road embankment. The individual swales would be approximately 600 feet long and spaced at ½ mile intervals. Maintenance would be performed from boats.

The culverts under the existing roadway embankment would be unaffected by new construction except for breaches for water flow, and would be left in place.

## F. Utilities

There are existing utilities within the corridor that will be affected by the new construction. There is a buried telephone facility running behind the guardrail on the north side of the roadway. There is also a buried telephone facility running behind the guardrail on the south side of the roadway.

All utilities within the proposed typical section will need to be relocated. Utility relocations will be coordinated with each utility owner.

## G. Environmental Factors

As this alignment is located between the existing Tamiami Trail and the L-29 borrow canal, it has limited environmental impacts. These include the temporary wetland impacts of the two detour roads at either end of the corridor which will impact wetlands to the south, an area of 0.9 acres for the two transitions. These areas would be restored after construction of the transitions is completed. There is no permanent encroachment into Water Conservation Area 3B, Everglades National Park, or the wood stork rookery.

## H. Maintenance of Traffic During Construction

In order to construct this alignment, the existing roadway will need to be shifted to the south. This shift will prevent any traffic flow to be allowed underneath the proposed structure. Once temporary pavement is constructed on the south shoulder, traffic can be shifted out from under the proposed alignment. Construction staging will be done from a barge in the L-29 Borrow Canal, minimizing the impact to both the wetlands and the traffic. Refer to Paragraph D above for additional discussion.

Temporary barricades spaced every 50 feet are to be placed at the south edge of the eastbound travel lane line. In ¼ mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the south, utilizing the new pavement. A 10-foot wide strip of temporary pavement is placed north of the existing center line to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed at the north south edge of the temporary pavement. The bridge is then constructed.

A temporary roadway is constructed south of the existing alignment in the transition areas. Once the temporary roadway is completed, traffic is shifted onto it and the transitions are constructed to the new bridge. Traffic is then shifted to the new alignment, and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time” basis at the work site.

## I. Construction and Life Cycle Costs

The cost of this alternative is approximately $135,915,000 million without water quality treatment and $140,314,000 with water quality control. Most of these costs are in the cost of the lengthy structure.

| | |
|---|---|
| ***Alternative 5*** | |
| *Alt. 5A - Without Water Quality Control* | |
| Roadway | $2,375,900 |
| Bridge | $133,539,100 |
| | |
| Total | $135,915,000 |
| *Alt 5B - With Water Quality Control* | |
| Roadway | $2,375,900 |
| Bridge | $137,938,100 |
| | |
| Total | $140,314,000 |

The life cycle costs for this alternative were developed for the total project, but not for the roadway alone as only a small part of the alignment is roadway on embankment. The total project life cycle costs will be in excess of the initial capital costs. Life cycle costs were calculated for this alternative, and would far exceed those of the other alternatives due to the high initial cost, and recurring costs for various elements of bridge maintenance. Paragraph 20 later in this section discusses the life cycle cost analysis.

### J. Other Aspects

The existing Tamiami Trail embankment will be breached at locations similar to the bridge locations for Alternative 4. Connecting roads will be provided for access to the airboat club to remain. Access to the Osceola camp will be by way of a connecting road from the west. At these locations turning lanes may be needed. The flow in the L-29 borrow canal will not be obstructed by piers or any other portion of the superstructure.

## 18. Life Cycle Cost Analysis

A life cycle cost analysis was prepared for the alternatives, to include those configurations with and without water quality treatment. While three detour/maintenance of traffic options were examined for Alt. 1 and Alt. 2A, the temporary detour to the south was used for this analysis. An analysis was also prepared for the scenario of overlaying the existing facility.

The analyses were based on a 50-year term using a 4% interest rate. While bridges are designed for a 75-year service life, no salvage value was presumed at the end of the analysis period for the bridges or any other features. Minor recurring costs of bridge inspection were also not considered. Other maintenance costs were considered to be similar between the alternatives and therefore not a substantial influence in the outcome.

Because of the importance of the issue of overlaying the existing roadway versus reconstructing it under the various alternatives and their variations, the life cycle cost was calculated by alternative for two cases: for the total project and for the pavement-related elements only. In this way, the relative merits of the pavement options could be assessed separately from other project components.

Specific assumptions for the two pavement cross section scenarios are presented in the following table:

| Life Cycle Cost Assumptions (Pavement) | |
|---|---|
| **Overlay Construction [Applies to Existing Roadway Improved to Standards, Alternative 1 (Without Water Quality Treatment) and Alternative 2B - Without Water Quality Treatment]**<br><br>7-year maximum overlay life, based on continued settlement caused by muck, and the fact that it has deteriorated to a condition of 6 over the past 7 years.<br><br>Overbuild quantity assumed over 50% of the road because of the continued differential settlement and the necessity to restore cross slope.<br><br>Thicker removal and replacement required (3" assumed) because of the increased possibility of structural problems (evidenced by the beginning of cracking in one of the thicker cores). Also, the pavement structure will be more susceptible to structural problems due to increased water level. | |
| To summarize the overlay requirements, the following table of pavement materials is provided: | |
| Friction Course | ¾" |
| Structural Course | 6" |
| Variable depth leveling course to remove surface deviations and restore cross slope | 0-12" |
| Existing roadway (considered LBR-40 subbase). | 12" minimum |
| **Reconstructed Roadway Section (Applies to Alternatives with New Embankment Construction (including subgrade), including Alternative 2 With Water Quality Treatment, Alternative 3 With and Without Water Quality Treatment, and Alternative 4 With and Without Water Quality Treatment]**<br><br>12-year maximum overlay life, based on the fact that the muck will be removed and differential settlement will cease.<br><br>Removal of muck means that no overbuild will be required.<br><br>New pavement structure will be more resistant to fluctuations in water level. As a result, structural problems are not likely.<br><br>Because of this, a thinner "functional" removal and replacement is required (2.25" assumed). | |

## Overlay Construction

The 50 year roadway designs will require periodic maintenance activities. These include resurfacings and a complete guardrail replacement. As discussed under the alternatives that only use an asphalt overlay (namely Upgrade the Existing and Alternative 2 without Water Quality Treatment), more frequent resurfacings will be required due to the proximity of the water table. It is anticipated that the resurfacings will be required due to future settlements and localized pavement failures. As the existing pavement has deteriorated to a condition of 6 in the past 7 years, it is recommended that a 7 year mill and resurfacing interval be used.

In addition, it is anticipated that sometime over the next 50 years, guardrail standards will change. It is therefore anticipated that a complete guardrail replacement will occur in about 30 years. The details of the life cycle cost are discussed at the end of Appendix C-4.

## Roadway Reconstruction Life Cycles

Reconstructed roadways are those that are on embankments rebuilt from the bedrock with all muck removed. In particular, this would be the remaining options B, C, D of Alternative 2, Alternative 3 and Alternative 4. The bridge approaches of Alternatives 1 and 5 are short and would be covered under the periodic maintenance Work Program for the remainder of the roadway. For the reconstruction alternatives, a longer mill and resurfacing interval of 12 years is recommended. This is due to the reconstructed embankment and the higher roadway elevations providing greater water separation.

In addition, it is anticipated that sometime over the next 50 years, guardrail standards will change. It is therefore anticipated that a complete guardrail replacement will occur in about 30 years. The details of the life cycle cost are discussed at the end of Appendix C-4.

## Summary of Results

The results of the life cycle cost analysis are presented in Table 1. It is seen that the pavement life cycle cost is the least for the Alternative 1, followed by Alternative 2A - Without Water Quality Treatment, as it is similar to Alternative 1. Neither of these calls for the rebuilding of the existing roadway embankment. Alternative 4 with or without water treatment is next in cost, followed by Alternative 2 with water quality treatment. The highest pavement life cycle costs are for Alternative 3 with and without water quality treatment. Alternative 1 has a lower life cycle cost because the pavement is not raised due to the higher water control level and will sustain occasional flooding. Alternatives 3A or 3B are more costly as they are built to a higher finished elevation and the embankment they sit on must be rebuilt.

The results of the life cycle cost analysis for the total project alternatives show the alternatives ranked from lowest to highest cost as follows:

*Table 1*
***LIFE CYCLE COST ANALYSIS***

Tamiami Trail Modifications 12/19/00

| | <A> | <B> | <C> | <D> | <E> | <F> | <G> | <H> |
|---|---|---|---|---|---|---|---|---|
| ***ALTERNATIVE*** | ***Roadway Cost Only (No Additives)*** | ***Resurfacing Interval (Yr.)*** | ***Roadway Area (SY mainline)*** | ***Roadway Maint. Life Cycle Cost (per SY)*** | ***Roadway Maint. Life Cycle Cost (Present Worth)*** *[D X C]* | ***Total Roadway Life Cycle Cost (Present Worth)*** *[A + E]* | ***Total Construction Cost*** *[MCACES]* | ***Composite Life Cycle Cost for Alternative (Present Worth)*** *[E+G]* |
| Existing Facility Improved to Standards | $5,594,655 | 7 | 150,504 | $54.32 | $8,175,377 | **$13,770,032** | $10,172,100 | **$18,347,477** |
| | | | | | | | | |
| 1- No Water Quality Treatment | $5,471,495 | 7 | 150,504 | $54.32 | $8,175,377 | **$13,646,872** | $14,330,871 | **$22,506,248** |
| | | | | | | | | |
| 2A - No Water Quality Treatment | $10,977,670 | 7 | 150,504 | $54.32 | $8,175,377 | **$19,153,047** | $24,354,700 | **$32,530,077** |
| 2B - Water Quality Treatment | $29,779,970 | 12 | 150,504 | $19.92 | $2,998,040 | **$32,778,010** | $58,550,700 | **$61,548,740** |
| | | | | | | | | |
| 3A - No Water Quality Treatment | $30,089,235 | 12 | 140,179 | $19.92 | $2,792,366 | **$32,881,601** | $67,959,300 | **$70,751,666** |
| 3B - Water Quality Treatment | $33,116,806 | 12 | 140,179 | $19.92 | $2,792,366 | **$35,909,171** | $73,457,400 | **$76,249,766** |
| | | | | | | | | |
| 4A - No Water Quality Treatment | $22,464,310 | 12 | 150,504 | $19.92 | $2,998,040 | **$25,462,350** | $45,235,100 | **$48,233,140** |
| 4B - Water Quality Treatment | $23,505,625 | 12 | 150,504 | $19.92 | $2,998,040 | **$26,503,665** | $47,128,400 | **$50,126,440** |
| | | | | | | | | |
| 5A - No Water Quality Treatment | $1,306,745 | 12 | 4,000 | $19.92 | $79,680 | **$1,386,425** | $135,914,500 | **$135,994,180** |
| 5B - Water Quality Treatment | $1,306,745 | 12 | 4,000 | $19.92 | $79,680 | **$1,386,425** | $140,313,800 | **$140,393,480** |

SY Life Cycle Costs for pavement increased to include shoulders. Maintenance cost for structures not included. Additive costs are contingency.
New bridges are not offset, and utilize temporary detour to south for construction.
Operational cost considered comparable for each alternative. 4% Discount Rate assumed.

Prepared: Dec. 19, 2000

1. Alternative 1 Without Water Quality Treatment
2. Alternative 2A Without Water Quality Treatment
3. Alternative 4A Without Water Quality Treatment
4. Alternative 4B With Water Quality Treatment
5. Alternative 2B With Water Quality Treatment
6. Alternative 3A Without Water Quality Treatment
7. Alternative 3B With Water Quality Treatment
8. Alternative 5A Without Water Quality Treatment
9. Alternative 5B With Water Quality Treatment

This ordering parallels the results for the pavement life cycle cost analysis. All other things being equal, Alternative 1 has the lowest life cycle cost. However, for not a large increase, Alternative 2A provides conformance with subgrade clearance and eliminates the overtopping of the roadway. Alternative 2B with water quality treatment is greater in cost than the Alternative 4 options because it requires removal of a portion of the existing roadway embankment. Alternative 3 options are more costly due to additional embankment removal and reconstruction as well several more bridges. Although there are insignificant ongoing maintenance costs associated with Alternative 5, it carries the highest life cycle cost due to the high initial construction cost spread over the 50-year life cycle period.

## 19. Comparative Evaluation of Alternatives

The environmental, economic and social and cultural effects of each primary alternative considered are shown in Tables 3 and 4. All the alternatives but one satisfy the functional requirements dictated by the project objective, namely to convey the Modified Water Deliveries Project flows while addressing roadway subgrade and cross-section requirements of the Florida Department of Transportation for the roadway, including subgrade clearances, with one exception. The exception is Alternative 1 which by definition does not include building up the roadway profile for subgrade clearance and to conform to the design high water elevation.

It is again noted that Alternatives 2, 3, and 4 have variations with and without the water quality treatment, which amounts to dry retention swales parallel to and on either side of the roadway. For simplicity in the tables, Option 2 for the construction of the four new bridges under Alternatives 1 and 2 was utilized. Option 2 calls for the placement of the bridges on the tangent of the finished roadway using a temporary detour road rather than offset to the south under Option 1 or a temporary bridge in the canal under Option 3. Option 2 is always more costly than Option 1 because it requires construction of a temporary detour road, removal and reconstruction of the existing embankment, and removal of the temporary detour road. The differential is from $1.5 million to $6 million depending upon the alternative. Option 3 is extremely high in cost differential. The ranking of alternatives according to cost is similar to that for the project life cycle cost listing. Dimensions for wetland encroachment generally extend the length of the corridor.

Several observations can be made upon inspection of the table, as follows:

- Water quality treatment cannot be included in Alternatives 2, 3 and 4 without introducing significant wetland encroachment.
- The inclusion of water quality treatment in Alternatives 2, 3 and 4 increases the project cost, by $34 million for Alternative 2, over $5 million for Alternative 3, and $2 million for Alternative 4, while affecting 71, 23, and 68 acres of wetlands, respectively.
- The inclusion of water quality treatment necessarily results in wetland impacts, and encroachment to either Water Conservation Area 3B or Everglades National Park.
- Alternative 1 is least costly and has the lowest life cycle cost, but has the drawbacks of not satisfying FDOT subgrade criteria, and being subject to flooding.
- An important issue is the efficacy of removing the existing roadway embankment as in Alternative 2A with water quality treatment versus raising the road on the existing embankment as in Alternative 2B without water quality treatment versus building new embankment and leaving the existing embankment in place as in Alternative 4 versus rebuilding the levee as a road in Alternative 3.
- Building on the existing road embankment is more cost-effective, provided water quality treatment is not required.
- Alternative 2 with water quality treatment is more expensive than Alternative 4 with water quality treatment because it requires removal of the existing road embankment.
- Impacts to real estate sites, recreational access, and water management infrastructure are generally minimal. Alternative 4 encroaches upon the Osceola Camp and the Airboat camp, while Alternative 3 is in proximity to the Tiger Tail Camp.
- Alternative 5 is substantially more expensive, although it has relatively limited adverse impacts. It could be viewed differently than the other alternatives because its elevated configuration might be judged to relate to potential long-range water management actions in the corridor under potential CERP actions.

*Table 2*
***SUMMARY COMPARISON OF ALTERNATIVES: Without Water QualityTreatment***
**(For option with Temporary Road at Bridges for Alts. 1, 2 and 4; No Offset Bridges)** **Tamiami Trail Modifications 12/19/00**

| EVALUATION FACTOR | Alt. 1 | Alt. 2A | Alt. 3A | Alt. 4A | Alt. 5A |
|---|---|---|---|---|---|
| ***COST FACTORS*** | | | | | |
| **Construction Cost** | $14,330,871 | $24,354,651 | $67,959,310 | $45,235,110 | $135,915,000 |
| **Roadway Cost** | $9,948,172 | $19,949,427 | $54,707,691 | $40,844,178 | $2,375,939 |
| **Bridge Cost** | $4,382,699 | $4,405,224 | $13,251,619 | $4,390,932 | $133,539,100 |
| **Annual O&M Cost** | $40,000 | $40,000 | $40,000 | $40,000 | Not calculated. |
| **Life Cycle Cost (Pavement only)** | $13,646,872 | $19,153,047 | $32,881,601 | $25,462,350 | $1,386,425 |
| **Life Cycle Cost (Total Project)** | $21,189,677 | $32,530,077 | $70,751,666 | $48,233,140 | $135,994,180 |
| ***ENVIRONMENTAL FACTORS*** | | | | | |
| **Wetland Impact - Permanent** | 1.6 acres (at bridges only) | 1.6 acres (at bridges only) | 12.3 acres | 68.3 acres | 0.0 acres |
| **Wetland Impact - Temporary** | 18.5 acres | 18.5 acres | 0.9 acres | 0.0 acres | 0.9 acres |
| **Water Conservation Area 3B Impacts** | No impact. | No impact. | Encroachments of 30 feet max. at two spillways and Tiger Tail Camp to realign roadway, and 7 feet along the entire corridor. | No impact. | No impact. |
| **Everglades National Park Impacts** | No encroachment, except for 5-6 feet near bridges. Road runoff is untreated. | No encroachment, except for 5-6 feet near bridges. Road runoff is untreated. | Temporary detour roads at both ends will encroach up to 40 feet for a short distance to the south of the existing road. Road runoff is untreated. | Encroachment of 50 feet the length of the corridor, and 5-6 feet more near the bridges. Road runoff is untreated. | Temporary detour roads at both ends will encroach for a short distance to the south of the existing road. Road runoff is untreated. |
| **Potential Wood Stork Impacts** | No impact. | No encroachment, except for 5-6 feet near bridges - north limits of rookery not well defined. | Temporary detour road at east end will encroach up to 40 feet for a short distance to the south of the existing road. | Encroachment of 50 feet the length of the corridor - north limits of rookery not well defined. | Temporary detour road at east end will encroach for a short distance to the south of the existing road. |
| **Relation to Future Everglades Restoration Actions** | No significant impact. Investment in new bridges. Road could be elevated at a later date. | Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made | Road will serve as permanent levee at protection elevation of 17.4 ft, with L-29 spillways and weirs undisturbed. Permits | Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made | Very significant highway investment, which allows flexibility in modifying or degrading existing water management and roadway |

| EVALUATION FACTOR | Alt. 1 | Alt. 2A | Alt. 3A | Alt. 4A | Alt. 5A |
|---|---|---|---|---|---|
| | | before construction. | future removal of most of the existing roadway. | before construction. | infrastructure. |
| ***REAL ESTATE FACTORS*** | | | | | |
| **Tiger Tail Camp** | No impact. Access via boat from Trail and from L-29 levee road maintained. | None. Access via boat from Trail and from L-29 levee road maintained. | Direct access provided from Trail. Proximity of highway will increase noise level at camp. | None. Access via boat from Trail and from L-29 levee road maintained. | No direct impact. Access via boat from Tamiami Trail not provided. |
| **Osceola Camp** | No impact. Access to remain as is. | No impact. Driveway will be adjusted for elevation change. | None. Access to be provided by existing highway connected to the west. | South edge of roadway 50 feet closer, probable partial acquisition. | None. Access to be provided by existing highway connected to the west. |
| **Airboat Ass'n. of Florida** | No impact. Access to remain as is. | No impact. Driveway will be adjusted for elevation change. | None. Access to be provided by new bridge across the L-29 Canal. | South edge of roadway 50 feet closer, probable partial acquisition. | None. Access to be provided by connection to the elevated highway. |
| **Other Property/Features** | No impact. | No impact. | Recreational areas on north side of L-29 canal will be reduced in size. | No impact. | No impact. |
| **Recreational Access** | No impact. | No impact. | No impact. | No impact. | No impact. |
| **Access to Water Management Facilities** | No impact. | No impact. | Improved for facilities along L-29 Levee. | No impact. | No impact. |
| ***CONSTRUCTION FACTORS*** | | | | | |
| **Construction Duration** | 18 months | 24 months | 30 months | 24 months | 48 months |
| **Maintenance of Traffic** | A "rolling" construction work zone as resurfacing progresses. Interruption of two-way flow or significant traffic control as 1/3 of road is repaved at at time. Delivery of materials is an issue. | A "rolling" construction zone as resurfacing progresses. Shifted centerline would permit resurfacing in 2 increments rather than in 3 as for Alt. 1. Temporary detours eliminate conflicts at bridges. Delivery of materials also an issue. | Only active disruptions are at connections at either end. The removal and delivery of materials is an issue. | Only limited impact with the connections at either end. The removal and delivery of materials is an issue. | Only active disruptions are at connections at either end and with the delivery of materials. Road to be shifted around areas of column construction, beam placement, and deck installation. |
| **Ease of Construction** | Complex due to space constraints. | Somewhat complex. | Straightforward. | Somewhat complex. | Complex due to the amount of work and material. |

| EVALUATION FACTOR | Alt. 1 | Alt. 2A | Alt. 3A | Alt. 4A | Alt. 5A |
|---|---|---|---|---|---|
| ***ROADWAY ENGINEERING FACTORS*** | | | | | |
| **Horizontal Geometry** | No significant change. | No significant change for constant offset condition with bridges on same tangent alignment. Twin reverse curves at four new bridges with the offset bridge option are not preferable. | Simple reverse curve transition at east end is acceptable. Three curve transition at west end is not desirable in relation to long tangent sections.<br>Twin reverse curves at weirs, spillways, and Tiger Tail camp are not preferable. | Simple reverse curves transitions to constant offset from the existing centerline are acceptable. | Simple reverse curve transition at east end is acceptable. Three curve transition at west end is not desirable in relation to long tangent sections. |
| **Vertical Geometry** | No significant impact. Bridges will create 4 modest humps that are widely separated. | No significant impact. Entire profile will be raised with modest, widely separated humps at the bridges. | No significant impact. Entire profile will be raised, but will be relatively flat, with transitions at either end. | No significant impact. Entire profile will be raised with modest, widely separated humps at the bridges. | No significant impact. Entire profile will be raised, but will be relatively flat, with transitions at either end. |
| **Pavement Serviceability** | Uneven riding surface and maintenance requirement is expected to continue due to settlement of the muck layer.<br>No clearance from design high water elevation per FDOT requirements with MWD project. Estimated overlay period is a maximum of 7 years.<br>Potential for structural problems to develop, since beginning of fatigue cracking seen in one core. | Uneven riding surface and maintenance requirement is expected to continue due to settlement of the muck layer.<br>Estimated overlay period is a maximum of 7 years.<br>Potential for structural problems to develop, since beginning of fatigue cracking seen in one core. | New pavement from the limestone bedrock up is expected to have excellent performance with low life cycle/ maintenance costs<br>The chance for reuse of the levee material exists, reducing the amount of new fill required.<br>Approximate 6 ft. clearance from the anticipated high water level and bottom of stabilized base. Estimated overlay period is 12 years. | New pavement from the limestone bedrock up is expected to have excellent performance with low life cycle/ maintenance costs<br>Estimated overlay period is 12 years.<br>Drainage layer allows greater protection from variable water levels.<br>Approximate 3 ft. clearance from the anticipated high water level and bottom of stabilized base. | New pavement for the transitions from the limestone bedrock up is expected to have excellent performance with low life cycle/ maintenance costs.<br>Estimated overlay period is 12 years. |
| **Safety and Operations** | No basic change, but the roadway will be susceptible to sporadic overtopping due to the MWDProject flows, with a resulting issues in traffic operations, traffic safety and potential road closures. | No significant change for option where new bridges are on tangent alignment. Where bridges are offset from existing alignment, reverse curves at bridges while within design criteria are less desirable from a safety standpoint due to the long tangent sections. | Triple curve at west end is not preferable due to long tangents for basic roadway. | No significant issues. | Triple curve at west end is not preferable due to long tangents for basic roadway. |

*Table 3*
***SUMMARY COMPARISON OF ALTERNATIVES: With Water QualityTreatment***
**(For option with Temporary Road at Bridges for Alts. 1, 2 and 4; No Offset Bridges)** **Tamiami Trail Modifications 12/19/00**

| EVALUATION FACTOR | Alt. 1 | Alt. 2B | Alt. 3B | Alt. 4B | Alt. 5B |
|---|---|---|---|---|---|
| ***COST FACTORS*** | | | | | |
| **Construction Cost** | Not applicable. | $58,550,650 | $73,457,360 | $47,128,440 | $140,314,000 |
| **Roadway Cost** | Not applicable. | $54,145,430 | $60,212,370 | $42,737,510 | $2,375,900 |
| **Bridge Cost** | Not applicable. | $4,405,220 | $13,244,990 | $4,390,930 | $137,938,100 |
| **Annual O&M Cost** | Not applicable. | $40,000 | $40,000 | $40,000 | Not calculated. |
| **Life Cycle Cost (Pavement only)** | Not applicable. | $32,778,010 | $35,909,171 | $26,503,665 | $1,386,425 |
| **Life Cycle Cost (Total Project)** | Not applicable. | $50,126,440 | $76,249,766 | $50,126,440 | $140,393,480 |
| ***ENVIRONMENTAL FACTORS*** | | | | | |
| **Wetland Impact - Permanent** | Not applicable. | 71.0 acres | 23.0 acres | 100.3 acres | 0.0 acres |
| **Wetland Impact - Temporary** | Not applicable. | 18.5 acres | 0.9 acres | 0.0 acres | 0.9 acres |
| **Water Conservation Area 3B Impacts** | Not applicable. | No impact. | Encroachment of 15 feet for the length of the corridor. Encroachments of 30 feet max. at two spillways and Tiger Tail Camp to realign roadway. | No impact. | No impact. |
| **Everglades National Park Impacts** | Not applicable. | Encroachment of 51 feet the length of the corridor, with 5-6 feet more near bridges. | No impact. | Encroachment of 74 feet the length of the corridor, with 5-6 feet more near bridges. | Minor temporary impact. |
| **Potential Wood Stork Impacts** | Not applicable. | Encroachment of 51 feet the length of the corridor, with 5-6 feet more near bridges. | Temporary detour roads at both ends will encroach up to 40 feet for a short distance to the south of the existing road. | Encroachment of 74 feet the length of the corridor, with 5-6 feet more near bridges.. | No impact. |
| **Relation to Future Everglades Restoration Actions** | Not applicable. | Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made before construction. | Road will serve as permanent levee at protection elevation of 17.4 feet, with L-29 spillways and weirs undisturbed. Permits future removal of most of the existing roadway. | Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made before construction. | Very significant highway investment, which allows flexibility in modifying or degrading existing water management and roadway infrastructure. |

| EVALUATION FACTOR | Alt. 1 | Alt. 2B | Alt. 3B | Alt. 4B | Alt. 5B |
|---|---|---|---|---|---|
| ***REAL ESTATE FACTORS*** | | | | | |
| **Tiger Tail Camp** | Not applicable. | None. Access via boat from Trail and from L-29 levee road maintained. | Direct access provided from Trail. Proximity of highway will increase noise level at camp. | None. Access via boat from Trail and from L-29 levee road maintained. | No direct impact. Access via boat from Tamiami Trail not provided. |
| **Osceola Camp** | Not applicable. | South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change. | None. Access to be provided by existing highway connected to the west. | South edge of roadway 74 feet closer, probable partial acquisition. | None. Access to be provided by existing highway connected to the west. |
| **Airboat Ass'n. of Florida** | Not applicable. | South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change. | None. Access to be provided by new bridge across the L-29 Canal. | South edge of roadway 74 feet closer, probable partial acquisition. | None. Access to be provided by connection to the elevated highway. |
| **Other Property/Features** | Not applicable. | No impact. | Recreational areas on north side of L-29 canal will be reduced in size. | No impact. | No impact. |
| **Recreational Access** | Not applicable. | No impact. | No impact. | No impact. | No impact. |
| **Access to Water Management Facilities** | Not applicable. | No impact. | Improved for facilities along L-29 Levee. | No impact. | No impact. |
| ***CONSTRUCTION FACTORS*** | | | | | |
| **Construction Duration** | Not applicable. | 24 months | 30 months | 24 months | 48 months. |
| **Maintenance of Traffic** | Not applicable. | Only limited impact with the connections at either end. The removal and delivery of materials is an issue. | Only limited impact with the connections at either end. The delivery of materials is an issue. | Only limited impact with the connections at either end. The removal and delivery of materials is an issue. | Only active disruptions are at connections at either end and with the delivery of materials. Road to be shifted around areas of column construction, beam placement and deck installation. |
| **Ease of Construction** | Not applicable. | Somewhat complex. | Straightforward. | Somewhat complex. | Complex due to the amount of work and material. |
| ***ROADWAY ENGINEERING FACTORS*** | | | | | |
| **Horizontal Geometry** | Not applicable. | No significant change for constant offset condition with bridges on same tangent alignment. Twin reverse curves at four new bridges with the offset bridge option are not | Simple reverse curve transition at east end is acceptable. Three curve transition at west end is not desirable in relation to long tangent sections. Twin reverse curves at | Simple reverse curves transitions to constant offset from the existing centerline are acceptable. | Simple reverse curve transition at east end is acceptable. Three curve transition at west end is not desirable in relation to long tangent sections. |

| EVALUATION FACTOR | Alt. 1 | Alt. 2B | Alt. 3B | Alt. 4B | Alt. 5B |
|---|---|---|---|---|---|
| | | preferable. | weirs, spillways, and Tiger Tail camp are not preferable. | | |
| **Vertical Geometry** | Not applicable. | No significant impact. Entire profile will be raised with modest, widely separated humps at the bridges. | No significant impact. Entire profile will be raised, but will be relatively flat, with transitions at either end. | No significant impact. Entire profile will be raised with modest, widely separated humps at the bridges. | No significant impact. Entire profile will be raised, but will be relatively flat, with transitions at either end. |
| **Pavement Serviceability** | Not applicable. | New pavement from the limestone bedrock up is expected to have excellent performance with low life cycle/ maintenance costs Estimated overlay period is 12 years. The chance for reuse of the levee material exists, reducing the amount of new fill required. Drainage layer allows greater protection from variable water levels. Approximate 1 ft. clearance from the anticipated high water level and bottom of stabilized base. | Same as without water quality treatment. | Same as without water quality treatment. | New pavement for the transitions from the limestone bedrock up is expected to have excellent performance with low life cycle/ maintenance costs. Estimated overlay period is 12 years. |
| **Safety and Operations** | Not applicable. | No significant change for option where new bridges are on tangent alignment. Where bridges are offset from existing alignment, reverse curves at bridges while within design criteria are less desirable from a safety standpoint due to the long tangent sections. | Triple curve at west end is not preferable due to long tangents for basic roadway. | No significant issues. | Triple curve at west end is not preferable due to long tangents for basic roadway. |

# H. OTHER ALTERNATIVE CONFIGURATIONS INVESTIGATED

## 20. Introduction

As part of the review of the Preliminary Design (75%) Submittal document, and based on comments received at an interagency coordination meeting, several technical topics were identified for which it was determined that additional information to augment the Preliminary Design (75%) submittal. This additional data would be useful in refining certain aspects of the original roadway alternatives and in examining slight modifications to the alternatives which might yield variations with fewer adverse impacts.

This information was compiled into an Interim Summary Report which was a compilation of the responses prepared to address the eight specific topic areas for which additional technical information was requested. As part of the Final Design (100%) Report, this additional information was incorporated into this section of the report, except for one topic detailing construction methods for the basic alternatives. That information was incorporated into the narrative describing maintenance of traffic for each of the alternatives.

## 21. Creative Water Quality Options

### Information Request

Identify and discuss “creative” water quality treatment (WQT) techniques for Alternative #2 that will minimize potential wetland impacts. Possible “creative” WQT techniques include, but should not be limited to, using reinforcement to steepen slopes, wet detention, using curb and gutter outside of the guardrail, etc. If a viable solution is identified, note whether it can be applied to other alternatives.

### Additional Information

### 1. Background

The initial definition of the set of alternatives considered for the Tamiami Trail corridor incorporated a simple, straightforward approach to meeting water quality treatment standards - dry retention systems were proposed on both sides of the roadway. This type of system is relatively simple to build and maintain. However, in consideration of the required wider footprint for the original Alternatives 2B, 3B and 4B with water quality treatment, and the resultant impacts to existing wetlands in Everglades National Park, the need to explore "creative" water quality treatment options was identified, and several such options have been evaluated. It was determined that the options would be applied to Alternative 2B - With Water Quality Treatment (Dry Retention Swales), and the applicability to Alternatives 3B and 4B noted. The results of this evaluation are summarized in this section.

The primary objective with all options considered was to lessen the width of the required footprint for the roadway section from toe-of-slope to toe-of-slope, thus reducing the area of existing wetlands affected by the project. This was pursued by considering alternate water quality treatment options, compressing the typical section, and encroaching into the L-29 Canal.

Plates depicting typical sections and related features of the options are included at the end of this section.

## 2. Definition of Potential "Creative" Water Quality Treatment Techniques for Alternative 2B

The following "creative" water quality treatment strategies have been identified and have been developed in view of the relevant regulatory requirements, and reviewed in terms of feasibility, cost, constructibility, impacts to wetlands, relevance to other alternatives:

Option 1: Shifting and/or compressing the roadway section.
Option 2: Exfiltration trenches with curb and gutter.
Option 3: Exfiltration trenches with shoulder gutter.
Option 4: Wet detention system.
Option 5: Single dry retention swale.

The five options are described as follows:

### Option 1: Shifting and/or Compressing the Roadway Section.

This option entails shifting the typical section for Alternative 2B - With Water Quality Treatment (Dry Retention Swale) to the north. In conjunction with this modification, the resulting encroachment into the L-29 Canal would be accommodated by widening the canal to the north, or by using vertical wall sections in two different configurations to reduce the width of the typical section in the area of the dry retention swales. These three options are discussed as follows:

**Option 1-A: Shift Alignment and Compress Swale With Wall Elements/South Side (Alt. 2C)**

In this option, the typical section would be compressed by installing a wall system on the south side of the roadway that would reduce encroachment into the wetlands of Everglades National Park, without any encroachment into the L-29 Canal. The construction of a reinforced wall along the south side of the existing roadway is included to minimize the extent of this encroachment, and the dry retention area is compressed between this taller wall and a short gravity wall.

The configuration permits construction of the raised roadway and walls to the south of the existing roadway with a temporary wall system. If the centerline of the new roadway section were not offset sufficiently from the existing centerline, it would not be possible to construct the new section literally on top of the existing section.

The existing pavement, sub-grade, fill and muck will be removed totally and back-filled with appropriate fill to the bottom of the sub-grade. A double wall section is proposed on the south side providing a 5-foot wide dry retention area. The placement of this walled section on the south side provides adequate space on the north side to provide again a 5-foot wide dry retention area with standard reinforced side slopes. Runoff from the south side of roadway would enter the south side swale through barrier wall inlets, whereas runoff from the north side would sheet flow into the north side retention area. The bottom elevation of the swales would be the same as for Alternative 2 With Water Quality Treatment (Dry Retention Swale), which is elevation 9.5 feet, one foot above the high water level control elevation, 8.5 feet.

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The additional profile elevation affects the section width, but requires 29 feet less in width compared to Alternative 2B - With Water Quality Treatment (Dry Retention Swales, for a net impact of 21 feet of wetland impact. This is in comparison to 50 feet of impact for the original Alternative 2B - With Water Quality Treatment (Dry Retention Swales). This option does not encroach into the hydraulic capacity of the L-29 Canal.

The estimated cost for this alternative is $132,214,250 for the length of the corridor. This is a $73,663,600 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

**Option 1-B: Shift Alignment and Compress Swale With Wall Elements/ North Side (Alt. 2D)**

In this option, the typical section would be compressed by installing a wall system that would encroach into the L-29 Canal sufficiently so that there would be no encroachment into the wetlands of Everglades National Park on the south side of the roadway. The construction of a reinforced wall along the north side of the existing roadway entails the placement of piles and concrete panels in the L-29 Canal at an elevation near the bottom of the canal.

The existing pavement, sub-grade, fill and muck will be removed totally and back-filled with appropriate fill to the bottom of the sub-grade. A double wall section is proposed on the north side providing a 5-foot wide dry retention area. The placement of this walled section on the north side provides adequate space on the south side to provide again a 5-foot wide dry retention area with standard reinforced side slopes. Runoff from the north side of roadway would enter the north side swale through barrier wall inlets, whereas runoff from the south side would sheet flow into the south side retention area. The bottom of the swales would be the same as for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), which is elevation 9.5 feet, one foot above the high water level control elevation, 8.5 feet.

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

This option does encroach into the hydraulic capacity of the L-29 Canal, removing about 200 square feet of flow area. This loss can be compensated for by removal of a like area along the north bank of the canal, or by deepening the canal by the same area.

The estimated cost for this alternative is $160,484,850 for the length of the corridor. This is a $101,934,200 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

**Option 1-C: Shift Typical Section North into L-29 Canal (Alt. 2E)**

In this option, the typical section for Alternative 2B – With Water Quality Treatment (Dry Retention Swales) would be shifted northward, encroaching into the L-29 Canal. The extent of encroachment is approximately 50 feet, such that the south bank of the canal would need to be filled in and the north bank of the canal would require excavation by the same amount.

While this is conceptually feasible, there are several issues associated with it. First, as the canal is approximately 100 feet wide presently, the 50 feet of widening to the north will consume most of the flat plateau to the north. It may be possible to excavate the lower portion of this replacement widening at a steeper slope so as to replace the lost area with a section that is less in width. This would allow for a relocated canal maintenance road and would permit the telephone and fiber optic utilities to remain in place. Turbidity control during excavation could also be a concern.

Another issue is the method for filling in the canal so that sufficient load capacity is achieved and that the fill is stable. This will be difficult to achieve underwater, and will also raise issues of turbidity control during fill placement. It may be necessary to use the construction method noted for Option 1-B wherein a concrete panel wall is constructed to contain the fill material. This approach would also reduce the lost cross-sectional area in the canal such that less excavation would be required to the north. However, this wall system would significantly increase the cost of the solution.

Other issues associated with this concept are preserving the required canal section in the vicinity of the Tiger Tail Indian Camp, the recreational area in the east part of the corridor next to the levee, at existing structures S-355A and S-355B, and at the site of the four proposed weir structures. In these areas, several solutions could be considered. The roadway section could be shifted to the south to avoid any impact, but would incur encroachment into wetlands in Everglades National Park. Also, to effect such an offset and the pair of alignment transitions at up to eight locations in the corridor could result in an unacceptably "wavy" alignment with safety implications. It appears that, if the extent of canal excavation is reduced from 50 feet to 25-30 feet, then the existing and future water control structures would not be affected.

Another solution would be to place the roadway on structure in these areas over the canal. However, considering the lengths involved this would add significant cost.

If impact to the water control structures is avoidable, then perhaps the compromise strategy at the Tiger Tail Indian Camp and the eastern recreational area would be to shift the alignment at these locations and incur some wetlands impact. A total distance of about 3,500 feet of the roadway would encroach into the wetlands in each of these areas, with the extent of the encroachment ranging up to 59 feet per the template for Alternative 2B - With Water Quality Treatment (Dry Detention Swales). This would yield a wetland impact of 2.7 acres per location or a total of 5.4 acres. The use of the vertical wall system as discussed for Options 1-A and 1-B would moderate the impact at additional cost so that there would be no encroachment into the wetlands of Everglades National Park on the south side of the roadway. However, application of this concept would make Option 1-C identical to Option 1-B.

Constructibility for this alternative would require that the traffic lanes be shifted to the south within the existing roadway and a temporary wall system be installed adjacent to this roadway on the north side. Then the remaining existing embankment on the north side would be removed and the new embankment installed in this area and in the canal up to the elevation of the existing road. The existing pavement, sub-grade, fill and muck will be removed totally and backfilled with appropriate fill to the bottom of the sub-grade.

This step would be preceded by the placement of the wall system in the canal if that were determined to be necessary. The temporary wall system would be extended upward to permit the completion a portion of the new roadway. Traffic would be shifted to the new roadway and the south portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this phasing scheme because of the roadway elevation differentials and the need for the temporary wall.

This option does encroach into the hydraulic capacity of the L-29 Canal, removing about 900 square feet of flow area.

For the configuration where the canal fill is not contained by a wall, and a like area is excavated from the north bank, the estimated cost for this alternative is $73,917,450 for the length of the corridor. This is a $15,366,800 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales). It is also assumed that the water control structures would not be affected and that the alignment would be shifted at the other two locations. These cost estimates do not include relocation of utilities on the levee or a wall system for retaining fill on the south bank of the canal.

**Option 2: Exfiltration Trenches With Curb and Gutter.**

The second category of option is to use an exfiltration trench below the roadway, with roadway runoff routed from a curb and gutter section with inlets spaced every 200 feet due to the flat roadway profile. The exfiltration trench would be comprised of an 18-inch perforated pipe surrounded by coarse aggregate and extending for the length of the corridor, less the bridge sections, on both sides of the roadway.

The concept would allow the collected runoff to infiltrate from the pipe into the surrounding aggregate and dissipate into the adjacent fill material. The trench will have an envelope of filter fabric to prevent the migration of any sand material into the rock trench. This option does require the invert of the exfiltration trench pipe to be above the design high water elevation of the L-29 Canal, which is elevation 9.3 feet. As such, the profile of the roadway would need to be approximately 2 feet higher than for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), or a centerline elevation of 16.0 feet.

The additional profile elevation affects the section width, but requires 17 to 27 feet less in width compared to Alternative 2B - With Water Quality Treatment (Dry Retention Swales), without and with stabilized side slopes respectively, for a net impact of 23 to 33 feet of wetland impact. This is in comparison to 50 feet of impact for the original Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B as discussed previously. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The estimated cost for this alternative is $76,116,250 for the length of the corridor. This is a $17,565,600 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

**Option 3: Exfiltration Trenches With Shoulder Gutter.**

The third option is to use an exfiltration trench below the roadway, with roadway runoff routed from a shoulder gutter section with inlets spaced every 200 feet due to the flat roadway profile. As for Option 2, the exfiltration trench would be comprised of an 18-inch perforated pipe surrounded by coarse aggregate and extending for the length of the corridor, less the bridge sections, on both sides of the roadway.

The concept would allow the collected runoff to infiltrate from the pipe into the surrounding aggregate and dissipate into the adjacent fill material. The trench will have an envelope of filter fabric to prevent the migration of any sand material into the rock trench. This option does require the invert of the exfiltration trench pipe to be above the design high water elevation of the L-29 Canal, which is elevation 9.3 feet. As such, the profile of the roadway would need to be approximately 2 feet higher than for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), or a centerline elevation of 16.0 feet.

The additional profile elevation affects the section width, but requires 17 to 27 feet less in width compared to Alternative 2B - With Water Quality Treatment (Dry Retention Swales), without and with stabilized side slopes respectively, for a net impact of 23 to 33 feet of wetland impact. This is in comparison to 50 feet of impact for the original Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B as discussed previously. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The estimated cost for this alternative is $76,394,750 for the length of the corridor. This is a $17,844,100 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

**Option 4: Wet Detention System.**

Utilizing a wet detention system requires the treatment of one inch of runoff from the contributing area in contrast to a dry retention system where the treatment volume is equal to 1/2 inch of runoff. It also requires a wider footprint than the dry retention swale design, due to the fact that the control elevation would be at the control elevation of the L-29 Canal rather than one foot above the control elevation. A minimum depth of 2 feet is proposed below the control elevation for deposition of sediments. Wet detention systems typically require a minimum width of 100 feet at the control elevation and an average depth between 6 and 8 feet which would require a wider footprint, thus impacting more wetland area. Proposing this type of a wet detention system would require a variance from the standard.

As depicted in the schematic in a narrow footprint, this option would require a distance of 55 feet beyond the edge of the shoulder for the swale as configured. The dry retention swale option as originally proposed requires 35 feet, so even if stabilized slopes were employed the wet retention option would still have slightly more impact as the dry retention technique. Alternative 2B - With Water Quality Treatment (Dry Retention Swales) has a 50 foot wetland impact with natural slope grading, and the wet detention technique with similar slope treatment would add 20 feet per swale, or 40 feet of impact, for a total impact of 90 feet.

The estimated cost for this alternative is essentially unchanged from the cost of Alternative 2B – With Water Quality Treatment (Dry Retention Swales), $58,550,650, since the change in fill areas associated with the swales is nearly the same.

**Option 5: Single Dry Retention Swale System**

In this option, there would be a dry retention swale on one side of the roadway. This single swale would retain the standard 5-foot width. Drainage from the side of the roadway without a swale would be channeled via a shoulder gutter and gutter inlets and piped under the roadway to the single dry detention swale.

To do this will require raising the roadway approximately 2.5 feet to accommodate an inlet, and a connecting pipe with a slope. While this eliminates a swale on the north side of the roadway, the swale on the south side of the road is approximately 0.5 feet deeper and the sideslopes of the roadway are wider due to the additional 2.5 feet of elevation. The net effect is that this footprint is 122 feet wide and that for Alternative 2B - With Water Quality Treatment (Dry Retention Swales) is 112 feet wide, for an increase of 10 feet of wetland impact. The wetland impact for this option is 60 feet, while that for Alternative 2B - With Water Quality Treatment (Dry Retention Swales) is 50 feet.

If the typical section were applied in a mirror image fashion, the result is similar. This is because the new alignment must be offset from the canal by a minimum amount to accommodate maintenance of traffic requirements, and if the typical section is compressed sufficiently, then this maintenance of traffic criterion governs.

It is seen that the construction cost for this option would be slightly greater than Alternative 2B - With Water Quality Treatment (Dry Retention Swales) because of the stormwater piping and gutter system, and with a slight increase in wetland impact.

The estimated cost for this alternative is $67,015,550 for the length of the corridor. This is a $8,464,900 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

## 3. Summary Evaluation of Potential “Creative” Water Quality Treatment Techniques for Alternative 2

Several "creative" water quality treatment strategies have been identified and reviewed. In summary, Options 1, 2 and 3 would reduce wetland impacts in comparison to Alternative 2 - With Water Quality Treatment (Dry Retention Swales), but at higher costs. Option 4 requires a wider footprint, a probable permitting exception, and will impact a greater area of wetlands. Option 5 has minimal advantage over Option 2 or 3, but would be slightly more costly. Options 1, 2, and 3 can be applied to the original alternatives with the exception of Alternatives 1, 2A - Without Water Quality Treatment, 5A, and 5B. The key characteristics of the various options are summarized in the following table:

***Table 4***
***SUMMARY OF "CREATIVE" WATER QUALITY TREATMENT ALTERNATIVES***

| ***"Creative" Water Quality Treatment Alternative*** | ***Feasibility Assessment*** | ***Cost Differential Relative to Alt. 2B - With Water Quality Treatment*** | ***Constructi-bility*** | ***Wetland Impacts to ENP*** | ***Applicability to Other Alternatives*** | ***Other Comments*** |
|---|---|---|---|---|---|---|
| **Option 1-A** Shift North and Compress Swale With Wall Elements/ South Side (Alt. 2 C) | Technically feasible. Reduces wetland impacts. Relatively high cost. | +$73,663,600 | Workable; centerline offset needed to execute MOT. | 21 feet of impact versus 51 ft. for Alt. 2B. | Applicable. | Could reduce strikes on the road. |
| **Option 1-B** Shift North and Compress Swale With Wall Elements/ North Side (Alt. 2D) | Technically feasible. Reduces wetland impacts. Relatively high cost. | +$101,934,200 | Workable; centerline offset needed to execute MOT. | No impact to ENP; affects L-29 canal. | Applicable. | Could reduce wildlife strikes on the road. |
| **Option 1-C** Shift North into L-29 Canal (Alt. 2E) | Technically feasible; reduces wetland impacts. Higher cost. | +$15,366,800 | Workable; requires temporary wall. | No impact to ENP; affects L-29 canal. | Applicable. | None. |
| **Option 2** Exfiltration Trench with Curb and Gutter | Technically feasible; reduces wetland impacts. Higher cost. | +$17,566,000 | Workable; requires temporary wall. | Up to 33 feet of impact versus 51 ft. for Alt. 2B. | Applicable. | None. |
| **Option 3** Exfiltration Trench with Shoulder Gutter | Technically feasible; reduces wetland impacts. Higher cost | +$17,844,100 | Workable; requires temporary wall. | Up to 33 feet of impact versus 51 ft. for Alt. 2B. | Applicable. | None. |
| **Option 4** Wet Detention System | Not feasible. Permitting exception needed. Same cost. | +$0 | Workable; requires temporary wall. | 90 feet of impact versus 51 ft. for Alt. 2B. | N/A | None. |
| **Option 5** Single Swale Dry Detention System | Technically feasible, but no advantage over simpler options. Higher cost. | +$8,464,900 | Feasible. | 60 feet of impact versus 51 ft. for Alt. 2B. | Applicable. | None. |

ENP = Everglades National Park

## 22. Alt. 2 Variation With Partial Water Quality Treatment

### Information Request

Evaluate and develop a variation of Alternative #2 that includes partial WQT. Discuss both the benefits and the drawbacks of this possible alternative.

### Additional Information

### 1. Approach to Partial Water Quality Treatment

This option proposes to utilize a five-foot wide grassed strip outside of the guardrail to the edge of a reinforced slope to provide a minimal treatment of surface water runoff. The option could possibly be utilized for the original Alternative 2A - Without Water Quality Treatment and Alternative 2B – With Water Quality Treatment (Dry Retention Swales).

The concept is to allow the runoff to sheet flow through this five-foot wide grass strip for pollutant uptake. A similar concept was utilized on the Howard Franklin Bridge Causeway in Tampa, where the Southwest Florida Water Management District (SWFWMD) approved this concept in lieu of a normal dry retention system.

### 2. Evaluation

The footprint for this alternative is 72.7 to 77.0 feet wide, with and without a stabilized side slope, respectively, and would encroach into wetlands to the south of the roadway by 11.0 to 15.0 feet with and without a stabilized side slope, respectively. Alternatively, a short wall system could be built into the L-29 Canal at additional cost, such that there would be no encroachment into the wetlands of Everglades National Park.

This option could be adapted to Alternative 2A but with some additional cost for additional fill area and costs associated with a slight shift in the alignment. There would be a wetland encroachment of 11.0 to 15.0 feet, depending if stabilized slopes were used. It is noted for reference that Alternative 2A does not rebuild the roadway embankment. Alternatively, the wetland encroachment could be avoided by encroaching into the L-29 Canal and building a short retaining wall or by building a retaining wall along the south right-of-way line. While these options were not priced out, they would be significantly more expensive due to the wall section the entire length of the corridor.

This option could be adapted to Alternative 2B which calls for rebuilding the roadway embankment. The dry retention swales would be removed and replaced by the grassed areas and stabilized side slopes on both sides of the roadway, and the roadway built to the finish profile elevation of 14.0 feet. This footprint would be somewhat wider than the variation discussed above, and would likewise have wetland encroachment if the bank of the L-29 Canal was held as the north limit. Alternatively, if the south existing roadway slope limit was kept so that wetlands were unaffected, then a wall in the L-29 Canal would be required.

Constructibility for this option would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B as discussed previously. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

## 23. Shift Alt. 2 into the L-29 Canal and Avoid ENP Wetlands

### Information Request

Evaluate moving the alignment for Alternative #2 with WQT into the L-29 canal so that there will be no wetland impacts. This conceptual level evaluation should consider potential construction methods and order of magnitude costs for filling the canal. Since this is an authorized project, the hydraulic capacity of the canal cannot be decreased. Therefore, if a portion of the canal is filled, additional excavation must be done to offset the loss of capacity. In addition to the evaluation, additional costs or construction constraints should also be identified (i.e. utility relocation, complexity of construction, potential access problems on the North side of the canal, impacts to the Tiger Tail camp, etc).

### Additional Information

### 1. Background

Because of concerns regarding encroachment into wetlands south of the existing Tamiami Trail, the possibility of modifying the configuration and placement of the typical section to minimize or eliminate this encroachment was identified. The initial concept envisioned was to simply shift northward the second variation of Alternative 2, that is Alternative 2B – With Water Quality Treatment (Dry Retention Swales). Such displacement would encroach into the L-29 Canal. It has been further determined that the canal shape is the minimum required for its hydraulic conveyance function, so that any encroachment into the canal from the south bank should be compensated by the excavation of the canal by a like area.

Exploration of this approach led to the identification of a variation involving the use of vertical walls to reduce the width of the dry detention swale. Further review of this concept led to the development of two different applications of the vertical wall treatment. Since they have relevance to the formulation of "creative" water quality treatment options as addressed in Topic 1 in this report previously, a description of them was contained in that section of the report. They are referred to in that section as Option 1-A (Alt. 2C) and Option 1-B (Alt. 2D). The concept of shifting the original of Alternative 2B – With Water Quality Treatment (Dry Retention Swales) northward into the canal is considered in that section as well, and is referred to as Option 1-C (Alt. 2E).

### 2. Summary

The key features of this strategy as characterized in the three options noted above, Options 1-A, 1-B, and 1-C, are summarized in Section 24 of this report.

## 24. Removal Of Existing Road Paving And Subgrade

### Information Request

Determine the cost of removing, to the extent possible, the existing roadbed and subgrade for all alternatives which effectively "abandon" the existing Tamiami Trail. The purpose of this exercise is to evaluate the cost of removing impermeable surface that may contribute to runoff requiring additional WQT.

### Additional Information

### 1. Background

The concept of removing the existing pavement and subgrade to compensate for new pavements is viable only for Alternatives 3A, 3B, 4A, 4B, 5A and 5B. For Alternative 1 and Alternatives 2A and 2B, the existing pavement continues to carry traffic or is not left in place. To reiterate, this concept entails the removal of any impervious asphaltic pavement in the upper roadway section down to the level of the subgrade comprised of limerock and similar materials which are pervious.

It is first noted, however, that the regulatory agencies do not typically require the removal of old pavement if traffic is prevented from utilizing the existing or abandoned roadway. Pollutants are primarily a result of motor vehicles, with only a minor contribution historically from roadway materials.

If removal of pavement is not required, it certainly is nevertheless an opportunity for partial mitigation of other impacts. It may be worth considering and asking the regulatory agencies to consider in this action in lieu of providing water quality treatment systems as shown in Alternatives 3B, 4B or 5B.

## 2. Relation to Alternatives 3A, 3B, 4A, 4B, 5A and 5B

Should this option be executed, it could be applied to Alternatives 3A, 3B, 4A, 4B, 5A and 5B as follows:

### Alternatives 3A and 3B

As this alternative with its variations with and without water quality treatment are situated along the L-29 Levee, the entire paved area of the existing Tamiami Trail corridor within the project limits could be removed, with the following exceptions:

- Roadway embankment segments removed as breaches to permit water flow from the L-29 Canal to Everglades National Park.
- The westernmost segment of the existing roadway which is to remain to provide access to the Osceola Indian Camp.
- Sections of the existing roadway on either end of the corridor which are already removed to accommodate the alignment transitions of the new roadway.

The cost of this pavement removal is estimated to be $1,672,800 for both Alternatives 3A and 3B, since the existing roadway embankment was left in place, except for breaches. This cost is calculated in a manner compatible with other prior cost estimates for other alternatives and actions in this corridor.

### Alternatives 4A and 4B

As this alternative with its variations with and without water quality treatment are situated to the south of the existing Tamiami Trail corridor, the entire paved area of the existing Tamiami Trail corridor within the project limits could be removed, with the following exceptions:

- Roadway embankment segments removed as breaches to permit water flow from the L-29 Canal to Everglades National Park.
- Sections of the existing roadway on either end of the corridor which are already removed to accommodate the alignment transitions of the new roadway.

The cost of this pavement removal is estimated to be $1,668,400 for Alternative 4A and $1,702,200 for Alternative 4B, the small difference being in the amount of existing pavement remaining under each alternative. This cost is calculated in a manner compatible with other prior cost estimates for other alternatives and actions in this corridor.

**Alternatives 5A and 5B**

As this alternative with its variations with and without water quality treatment are situated between the existing roadway and the L-29 Levee along a raised profile on structure, the entire paved area of the existing Tamiami Trail corridor within the project limits could be removed, with the following exceptions:

- Roadway embankment segments removed as breaches to permit water flow from the L-29 Canal to Everglades National Park.
- The westernmost segment of the existing roadway which is to remain to provide access to the Osceola Indian Camp.
- Sections of the existing roadway on either end of the corridor which are already removed to accommodate the alignment transitions of the new roadway.
- For the variation with water quality treatment, numerous short segments of the existing embankment where dry retention swales are to be installed to provide water quality treatment for the elevated structure.

The cost of this pavement removal is estimated to be $460,400 for Alternative 5A and $348,900 for Alternative 5B, as the dry detention swales already necessitated some pavement removal. Alternatives 5A and 5B are less costly than the other options due to partial pavement removal during bridge construction. This cost is calculated in a manner compatible with other prior cost estimates for other alternatives and actions in this corridor.

***Table 5***
***SUMMARY OF PAVEMENT REMOVAL***

| Alternative | Applicability of Pavement Removal To This Alternative | Cost of Removal |
|---|---|---|
| **Alternative 1**<br>Existing Alignment / Same Profile | NO | N/A |
| **Alternative 2A**<br>Existing Alignment Without WQT | NO | N/A |
| **Alternative 2B**<br>Existing Alignment With WQT | NO | N/A |
| **Alternative 3A**<br>North Alignment Without WQT | YES | $1,672,800 |
| **Alternative 3B**<br>North Alignment With WQT | YES | $1,672,800 |
| **Alternative 4A**<br>South Alignment Without WQT | YES | $1,668,400 |
| **Alternative 4B**<br>South Alignment With WQT | YES | $1,702,200 |
| **Alternative 5A**<br>Structure Without WQT | YES | $ 460,400 |
| **Alternative 5B**<br>Structure With WQT | YES | $ 348,900 |

WQT = Water Quality Treatment with Dry Retention Swales

## 26. Impact Of Future CERP Operational (Water Management) Changes On Alternatives

### Information Request

Discuss, on a conceptual basis, how future operational changes could impact to each alternative and what changes, including costs, might be required. To do this, water stages associated with a hypothetical increase in flow will be provided by the Government.

### Additional Information

### 1. Background

This topic addresses two hypothetical water management operational scenarios related to potential future conditions in the Tamiami Trail corridor under the Comprehensive Everglades Restoration Plan (CERP). The Modified Water Deliveries Program has been developed on the basis of a 4,000 cfs flow rate across the section of the Tamiami Trail covered by this project. In hydraulic modeling including the proposed four bridges along Tamiami Trail, this condition yielded a stage elevation in the L-29 Canal previously of 9.0 feet (NDVD 29) for a 100-year event, and as the result of a recent model update, the current design high water elevation of 9.3 feet.

The hypothetical flow scenario selected for review has a flow rate of 10,000 cfs for Tamiami Trail as proposed with four new bridges. The resulting L-29 Canal stage elevation for a 100-year event is 10.45 feet (NGVD 29), or nominally 10.5 feet, for an increase of 1.2 feet. Originally, a second hypothetical scenario adding two additional bridges to the four new bridges was to be discussed. However, hydraulic modeling yielded results nearly identical to those for the first scenario, because of backwater conditions. As a result, only minimal discussion of this second scenario is provided.

It is noted that for a CERP flow of 5,500 cfs, Alt. 2A remains feasible, and comments for Alts. 2A, 3A, 3B, 4A and 4B below would also apply.

### 2. Scenario 1: 10,000 cfs Flow Rate with 4 Bridges as Proposed

In this scenario, the alternatives would need to be raised 1.2 feet to accommodate an increased Design High Water elevation of 10.5 feet. As noted, Alternative 1 and Alternative 2A – Without Water Quality Treatment could not be modified to address this change and are therefore infeasible under this scenario.

Alternatives 3A and 3B are set at the top of levee elevation and do not require raising. Alternatives 2B, 4A, and 4B would all need to have the finished roadway and structure elevations raised 1.2 feet to satisfy the increased Design High Water elevation criterion. This would be done by increasing the depth of the embankment under the roadway and by raising the structures slightly. This will have the effect of increasing the width of the typical section for these alternatives by about 6 feet. For all these alternatives as originally defined, this would translate into an additional wetland impact of 6 feet as well, as defined by the intersection of the toe of slope with existing ground elevation.

In addition, while not a part of this project, this elevation would affect the previously relocated Tiger Tail Indian Camp, the Osceola Indian Camp, the recreation area near the east end of the corridor, and the Airboat Association of Florida site. These would require raising of the site elevation, and modification of access roads to serve each one as well.

These impacts are associated solely with the increase water levels. Should the L-29 Levee and L-29 Canal be degraded, different access arrangements for each site would be necessary, assuming they remained in the corridor at a suitable site elevation.

Cost estimates were developed for the adjustments to the alternatives for the increased water elevation, excluding site and access impacts to the noted land uses.

For Alternative 5 on structure, the structure for both the situations with and without water quality treatment would require the deck elevation to be raised 1.2 feet as for the other alternatives. In addition, the alternative with water quality treatment would require additional work to raise the elevation of the dry detention swales to be built on segments of the remnant existing embankment. These swales could be raised using additional adjacent embankment material.

Costs estimates for the affected alternatives are presented in the Summary section of this topic discussion.

### 3. Scenario 2: 10,000 cfs Flow Rate with 6 Bridges as Proposed

This hypothetical scenario as defined would require the construction of two additional bridges. While there is no apparent hydraulic benefit from doing so, this scenario would affect the overall construction cost of each alternative, except Alternative 5, by approximately $1,000,000 for two additional 300-foot long bridges. This is in addition to the costs identified above for raising the various alternatives an additional 1.2 feet to adjust for the increased Design High Water elevation of 10.5 feet. Otherwise, the relation of this scenario to the alternatives would be as described above.

### 4. Summary

The impact of this hypothetical scenario would be to require raising the profile of all corridor alternatives by 1.2 feet to accommodate the increased design high water elevation. The exceptions to this would be Alternative 1 and Alternative 2A which cannot be raised this much and are therefore infeasible under this condition, and Alternatives 3A and 3B which do not require raising. There would be a corresponding increase in the width of the improvement for these alternatives as well. The cost of the added fill for Alternatives 2B, 4A and 4B, which have similar typical section widths, ranges from $1.35 million to $1.76 million. Alternatives 5A and 5B have less cost because there is little embankment to raise. The cost to raise structures is considered negligible as piles will simply be cut off at a higher finish elevation. The results of this review are summarized in the following table.

***Table 6***
***IMPACT OF FUTURE CERP OPERATIONAL CHANGES (Scenario 1)***

| **Alternative** | **Effect of the Increased Design High Water Elevation on Alternative** | **Wetland Impact of Modification to Alternative** | **Added Cost To Raise Alignments** |
|---|---|---|---|
| **Alternative 1**<br>Existing Alignment / Same Profile | *Alternative not feasible. Cannot be raised.* | N/A | N/A |
| **Alternative 2A***<br>Existing Alignment Without WQT | *Alternative not feasible. Cannot be raised.* | N/A | N/A |
| **Alternative 2B**<br>Existing Alignment With WQT | Roadway and structure elevation must be raised. | Section will be 6 ft. wider, with added wetland impact. | $1,490,700 |
| **Alternative 3A**<br>North Alignment Without WQT | No adjustment needed | | $ 0 |
| **Alternative 3B**<br>North Alignment With WQT | No adjustment needed. | | $ 0 |
| **Alternative 4A**<br>South Alignment Without WQT | Roadway and structure elevation must be raised. | Section will be 6 ft. wider, with added wetland impact. | $ 1,345,000 |
| **Alternative 4B**<br>South Alignment With WQT | Roadway and structure elevation must be raised. | Section will be 6 ft. wider, with added wetland impact. | $ 1,759,200 |
| **Alternative 5A**<br>Structure Without WQT | Roadway and structure elevation must be raised. | Minor impact as alignment is on structure. | $ 0 |
| **Alternative 5B**<br>Structure With WQT | Detention swales and structure elevation must be raised. | Minor impact as alignment is on structure. | $ 320,000 |

WQT = Water Quality Treatment with Dry Retention Swales
*Based on hypothetical 10,000 cfs flow. For CERP flow of 5,500 cfs, Alt. 2A is feasible; in this case, comments for Alt. 2B, 4A and 4B would apply.

## 27. Compatibility Of Alternatives To CERP

### Information Request

Discuss how each alternative is compatible, or can be made compatible, with the goals of the CERP plan (passing increased flows and promoting the decompartmentalization of the Everglades, ecological connections between restored areas, and increased sheet flow throughout the system).

## Additional Information

### 1. Background on CERP

The Comprehensive Review Study for the Comprehensive Everglades Restoration Plan (CERP) has identified the potential for additional modifications to water management facilities over and above those contemplated under the Modified Water Deliveries program. While the additional CERP modifications are not yet authorized, it is appropriate to consider the relation of these potential projects with the alternatives being considered for the modification of Tamiami Trail.

The Comprehensive Review Study has identified several projects relating to Water Conservation Area 3 in the Eastern Everglades. Of specific relevance to the Tamiami Trail corridor is one specific project relating to "decompartmentalization" of water management basins and enhancement of sheetflow. This project is the degrading of the L-29 Levee and L-29 Canal to restore sheet flow between Water Conservation Area 3B to the north of Tamiami Trail and Everglades National Park to the south.

The Project Implementation Report for CERP will address the scope and method to be used for this and other related projects. The same report will address the sequencing of the various additional proposed modifications.

According to the Comprehensive Review Study, this modification and several others will have the effect of providing "the initial increment of more integrated passive management of Water Conservation Area 3 and Everglades National Park. It is anticipated that these modifications will be made in association with the implementation of rainfall driven operational schedules for both Water Conservation Area 3 and Everglades National Park."

"The benefits to the project from this feature are that restoring sheet flow will reduce the unnatural discontinuities in the landscape. Depth patterns will be more gradual, aquatic organisms will be able to move more freely, exotic species will not have the advantage of deep water canals that provide thermal refuge or dry levees on which to grow. Normal proportions of predators/prey species in fish populations will be undisturbed. Natural interspersions of different marsh habitats will replace the current system of upstream pools and downstream dry area on either side of barriers. The result will be better quality and more easily accessible habitat for wading birds and other Everglades species."

### 2. Increased Flows

The scenario of increased water flow was discussed in the preceding topic. Under the hypothetical flow of 10,000 cfs, the 100-year stage elevation would be nominally 10.5

feet, which would require alternatives to be raised by 1.2 feet to keep the roadway subgrade in the dry. Alternatives 1 and 2A – Without Water Quality Treatment are not amenable to such a large change in profile grade, and thus are not compatible with the increased flow scenario.

Alternatives 3A and 3B would not require raising a s they are set at elevation 17.4 feet, effectively replacing the top of the levee with a road. The remaining alternatives, Alternatives 2B, 4A, 4B, 5A, and 5B could be raised in their design to accommodate the higher Design High Water condition. The costs of doing so were noted previously as well. There is also an incremental wetland impact of raising the alternatives on embankment of approximately 6 feet. Alternative 5A and 5B require raising as well, but there is little wetland impact as they are on structure except for short transition sections at either end of the corridor.

It is also noted that the Tiger Tail and Osceola Indian Camps, the Airboat Association of Florida site, and the eastern recreational area and their access provisions would also be affected by this increased water elevation. These sites would need to be raised and their access routes modified as well.

It is presumed that, should the hypothetical flow rate actually be implemented, the alternatives would be designed accordingly prior to construction to conform to this design condition. To attempt to retrofit alternatives developed for the Modified Water Deliveries program once constructed to function under this hypothetical CERP flow condition would be very costly due to construction phasing and maintenance of traffic considerations, with potential temporary wetland impacts.

A variation of this approach would be if Alternative 1 or 2A – Without Water Quality Treatment, with or without the four bridges, were built first, then abandoned after another alternative were built. The original improvement would in this case be considered a “throwaway” cost, expended for the benefit of providing less expensive, but immediate conformance with short-term flow requirements while deferring somewhat the time line for more expensive permanent improvements that would be CERP-compatible.

### 3. Increased Sheet Flow

For this discussion, it is assumed that decompartmentalization is implemented, such that the L-29 Canal and Levee are degraded where possible, and that remnant sections of the existing Tamiami Trail embankment would be degraded as well.

As defined, Alternatives 1, 2A, 2B, 3A, 3B, 4A and 4B employ embankment typical sections with at least 4 bridges for conveying the Modified Water Deliveries program flows. Alternatives 1 and 2A are not discussed further, because as defined, they cannot be raised to satisfy the hypothetical CERP flow scenario, and are therefore infeasible.

For the remaining embankment alternatives, Alternatives 2B, 3A, 3B, 4A, and 4B, the continuous sheet flow along the 11-mile corridor will be affected by the four openings on Alternatives 2B, 4A and 4B. Alternatives 2B, 4A and 4B have only 2.5% of the corridor embankment open due to the bridges. Alternatives 3A and 3B would be somewhat better (10% of corridor embankment with openings) in dispersing water flows through their embankments as each would have 6 bridges at the weirs and water control structures, plus two more on a diagonal across the L-29 Canal corridor.

Alternative 5A – Without Water Quality Treatment would provide good continuity of sheet flow as it is for nearly the entire length a raised structure (98% of the corridor). Thus there would be no interruptions to sheet flow. Alternative 5B –With Water Quality Treatment (Dry Detention Swales) as defined would utilize short (600-foot long) segments of the existing roadway embankment, retrofitted as dry detention cells. These would occur once every ½ mile, such that approximately 25% of the corridor would be blocked by these "islands" for water quality treatment. This would still afford generally good continuity (75% of corridor) of sheet flow across the corridor.

### 4. Decompartmentalization

Under the CERP as proposed, the degradation of the L-29 Canal and Levee would occur. For the purposes of this discussion, it is presumed that remnant portions of the existing Tamiami Trail roadway embankment unutilized by a specific roadway improvement alternative would also be degraded. It is also presumed that the alternative would have been raised to meet the CERP flow conditions.

As noted before, this discussion is not relevant for Alternatives 1 and 2A as they cannot be raised to conform to the CERP Design High Water elevation of 10.5 feet (NGVD 29).

Under Alternative 2B, all of the existing roadway embankment would be removed. Decompartmentalization would address therefore the L-29 Levee and Canal only, leaving Alternative 2B as the remaining built facility in the corridor.

Under Alternatives 3A and 3B, which in effect replace the L-29 Levee, decompartmentalization would address therefore the L-29 Canal and the remaining sections of the existing roadway embankment, leaving Alternative 3A or 3B as the remaining built facility in the corridor.

Under Alternatives 4A and 4B, which are built to the south of the existing embankment, decompartmentalization would address therefore the L-29 Levee and Canal, and the remnant embankment of the existing Tamiami Trail roadway as well, leaving Alternative 4A or 4B as the remaining built facility in the corridor.

Under Alternatives 5A and 5B, which are built on elevated structure for nearly the entire length of the corridor, decompartmentalization would address therefore the L-29 Levee and Canal, and the remnant embankment of the existing Tamiami Trail roadway as well, leaving the elevated Alternative 4A or 4B as the remaining built facility in the corridor. For Alternative 5B, "islands" of the existing roadway embankment would remain for water quality treatment in the form of dry retention swales.

It is noted that in the process of decompartmentalization, another issue is the fate of the existing Indian camps, the airboat club, and the eastern recreational area. If they were to remain, each would have to be raised and their access modified as well. Recreational opportunities would be restricted to access points at either end of the 11-mile corridor, unless other provisions were made.

The degrading of the L-29 Canal, the L-29 Levee and remnant sections of the existing Tamiami Trail embankment have not been quantified as a construction project. Presumably certain embankment materials could be used to fill in the L-29 Canal, reducing the quantity of spoil material and the cost associated with hauling and disposing of it. Excess or unsuitable materials would likely be hauled on the existing road eastward past Krome Avenue to a deposition site. There would be work zone, staging area, and construction traffic issues associated with this removal effort. Sequencing may be critical as well; for example, it may be sensible to start at the west end of the corridor and work eastward. Control of turbidity would likely be a special issue during the removal work.

There will also be issues of right-of-way conveyance as US 41 is operated by the Florida DOT. Other agencies have right-of-way, easement, or lease interests in the corridor which would likewise have to be resolved.

## 5. Ecological Connectivity

The present roadway embankment has the L-29 Canal to the north, wetlands to the south, and numerous culverts which pass water from north to south under the roadway. North of the L-29 Canal is the L-29 Levee. These facilities may inhibit the free movement of mammals, amphibians and aquatic species, or contribute to road strikes for some populations.

The proposed corridor improvement alternatives will all introduce new bridge structures which will afford enhanced opportunities for the movement of a wide range of species. Without the degrading of the L-29 Canal and the adjacent levee with its existing and proposed water control structures, movement would still be somewhat restricted.

With the additional effects of decompartmentalization, the impediments of the levee and canal would be removed, leaving the improved roadway corridor. All alternatives would have bridge structures to pass water flows which would also be available for movement of various species, to varying degrees depending on water levels and the extent of openings provided by the alternatives. These openings range from the 4 bridges for Alternatives 1, 2A, 2B, 4A, and 4B, to 8 bridges for Alternatives 3A and 3B, to a continuous bridge for Alternatives 5A and 5B.

For all but Alternatives 5A and 5B, undercrossings through the embankment could also be provided. These are essentially box culverts of appropriate dimensions to permit and encourage specified species to pass under the roadway. The spacing of these would depend on the quantity of movement and the patterns, but perhaps one per mile where there are no bridges would be a suitable spacing. The dimension of the structure would also dictate the effect if any on the roadway profile. It is likely that the height of the undercrossing in relation to the road profile for either the Modified Water Deliveries or the CERP Design High Water elevations would be such that an adjustment to the roadway profile would be not be required, with three exceptions. The exceptions would likely be Alternative 1 and Alternative 2A which both have lower profiles, and Alternatives 5A and 5B which are entirely on structure.

There are several instances of special provisions along roadway corridors for the movement of wildlife. These include a 2 mile section of US 441 near Gainesville, and the I-75/Alligator Alley corridor in South Florida. Similar accommodations have been incorporated into the proposed improvements to US 1 between Homestead and Key Largo.

For example, the US 441 segment was thought to have the highest incident of mortality in the state. Thousands of animals from more than 80 species have been killed annually. In 1997, a multidisciplinary group representing transportation agencies, natural resource agencies, environmental groups, and the University of Florida brainstormed solutions to mitigate the losses and help restore natural movement patterns. The result was a 3 1/2-foot-high with a lip at the top similar to those in zoo serpentariums. The intent was to deter climbing and jumping animals from entering the road corridor. Instead they will be channelled by the wall to 4 new pipe culvert undercrossings and four existing culverts. FDOT began construction in December 1999.

On the I-75 corridor, several animal undercrossings were provided in addition to hydraulic culverts. In this case, continuous fencing with mesh was installed on both sides of the roadway to divert animals to the undercrossing locations.

It would be possible to incorporate such features in the initial construction, or added later. In the latter case, detours within the existing road section or lane closures should permit adequate work area to permit construction of the undercrossings.

## 6. Summary Evaluation

The results of this review are summarized in the following table:

***Table 7***

***SUMMARY OF COMPATIBILITY OF ALTERNATIVES TO CERP***

| ***Corridor Roadway Alternative*** | ***CERP COMPONENT*** | | | |
|---|---|---|---|---|
| | ***Increased Flows*** | ***Increased Sheet Flow*** | ***Decompart-mentalization*** | ***Ecological Connections (See also "Increased Sheet Flow")*** |
| **Alternative 1** Existing Alignment / Same Profile | *Alternative not feasible. Cannot be raised.* | *Alternative not feasible. Cannot be raised.* | Not applicable. | Animal undercrossings not feasible. |
| **Alternative 2A*** Existing Alignment Without WQT | *Alternative not feasible. Cannot be raised.* | *Alternative not feasible. Cannot be raised.* | Not applicable. | Animal undercrossings not feasible. |
| **Alternative 2B** Existing Alignment With WQT | Roadway and structure elevation must be raised. Incremental + 6 ft. wetland impact. **Added cost of $1,490,700.** | Four bridges provide 2.5% opening along corridor. | Compatible. Removes levee and canal. | Very limited connectivity via bridges. Additional animal undercrossings feasible. |
| **Alternative 3A** North Alignment Without WQT | No adjustment needed. | Eight bridges provide 10% opening along corridor. | Compatible. Removes levee, canal, and abandoned existing roadway. | Somewhat limited connectivity via bridges. Additional animal undercrossings feasible. |
| **Alternative 3B** North Alignment With WQT | No adjustment needed | Eight bridges provide 10% opening along corridor. | Compatible. Removes levee, canal, and abandoned existing roadway. | Somewhat limited connectivity via bridges. Additional animal undercrossings feasible. |
| **Alternative 4A** South Alignment Without WQT | Roadway and structure elevation must be raised. Incremental + 6 ft. wetland impact. **Added cost of $1,345,000.** | Four bridges provide 2.5% opening along corridor. | Compatible. Removes levee, canal, and abandoned existing roadway. | Very limited connectivity via bridges. Additional animal undercrossings feasible. |
| **Alternative 4B** South Alignment With WQT | Roadway and structure elevation must be raised. Incremental + 6 ft. wetland impact. **Added cost of $1,759,200.** | Four bridges provide 2.5% opening along corridor. | Compatible. Removes levee, canal, and abandoned existing roadway. | Very limited connectivity via bridges. Additional animal undercrossings feasible. |

| Corridor Roadway Alternative | CERP COMPONENT | | | |
|---|---|---|---|---|
| | ***Increased Flows*** | ***Increased Sheet Flow*** | ***Decompart-mentalization*** | ***Ecological Connections (See also "Increased Sheet Flow")*** |
| **Alternative 5A** Structure Without WQT | Roadway and structure elevation must be raised. Very minor added wetland impact. **No added cost.** | Single bridge provides 98% opening along corridor. | Compatible. Removes levee, canal, and abandoned existing roadway. | Very good connectivity. No animal undercrossings needed. |
| **Alternative 5B** Structure With WQT | Roadway and structure elevation must be raised. Very minor added wetland impact. **Added cost of $320,000.** | Single bridge and detention swales provide 75% opening along corridor. | Compatible. Removes levee, canal, and abandoned existing roadway. | Very good connectivity. No animal undercrossings needed. |

*Based on hypothetical 10,000 cfs flow. For CERP flow of 5,500 cfs, Alt. 2A is feasible; in this case, comments for Alt. 2B, 4A and 4B would apply.

## 28. Cost Of Expediting Construction Schedule For Alternatives 1 To 4

### Information Request

Determine the cost for expediting construction for Alternatives #1 through #4.

### Response

### 1. Definition of Expedited Construction

The base cost estimates for alternatives were developed assuming standard or routine construction resources and methods. However, there is concern that requirements for increased water flows in the near term may necessitate the expediting of construction in order to accommodate those increased flows. As a result, each alternative was reviewed in this regard, and a second estimate developed to reflect an acceleration of the construction.

The basic adjustment made was to increase the availability of additional construction staffing and in the associated administrative costs. The achievement of the accelerated schedule will, of course, be dependent upon the actual availability of this construction staffing and in the timely delivery of required construction materials and products.

### 2. Summary of Alternatives Cost with Expedited Construction

The results of this analysis are summarized in the following table.

***Table 8***
***SUMMARY OF EXPEDITED CONSTRUCTION***

| Alternative | Standard Construction | | Expedited Construction | | Added Cost |
|---|---|---|---|---|---|
| | Timeline (months) | Cost (millions) | Timeline (months) | Cost (millions) | Cost (millions) |
| **Alternative 1**<br>Existing Alignment / Same Profile | 18 | $14.3 | 12 | $16.2 | $1.9 |
| **Alternative 2A**<br>Existing Alignment Without WQT | 24 | $24.9 | 16 | $28.2 | $3.3 |
| **Alternative 2B**<br>Existing Alignment With WQT | 24 | $41.5 | 16 | $46.9 | $5.4 |
| **Alternative 3A**<br>North Alignment Without WQT | 30 | $57.5 | 20 | $63.5 | $6.0 |
| **Alternative 3B**<br>North Alignment With WQT | 30 | $58.7 | 20 | $64.7 | $6.0 |
| **Alternative 4A**<br>South Alignment Without WQT | 24 | $32.1 | 16 | $36.3 | $4.2 |
| **Alternative 4B**<br>South Alignment With WQT | 24 | $33.6 | 16 | $38.0 | $4.4 |
| **Alternative 5A**<br>Structure Without WQT | 48 | $135.9 | 32 | $153.6 | $17.7 |
| **Alternative 5B**<br>Structure With WQT | 48 | $140.3 | 32 | $158.6 | $18.3 |

WQT = Water Quality Treatment with Dry Retention Swales

# I. HYDROLOGY AND HYDRAULICS

## 28. Project Drainage Overview

The existing roadway does not have any collection or conveyance system. Runoff from the roadway presently discharges off the road and discharges into adjacent canal on the north side of the roadway or into the wetlands on the south side. No water quality or attenuation presently takes place. There are 55 cross drains under this segment of US 41 conveying runoff form the canal on the north side of the roadway to the wetlands on the south.

**While the South Florida Water Management District (SFWMD) and the Dade County Department of Environmental Resources Management (DERM) do not necessarily have jurisdiction over the stormwater quality criteria for the project, the following subsections outline their requirements as a point of reference.**

*South Florida Water Management District (SFWMD)*

The SFWMD require that all projects meet State water quality standards, as set forth in Chapter 17-302, Florida Administrative Code (FAC). To assure that these criteria are met, the must meet the following volumetric retention/detention requirements, as described in the SFWMD Permit Information Manual Volume IV:

1. For wet detention systems, the first one inch of runoff from the project or the total runoff from 2.5 inches times the percent impervious, whichever is greater, must be detained on site. A wet detention system is a system that maintains the control elevation below one foot from the seasonal high ground water elevation and does not bleed-down more than one-half inch of detention volume in 24 hours.

2. Dry detention systems must only provide 75 percent of the required wet detention volume. Dry detention systems maintain the control elevation at or above the seasonal high ground water elevation.

3. Retention systems must only provide 50 percent of the wet detention volume.

4. For projects with more than 50 percent imperviousness, discharge to the receiving water bodies must be made through baffles, skimmers or other mechanisms suitable of preventing oil and grease from discharging to/or from the retention/detention areas.

*Dade County Department of Environmental Resources Management (DERM)*

DERM also requires that all projects meet the State water quality standards. To assure that this criteria is met, 100 percent of the first one (1) inch of runoff must be retained on site. This volume is equivalent to retaining one inch of runoff from the furthest hydrologic point in the project. The methodology for estimating this volume is outlined in DERM's Policy for Design of Drainage Structure, dated December 1980 as follows:

$$V = 60CiAT_t$$

Where: $V =$ Required stormwater quality volume, cubic feet

$C =$ Runoff Coefficient; 0.2 for pervious areas and 0.9 for impervious areas

$A =$ Total tributary area, acre

$T_t =$ Duration of storm whose runoff is polluted and contaminated, minutes

$= T_{1"} + T_c$

Where: $T_{1"} =$ Time to generate one inch of runoff, minutes

$$= \frac{2940\,F^{-0.11}}{308.5\,C - 60.5\,(0.5895 + F^{-0.67})}$$

Where: $F =$ Storm frequency, years

$T_c =$ Time of concentration, minutes

$i =$ Storm intensity, inches per hour

$$\frac{308.5}{48.6F^{-0.11} + T_t\,(0.5895 + F^{-0.67})}$$

For highway systems, DERM requires that the first one (1) inch of runoff be retained for a rainfall event with a 10-year frequency. DERM also requires that the retained volume is infiltrated into the groundwater **table in a period of 24 hours and does not allow bleeder mechanisms.**

*Stormwater Quantity Criteria*

The following subsections outline these requirements.

- South Florida Water Management District (SFWMD)

The SFWMD requires that off-site discharge rate be limited to rates not causing adverse impacts to existing off-site properties, and:

1. Historic discharge rates,
2. Rates determined in previous SFWMD permit action, or
3. Basin allowable discharge rates.

In general, discharges to receiving water bodies that are tidally influenced are usually not subject to a specific limited discharge rate. However, water quality control shall always be considered. This basin does not have a historic or an allowable discharge criterion. Nevertheless, the SFWMD requires that pre-development flows during a 25-year, 72-hour rainfall event are not increased during post-development conditions.

X Dade County Department of Environmental Resources Management (DERM)

DERM's stormwater quantity criteria are determined by the land use type and are summarized as follows:

| Land Use | Rainfall Frequency | Flood Limit |
|---|---|---|
| 1. Residential and commercial areas. | 5 year | To crown of street, or to within 15 feet of a dwelling or other occupied building, which ever is lower. |
| 2. 2-lane roads in residential and commercial areas. | 5 year, except 10 year for a bridge or culvert in the canal system | To crown of street. |
| 3. 4-lane roads in high density, high traffic areas. | 10 year | To outer edge of traffic lanes. |
| 4. Private parking lots and similar paved areas. | 2 year | As per Florida Building Code 4611. |

These criteria are outlined in DERM's Policy for Design of Drainage Structure, dated December 1980.

O Florida Department of Transportation (FDOT)

FDOT requires that new drainage systems discharging into FDOT drainage systems must not exceed pre-development critical storm peak discharge rate during post-development conditions. Critical storm frequency analysis includes storm events with 2- to 100-year frequency and 1-hour to 10-days duration. This criteria is outlined in Chapter 14-86 FAC. Stormwater Management System Design Criteria.

The project's Stormwater Management Plan will be developed to meet the stormwater quality and quantity criteria of the agencies that maintain jurisdiction over the corridor. The following subsections describe the design criteria for the available best management practices (BMPs) to meet the required stormwater quality and quantity criteria.

- Retention Ponds

DERM does not allow wet detention ponds to meet stormwater quality criteria. Therefore, all ponds will be dry retention ponds. These ponds must be designed in accordance with the following design criteria and parameters:

1. The design of the proposed retention areas should not allow saturation of the roadway subgrade. A minimum of 1-foot (?) subgrade clearance shall be provided. This standard value assumes that the subgrade is susceptible to structural deterioration due to its proximity to standing water. Roadway subgrade shall not be exposed for more than 24-hours to standing waters in comparison to the Design High Water (DHW), which has been defined by FDOT District 6 as a 75-year storm event. Base Clearance Protection Design High Water establishment shall be consistent with methodology outlined in FDOT Drainage Manual.

2. Retain the greater of the SFWMD or DERM stormwater quality volume, prior to offsite discharge. The retained volume must be infiltrated to the groundwater within 24-hours.

3. Bottom shall be at least 1 foot above the control groundwater level.

4. Discharge from the pond shall be through a control structure, and the discharge rate shall not exceed the 25-year, 72-hour pre-development flow rates.

O French Drains

French drains are allowed when insitu soil hydraulic conductivity are sufficient to promote exfiltration of the required stormwater quality volumes. French drains must be designed in accordance with the following design criteria and parameters:

1. Exfiltrate to the groundwater the greater of the SFWMD or DERM stormwater quality volume, prior to discharge over control weir.
2. Percolate runoff into areas of aquifer that do not contain contaminated soil.
3. Exfiltration pipe shall be 12 inches minimum with an invert elevation at or above the average October elevation.
4. Provide baffles, skimmers and sumps in inlets to minimize entrance of oils and sediments into drainage pipes.
5. Bottom of skimmers shall be set at a minimum of 18 inches below the average yearly lowest groundwater elevation, as outlined in the Metropolitan Dade County Public Works Department Design Standards and are shown in Figure 2.3.
6. Trench width shall be a minimum of 3 feet.
7. Rock in trench must be enclosed in filter material, at least on the top and sides.
8. Insitu soil exfiltration capacity must be determined by the FDOT percolation test method. Percolation test hole must be advanced to a depth that will yield a minimum of 4 gpm per 1.0 of head of exfiltration capacity.
9. Depth of French drain trench must be at or below the percolation test hole depth.
10. As required by the SFWMD, French drain exfiltration can only be accounted for a total of one hour of the rainfall event. This volume is typically the volume required to be retained in the French drain to meet the SFWMD stormwater quality volume retention/detention criteria.

*Wetland Areas*

The SFWMD and USACOE have jurisdiction over the wetland areas to be impacted by the project and require mitigation for these impacts. The requirements of those agencies are outlined in the Federal Regulations and the SFWMD Basis of Review, Chapter 40E FAC.

*Permit Requirements*

O South Florida Water Management District (SFWMD)

In Dade County, the SFWMD requires that all development projects that do not provide full on-site retention with greater that 16 hectares (40 acres) of project area must permitted as an Individual Environmental Resources Permit (ERP). In Broward and Palm Beach Counties any project with an acreage greater that 100 acres shall be processed as an individual permit and presented to the District'' Governing Board for approval. The ERP permit is a joint-permit application that addresses surface and storage of surface waters, dredge and fill, and wetland mitigation. This application is submitted to the SFWMD but is also reviewed by the Florida Department of Environmental Protection (FDEP) and U.S. Army Corps of Engineers (USACOE).

- Dade County Department of Environmental Resources Management (DERM)

Any stormwater management system that overflows into any water bodies located within Dade County, including lakes and canals, require a DERM Class II permit. A Class II permit generally takes a minimum of 14 days. Items required to process this permit are the name, address, and phone number of the permittee and contact person; address, phone number, and license of the contractor to perform the drainage work in Dade County; the type of bond (Letter of credit, cash, surety bond); three sets of signed and sealed plans by a engineer registered in Florida; and signed and sealed letter from contractor with the breakdown of the construction cost.

A Class III permit is required for works in canals under Dade County Jurisdiction, and Class IV permits are required for stormwater management impacting wetlands in Dade County.

# J. SURVEYING AND MAPPING

## 29. General

As part of the work program, specific field survey tasks were performed to assist in the development of conceptual alternatives. The scope of these services are summarized as follows:

### Field Work

1. Centerline elevations at 500 foot spacing.
2. Cross-sections at an interval of approximately 1 mile, to include Tamiami Trail, the L-29 Canal and the L-29 Levee.
3. Planimetric/topography survey of principal features.
4. Other specific spot elevations.

### Plan Sheet Deliverables

1. Control sheet showing control points and monuments with table showing x, y, z station and other pertinent data.
2. Topographic/planimetric sheets.
3. Elevations/sections.
4. Roadway profile sheets.

### Deliverables

The products from this survey are provided to the COE Jacksonville office in a deliverable format on a CD-ROM. The topographic/planimetric sheets are presented also as a set of plates (Plates PP-01 to PP-10) in this document.

# K. GEOTECHNICAL DATA

## 30. General

The following report presents geotechnical investigations and findings.

LAWGIBB GROUP

REPORT OF A GEOTECHNICAL EXPLORATION

# TAMIAMI TRAIL – ALTERNATIVE STUDY

## US ARMY CORP OF ENGINEERS PROJECT NO. 011032.05

## MIAMI, DADE COUNTY, FLORIDA

- PREPARED FOR -

POST BUCKLEY SCHUH & JERNIGAN, INC.
1560 N. ORANGE AVENUE
WINTERS PARK, FLORIDA 32789

- PREPARED BY -

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
5845 N.W. 158TH STREET
MIAMI LAKES, FLORIDA 33014

LAW PROJECT NUMBER 40700-0-2369 (REVISED)

DECEMBER 1, 2000

December 1, 2000

Post Buckley Schuh & Jernigan, Inc.
1560 N. Orange Avenue
Winters Park, Florida 32789

Attention: Mr. Mark Jansen

Subject: Report of Geotechnical Exploration (Revised)
**TAMIAMI TRAIL – ALTERNATIVE STUDY**
US Army Corp of Engineers Project No. 011032.05
Maimi – Dade County, Florida
LAW Project No. 40700-0-2369

Dear Mr. Jansen:

We thank you for the opportunity to provide drilling and laboratory testing services as well as deep foundation evaluations for this project in Miami – Dade County, Florida under our Indefinite Delivery Contract for Multidiscipline Civil and Military Works, Addendum 3, January 18, 2000 for Geotechnical Investigation, Tamiami Trail Alternative Study. This revised report contains the revisions requested in an e-mail correspondence dated November 27, 2000 from Mr. John Anderson of Post Buckley Schuh and Jernigan.

## DRILLING AND LABORATORY TESTING SERVICE PROVIDED

The subsurface conditions along the subject site were explored by drilling sixteen soil test borings to a depth of 10.5 feet or 20 feet and collection of fourteen soil samples for Limerock Bearing Ratio (LBR) and California Bearing Ratio (CBR) tests. LBR and CBR soil samples were collected from boring location and companion borings. Also, soil samples were collected and submitted for Organic Content, Sulfate, Chloride, pH, soil moisture and resistivity analysis. Analysis were done in accordance to ASTM and other accepted Standard Procedures. The results of the laboratory testing are attached.

Core borings DCB-0.5 through DCB-10.6 and core borings L-2.5, L-6.5, L-10.5 was drilled to a depth of 10.5 feet each. Core borings L-0.5, L-4.5, and L-8.5 were drilled to a depth of 20 feet each. A representative of your office selected boring locations and drilling depth during a site visit prior to the project starting. Surveying of the boring locations and determining ground surface elevations for the boring locations was provided by Post Buckley Schuh and Jerningan.

Law Engineering and U.S. Drilling drilling crews were on site from July 25, 2000 to August 18, 2000. Each Soil test boring was performed in the approximate location identified and in accordance to the PBS&J boring site layout. The borings were drilled to varying depths and soil samples were collected continuously using an 18-inch split spoon sampler. The subsurface conditions encountered in the soil test borings are shown on the attached drilling logs. These logs represent our interpretation of the subsurface conditions based on the field logs, visual classifications of field samples by a geotechnical engineer, and the laboratory tests on selected soil samples. The line between various strata on the Drilling Logs represent the approximate interface location, however, the transition between strata may be gradual.

Groundwater table was observed to be between 3.0 feet to 3.25 feet below the top of the asphalt layer along the Tamiami Trail. On the north side of the the Tamiami Canal the groundwater level was measured at depths ranging from 2.8 feet to 9.5 feet below the top of the gravel road and below the top of the levee. A Boring Location Plan depicting the boring locations is provided.

## DEEP FOUNDATION EVALUATIONS – BRIDGE STRUCTURE

LAW has been requested to provide preliminary deep foundation alternatives based on soil test borings previously performed by the US Army Corp of Engineers for Structures S-333 and S-334 along the canal adjacent to US-41. We were asked to provide pile and drilled shaft capacities versus tip depths for the following foundations:

| Foundation Type | Foundation Size |
|---|---|
| Driven Piles | 14-inch, 18-inch square |
| Drilled Shafts | 36, 48 and 60-inch diameter |

The results of our evaluation are presented below.

## SUBSURFACE CONDITIONS

### GENERAL

The representative subsurface soil conditions at the bridge locations were determined from the provided soil borings performed for Levee 29, Borrow Canal Enlargement Structures 333, 334, and 336 for the US Army Corps or Engineers. We used borings CB-S333-3 and CB-S334.2 in our drilled shaft driven pile evaluations.

The subsurface conditions at the two locations are similar and consist of the following:

| ELEVATION RANGE (feet) | STANDARD PENETRATION N VALUE BLOW/FOOT | DESCRIPTION |
|---|---|---|
| +19 to +2 | 15 to 40 | SAND, fine to coarse carbonate, limestone fragments, silty, brown, fill. |
| +5 to +1 | 13 to 14 | PEAT, soft, fibrous, spongy brown to black (PT) |
| +1 to -25 | 30 to 100 | Limestone, soft to medium hard fossiliferous and sandstone, soft, calcareous, porous |

## SUBSURFACE CONDITIONS

**Tamiami Trail Roadway** – The borings along the roadway encountered asphalt pavement varying in thickness from 2.25 to 12 inches. Below the pavement layer, a fill layer consists of loose to dense coarse to fine limestone gravel fragments and some fine to medium sand (GP-GM) was encountered to depths of 3 to 7.5 feet below the pavement. Below this fill 1.5 to 3 feet is very soft black organic peat (PT) was found overlying the natural limestone formation. The limestone formation extended to the termination depths of the borings of 10.5 feet. The limestone formation consisted of a moderately weathered, medium hard limestone with some fine to medium sand.

**Levee Alignment** – The borings along the levee generally encountered 2 to 11.5 feet of fill consisting of loose to dense coarse to fine limestone gravel with some fine to medium sand (GP-

GM). Below this fill layer, layers of silt with some limestone fragments and fine sand (ML) and black organic peat (PT) were encountered, These layers had combined thickness of 1.5 to 5 feet and occurred between depths of 7.5 to 14 feet below the top of the levee and between depths of 2 to 6 feet below the toe of the levee. Below the peat and silt layers, the natural limestone formation was encountered. This formation consisted of a moderately weathered medium hard, limestone with some fine sand. The limestone layer extended to the termination depths of the borings of 10.5 and 20.5 feet.

**Peat Layer** – The peat thickness was determined by the thick peat sample retrieved in the standard penetration test (SPT) samples and by interpretation of the soil conditions based on the SPT blow count. In zones where the SPT blow count was very low (N=1 or Weight of Hammer) and the sample was plugged with a few pieces of limestone gravel and did not retrieve a sample, we interpreted this to be peat if this occurred at the same depths were peat had been previously encountered on nearby borings. Beneath the roadway, the peat layer could be up to 3 feet in thickness. To obtain better thickness measurements of the peat additional soil borings and or backhoe observation pits would be required.

The peat and silt layers encountered should be relatively easy to excavate with conventional excavation equipment, such a backhoe and drag lines. The side slopes up the peat and silt layers should temporarily stand on vertical slope of 3 to 5 feet in virgin areas away from roadway or levee fill embankments. Excavations through the existing fill embankments and into the peat and silt layers will experience slope instability where significant heights of fill overly the peat layer.

Local experience of roadway fill embankment constructed over natural peat layers indicates that large settlements (many inches) will occur rapidly in the first year. Long term secondary compression of the peat layer may continue for many years (5 to 10 years) and cause several additional inches of settlement. It is preferable to demuck and remove the compressible peat layers and replace it with a compacted crushed limerock fill. If the removal of the peat layer is impractical, the roadway embankment can be reinforced with geosynthetic grids or fabrics and constructed directly over the peat layer. The long term settlements can be reduced by preloading the embankment with a surcharge fill to precompress the peat layer and reduce future secondary compression settlements.

For existing roadway embankment which have been constructed over peat layers and the major portion of the settlement has already occurred, the addition of load caused by raising the road grade will usually initiate increased settlements. For the case of adding 12 inches of additional asphalt pavement with a unit weight of 135 PCF, that will increase the load by 135 psf. If the surrounding groundwater level is raised from 7.5 feet to 9.3 feet, (1.8 feet), the loading on the compressible peat layer will be reduced by the bouyances effect on the submerged soil by the 1.8 feet of additional groundwater level. For a crushed limestone fill with a compacted moist unit weight of 139 PCF this would be equivalent to approximately 112 PSF of reduction in loading. The net effect will be a slight increase in loading of 23 PSF (135 PSF increase due to the asphalt minus a decrease in loading of 112 PSF due to the rising water level). This may cause a slight increase in settlement of maybe 1 inch. If the groundwater level cannot be permanently maintained and is allowed to drop below the +9.3 level, then the loss of bouyancy will cause an increase in soil loading and increased settlements.

### GROUNDWATER CONDITIONS

The groundwater was indicated on the borings to be at elevation +5 to +7 feet (NGVD). However, fluctuation in the observed water or groundwater levels should be expected due to seasonal climatic changes, construction activities, tidal fluctuations, rainfall variations, surface water runoff, and other site-specific factors. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

## FOUNDATION EVALUATION

### Basis of Evaluation

The following preliminary evaluation is based upon the provided foundation information and subsurface conditions along the alignment. The field data have been compared with previous performances of similar bridge structures bearing on and within soil conditions similar to those encountered in this exploration. If the structural information is incorrect, or if the alignment or the location of the proposed replacement bridge is changed, please contact us so that our evaluation (and subsequent recommendations) can be reviewed.

In our evaluation of the subject project, we have addressed the following geotechnical design and construction considerations:

- Support the replacement bridge structure utilizing either 18 or 24 inch square Prestressed Concrete Piles or 36-inch, 48-inch or 60-inch diameter drilled shaft.

## DRIVEN PILE SUPPORT OF REPLACEMENT BRIDGE

### General

We have evaluated the use of a driven pile foundation system for support of the proposed replacement bridges.

### Pile Foundation Compression Capacity Analysis

In order to evaluate pile compression capacities, a static analysis using the design methodology in Research Bulleting 121 (RB-121) developed by Professor J.H. Schermertmann, was performed. A computerized version of this method, entitled *SPT97*, was used. This method generates pile capacities through the use of empirical correlations with standard penetration test (SPT) "N" values, and soil/rock end bearing and side friction curves generated for given soil and rock types. The Estimated Davisson (failure load) capacity from *SPT97* is taken as the unfactored pile resistance and is calculated as the sum of the Ultimate Side Friction Plus the Mobilized End Bearing (one-third of the ultimate end bearing).

The *SPT97* analyses indicate that a range of loadings for each pile can be achieved within the depths explored. The *SPT97* results, attached, summarize the estimated ultimate and service capacities versus elevation at each boring location. These estimated pile tip elevations are based on the *SPT97* analyses did not include scour considerations.

**Pile Downdrag Considerations**

Although we did not perform a downdrag analysis for the piles, we anticipate that the additional pile compression capacity required to resist the downdrag loads should be achieved by driving the piles to a higher utlimate bearing capacity. Other measures can be taken to reduce the negative friction, such as the application of a bitumen coating on the pile although the downdrag zone or use of a slip casing around the piles.

**Pile Foundation Tension Capacity**

In general, based on our experience, allowable pile uplift capacities on the order of 33 percent of the allowable compression skin friction capacity should be available for use in design (with a factor of safety of at least 2). Jetting will reduce the allowable tension capacities. Since specific tension loading information has not been furnished to us, we have not performed a detailed tension capacity analysis at this time. Static pile uplift (tension) capacities can be estimated based upon the RB-121 analsysis outlined previously. Ultimate skin friction values for tension loading may be outlined by reducing the compression ultimate skin friction values, computed using the *SPT97* program, by approximately 33 percent.

**Pile Foundation Settlement Potential**

We have preliminary estimated pile foundation settlement potential for 18-inch and 24-inch square PSC piles. The results indicate a maximum settlement of approximately ½-inch for the design loadings on the pile sizes.

**Drilled Shaft Evaluation**

We have also evaluated 36-inch, 48-inch and 60 inch diameter drilled shafts for the support of the proposed replacement bridge structure. The capacity of the shafts was assumed to be derived from side shear in the cemented sandstone limestone formation. Utlimate side shear resistances ranging from 15 to 25 ksf were estimated (depending on blow count and depth). Using a factor of safety of FS=3 for side shear the drilled shaft allowance compression and tension capacities were calculated. The results of our calculation for 36, 48 and 60-inch shafts are presented on the attached tables.

**Drilled Shaft Settlement Analysis**

We have compared the field test data obtained in this exploration with out experience with similar structures and published empirical relationships for settlement. Using the axial compression and lateral capacities outlined above, we have estimated that the total settlement for the 36-inch, 48-inch and 60-inch diameter shaft will be negligible (less than ¼ to ½ of an inch).

**Drilled Shaft Downdrag Considerations**

Although we did not perform a downdrag analysis for the shafts, we anticipate that the additional shaft compression capacity required to resist the downdrag loads should be achieved by installing the shafts to a higher ultimate bearing capacity.

**Drilled Shaft Tension Capacity**

In general, based on our experience, allowable uplift capacities of drilled shafts is on the order of 50 percent of the allowable compression capacity should be available for use in design (with a factor of safety of at least 2). Since specific tension loading information has not been furnished to us, we have not performed a detailed tension capacity analysis at this time. Ultimate skin friction values for tension loading may be outlined by reducing the compression ultimate skin friction values, computed by approximately 50 percent.

We appreciate the opportunity to assist you and look forward to continuing to build our relationship. If you have any question or concerns on this project please feel free to call us.

Sincerely,

**LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.**

Ruben Ponciano, P.G.
Staff Geologist

**SIGNED BY ______ WITH PERMISSION**

G. Thomas McDaniel, P.E.
Principal Geotechnical Engineer
Florida Registration 26158

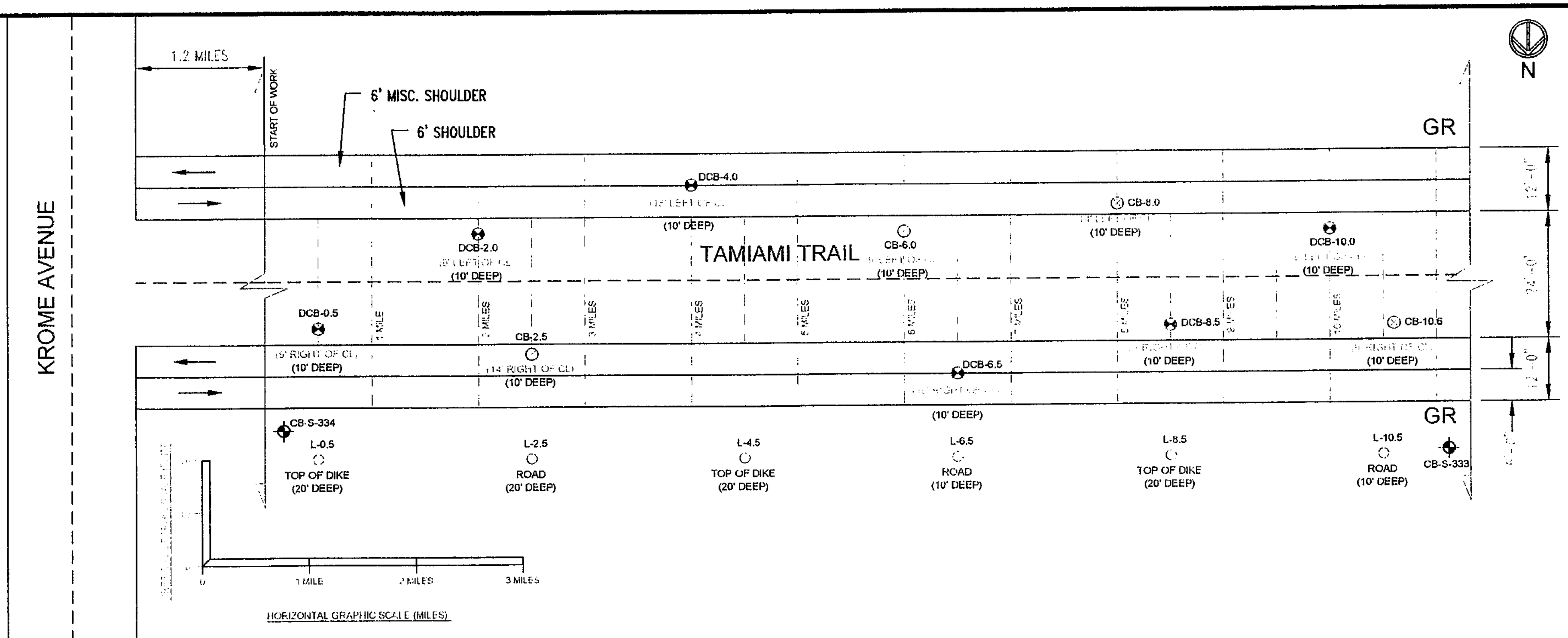
Appendix: Figure 1 – Boring Location Plan
Drilling Logs
Summary of Groundwater Elevations
Summary of Laboratory Test Results
SPT-97 Driven Pile Analyses
Drilled Shaft Axial Capacity Analyses
Laboratory Analysis

Distribution: Addressee (8)
File (1)

\\MIAMI-1\GROUPS\Facilities\OSPINA\REPORT\40700-0-2369 (Revised) tamiami.doc

# APPENDIX

# FIGURE 1
# BORING LOCATION PLAN




## LEGEND:

| | |
|---|---|
| CB-S-334 | STRUCTURE BORING - U.S. ARMY CORPS OF ENGINEERS STRUCTURES S-333 & S-334 |
| CB-2.5 | CORE / SPT IN ROADWAY |
| DCB-0.5 | CORE / SPT / SAMPLE IN ROADWAY |
| L-2.5 TOP / ROAD | SPT / DRILL ON TOP OF LEVEE OR ON UNPAVED ROAD TOE OF LEVEE |
| (20' RIGHT OF CL) | OFFSET FROM CENTERLINE (FEET) |
| (20' DEEP) | BORING DEPTH (FEET) |

FILE #. 40700-0-2369-1

AREA OF WORK - TAMIAMI TRAIL

PROFESSIONAL ENGINEER
SIGNATURE: (NOT VALID WITHOUT SIGNATURE & RAISED SEAL)
DATE:
NAME: G. THOMAS McDANIEL
STATE: FLORIDA
LICENSE No.: 26158
EXPIRATION DATE: 02/28/01

TAMIAMI TRAIL ALTS STUDY

MIAMI, FLORIDA

LAW PROPOSAL NUMBER: 40700-0-2369

LAWGIBB GROUP
5845 N.W. 158th STREET
MIAMI LAKES, FL

BORING LOCATION PLAN
TAMIAMI TRAIL

DRAWN BY: N.A.B. | DATE: 11/30/00
CHECKED BY: | SCALE: AS SHOWN

# DRILLING LOGS

**Hole No.DCB-0.5**

| | |
|---|---|
| **DRILLING LOG** — DIVISION: South Atlantic | INSTALLATION: Jacksonville District — SHEET 1 OF 1 |
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 3 7/8" Casing & Roller Bit |
| 2. LOCATION (Coordinates or Station): X=818,062 Y=519,142 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY: LAW Engineering and Environmental Services, Inc. | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 |
| 4. HOLE NO. (As shown on drawing title and file number): DCB-0.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER: W. Candelaria | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE: STARTED 7/25/00 COMPLETED 7/25/00 |
| 7. THICKNESS OF BURDEN: 10.5 Ft. | 17. ELEVATION TOP OF HOLE: +11.1 Ft. |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % |
| 9. TOTAL DEPTH OF HOLE: 10.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ricardo Bernal |

| ELEV. | DEPTH | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/.5' |
|---|---|---|---|---|---|---|
| 11.1 | .0 | | | | 11.1 | |
| 10.6 | .5 | ASPHALTIC CONCRETE - 6 inches | | | 10.6 | - |
| | | GRAVEL, coarse to fine limestone, some fine quartz sand, little silt, trace organic black sand (GP-GM) | 44 | 1 | SPLIT SPOON 9.6 | 25 / 6 |
| | | | 44 | 2 | SPLIT SPOON 8.1 | 15 / 10 / 7 |
| | | | 39 | 3 | SPLIT SPOON 6.6 | 2 / 4 / 3 |
| | | | 39 | 4 | SPLIT SPOON 5.1 | 3 / 3 / 3 |
| 3.6 | 7.5 | | 0 | 5 | SPLIT SPOON 3.6 | 1 / / 1 |
| 2.1 | 9.0 | PEAT, little silt, black (PT) | 39 | 6 | SPLIT SPOON 2.1 | WOH / WOH / WOH |
| .6 | 10.5 | LIMESTONE, moderately weathered, medium hard, porous, little fine to medium quartz sand, trace silt, brown to tan (LS) | | 7 | SPLIT SPOON .6 | 5 / 9 / 19 |
| | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) WOH - Weight of Hammer | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT: Tamiami Trail | HOLE NUMBER: DCB-0.5

Hole No.DCB-2.0

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|
| 1. PROJECT Tamiami Trail | | 10. SIZE AND TYPE OF BIT 4 1/4" Auger | |
| 2. LOCATION (Coordinates or Station) X=810,052 Y=519,086 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD 29 Horizontal Datum: FLE NAD 27 | |
| 3. DRILLING AGENCY U. S. Drilling | | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-55 | |
| 4. HOLE NO. (As shown on drawing title and file number) DCB-2.0 | | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 7 undisturbed: 0 | |
| 5. NAME OF DRILLER J. C. | | 14. TOTAL NUMBER OF CORE BOXES | |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | | 15. ELEVATION GROUND WATER | |
| | | 16. DATE HOLE STARTED 8/14/00 COMPLETED 8/14/00 | |
| 7. THICKNESS OF BURDEN 10.5 Ft. | | 17. ELEVATION TOP OF HOLE +10.0 Ft. | |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | | 18. TOTAL CORE RECOVERY FOR BORING See Below % | |
| 9. TOTAL DEPTH OF HOLE 10.5 Ft. | | 19. SIGNATURE OF Civil Engineer Ruben Ponciano | |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 10.0 | .0 | | | | | 10.0 | |
| 9.5 | .5 | | ASPHALTIC CONCRETE - 6 inches | | | 9.5 | - |
| | | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, brown (GP-GM) | 39 | 1 | SPLIT SPOON 8.5 | 9, 8 |
| | | | | 50 | 2 | SPLIT SPOON 7.0 | 4, 5, 4 |
| 5.5 | 4.5 | | | 39 | 3 | SPLIT SPOON 5.5 | 5, 5, 8 |
| 4.0 | 6.0 | | PEAT, some silt, black to dark brown (PT) | 17 | 4 | SPLIT SPOON 4.0 | 6, 2, 1 |
| | | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, trace shell fragments, some medium to fine quartz sand, little silt, light brown to tan (LS) | 67 | 5 | SPLIT SPOON 2.5 | 20, 29, 19 |
| | | | | 55 | 6 | SPLIT SPOON 1.0 | 14, 15, 20 |
| -.5 | 10.5 | | | 67 | 7 | SPLIT SPOON -.5 | 12, 6, 9 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT Tamiami Trail | 10. SIZE AND TYPE OF BIT 3 7/8" Casing & Roller Bit |
| 2. LOCATION *(Coordinates or Station)* X=807,338 Y=519,100 | 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY LAW Engineering and Environmental Services, Inc. | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-55 |
| 4. HOLE NO. *(As shown on drawing title and file number)* DCB-2.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER W. Candelaria | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE STARTED 7/25/00 COMPLETED 7/25/00 |
| 7. THICKNESS OF BURDEN 10.5 Ft. | 17. ELEVATION TOP OF HOLE +10.1 Ft. |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING See Below % |
| 9. TOTAL DEPTH OF HOLE 10.5 Ft. | 19. SIGNATURE OF Civil Engineer Ricardo Bernal |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 10.1 | .0 | | | | | 10.1 | |
| 9.8 | .3 | | ASPHALTIC CONCRETE - 4.5 inches | | | 9.6 | - |
| | | | GRAVEL, coarse to fine limestone, some fine quartz sand, little silt, brown (GP-GM) | 44 | 1 | SPLIT SPOON 8.6 | 8, 10 |
| | | | | 22 | 2 | SPLIT SPOON 7.1 | 7, 10, 6 |
| 6.1 | 4.0 | | | 39 | 3 | SPLIT SPOON 5.6 | 2, 2, 1 |
| | | | PEAT, little silt, black (PT) | 17 | 4 | SPLIT SPOON 4.1 | 1, WOH, WOH |
| 3.1 | 7.0 | | | 55 | 5 | SPLIT SPOON 2.6 | WOH, WOH, 70 |
| | | | LIMESTONE, moderately weathered, medium hard, porous, some fine quartz sand, brown to tan (LS) | 89 | 6 | SPLIT SPOON 1.1 | 19, 21, 19 |
| -.4 | 10.5 | | | 89 | 7 | SPLIT SPOON -.4 | 18, 13, 18 |

Notes:
1. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.)

WOH - Weight of Hammer

Scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

**Hole No.DCB-4.0**

# DRILLING LOG

| | |
|---|---|
| DIVISION: South Atlantic | INSTALLATION: Jacksonville District — SHEET 1 OF 1 |
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 4 1/4" Auger |
| 2. LOCATION *(Coordinates or Station)*: X=799,368 Y=519,034 | 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY: U. S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 |
| 4. HOLE NO. *(As shown on drawing title and file number)*: DCB-4.0 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER: J. C. | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE: STARTED 8/14/00 COMPLETED 8/14/00 |
| 7. THICKNESS OF BURDEN: 10.5 Ft. | 17. ELEVATION TOP OF HOLE: +10.6 Ft. |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % |
| 9. TOTAL DEPTH OF HOLE: 10.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ruben Ponciano |

| ELEV. | DEPTH | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/.5' |
|---|---|---|---|---|---|---|
| 10.6 | .0 | | | | 10.6 | – |
| 9.6 | 1.0 | ASPHALTIC CONCRETE – 12 inches | | | 9.6 | – |
| | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, brown (GP-GM) | 17 | 1 | 9.1 SPLIT SPOON | 7 |
| | | | 44 | 2 | SPLIT SPOON 7.6 | 6, 5, 6 |
| | | | 0 | 3 | SPLIT SPOON 6.1 | 5, 4, 3 |
| | | | 22 | 4 | SPLIT SPOON 4.6 | 2, 2, 2 |
| 3.6 | 7.0 | | 55 | 5 | SPLIT SPOON 3.1 | 4, 9, 4 |
| 2.8 | 7.8 | PEAT, little silt, black (PT) | | | | |
| | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, some fine to medium quartz sand, little silt, trace clay, light brown to tan (LS) | 100 | 6 | SPLIT SPOON 1.6 | 22, 22, 19 |
| .1 | 10.5 | | 67 | 7 | SPLIT SPOON .1 | 15, 23, 25 |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

Notes:
1. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.)

Hole No.DCB-6.0

# DRILLING LOG

| | |
|---|---|
| DIVISION: South Atlantic | INSTALLATION: Jacksonville District — SHEET 1 OF 1 |
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 4 1/4" Auger |
| 2. LOCATION *(Coordinates or Station)*: X=788,503 Y=518,998 | 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY: U. S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 |
| 4. HOLE NO. *(As shown on drawing title and file number)*: DCB-6.0 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 1 |
| 5. NAME OF DRILLER: J. C. | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE: STARTED 8/4/00 COMPLETED 8/4/00 |
| 7. THICKNESS OF BURDEN: 10.5 Ft. | 17. ELEVATION TOP OF HOLE: +10.6 Ft. |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % |
| 9. TOTAL DEPTH OF HOLE: 10.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 10.6 | .0 | | | | | 10.6 | |
| 9.9 | .7 | | ASPHALTIC CONCRETE - 8 inches | | | 9.9 | - |
| | | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, brown (GP-GM) | 33 | 1 | SPLIT SPOON 9.1 | 28, 20 |
| 7.6 | 3.0 | | | 44 | 2 | SPLIT SPOON 7.6 | 12, 11, 8 |
| 6.1 | 4.5 | | PEAT, some silt, black to dark brown (PT) | 39 | 3 | SPLIT SPOON 6.1 | 4, 3, 3 |
| | | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, some medium to fine quartz sand, little silt, trace clay, light brown to tan (LS) | 28 | 4 | SPLIT SPOON 4.6 | 3, 12, 13 |
| | | | | 67 | 5 | SPLIT SPOON 3.1 | 17, 28, 30 |
| | | | | 78 | 6 | SPLIT SPOON 1.6 | 20, 22, 28 |
| .1 | 10.5 | | | 72 | 7 | SPLIT SPOON .1 | 21, 28, 33 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT: Tamiami Trail HOLE NUMBER: DCB-6.0

**Hole No.DCB-6.5**

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT Tamiami Trail | 10. SIZE AND TYPE OF BIT 3 7/8" Casing & Roller Bit |
| 2. LOCATION (Coordinates or Station) X=785,803 Y=519,016 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY LAW Engineering and Environmental Services, Inc. | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-55 |
| 4. HOLE NO. (As shown on drawing title and file number) DCB-6.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER W. Candelaria | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE STARTED 7/25/00 COMPLETED 7/25/00 |
| 7. THICKNESS OF BURDEN 10.5 Ft. | 17. ELEVATION TOP OF HOLE +9.7 Ft. |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING See Below % |
| 9. TOTAL DEPTH OF HOLE 10.5 Ft. | 19. SIGNATURE OF Civil Engineer Ricardo Bernal |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 9.7 | .0 | | | | | 9.7 | |
| 9.5 | .2 | | ASPHALTIC CONCRETE - 2.25 inches<br>GRAVEL, coarse to fine limestone, little fine quartz sand, brown (GP-GM) | 44 | 1 | SPLIT SPOON<br>8.2 | 1<br>6<br>5 |
| | | | | 22 | 2 | SPLIT SPOON<br>6.7 | 4<br>9<br>7 |
| | | | | 17 | 3 | SPLIT SPOON<br>5.2 | 4<br>5<br>6 |
| | | | | 0 | 4 | SPLIT SPOON<br>3.7 | 6<br>1<br>1 |
| 3.7 | 6.0 | | PEAT, little silt, black (PT) | 22 | 5 | SPLIT SPOON<br>2.2 | 1<br>WOH<br>WOH |
| 2.0 | 7.7 | | LIMESTONE, moderately weathered, medium hard, porous, little fine quartz sand, light brown to tan (LS) | 39 | 6 | SPLIT SPOON<br>.7 | WOH<br>3<br>3 |
| | | | | 78 | 7 | SPLIT SPOON<br>-.8 | 10<br>9<br>26 |
| -.8 | 10.5 | | Notes:<br>1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.)<br>WOH - Weight of Hammer | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

Hole No.DCB-8.0

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT Tamiami Trail | 10. SIZE AND TYPE OF BIT 3 1/4" I.D. Augers |
| 2. LOCATION *(Coordinates or Station)* X=777,834 Y=518,964 | 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY U. S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL SIMCO |
| 4. HOLE NO. *(As shown on drawing title and file number)* DCB-8.0 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER Kevin Claprood | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE STARTED 8/3/00 COMPLETED 8/3/00 |
| 7. THICKNESS OF BURDEN 10.5 Ft. | 17. ELEVATION TOP OF HOLE +10.6 Ft. |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING See Below % |
| 9. TOTAL DEPTH OF HOLE 10.5 Ft. | 19. SIGNATURE OF Civil Engineer Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 10.6 | .0 | | | | | 10.6 | |
| 9.8 | .8 | | ASPHALTIC CONCRETE - 10 inches | | | 9.6 | - / - |
| | | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, brown (GP-GM) | 11 | 1 | 9.1 SPLIT SPOON | 1 |
| | | | | 22 | 2 | SPLIT SPOON 7.6 | 7 / 4 / 17 |
| | | | | 22 | 3 | SPLIT SPOON 6.1 | 15 / 6 / 10 |
| 4.6 | 6.0 | | | 28 | 4 | SPLIT SPOON 4.6 | 7 / 4 / 3 |
| 4.1 | 6.5 | | PEAT, little silt, black (PT) | | | | 2 |
| | | | LIMESTONE, moderately weathered, medium hard, some medium to fine quartz sand, little silt, trace clay (LS) | 67 | 5 | SPLIT SPOON 3.1 | 12 / 9 |
| | | | | 72 | 6 | SPLIT SPOON 1.6 | 50 / 27 / 22 |
| .1 | 10.5 | | | 44 | 7 | SPLIT SPOON .1 | 22 / 24 / 50/2 |

Scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

Notes:
1. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.)

Hole No.DCB-8.5

| DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 3 7/8" Casing and Roller Bit |
| 2. LOCATION (Coordinates or Station): X=775,095 Y=518,997 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY: LAW Engineering and Environmental Services, Inc. | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 |
| 4. HOLE NO. (As shown on drawing title and file number): DCB-8.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER: W. Candelaria | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE: STARTED 7/26/00 COMPLETED 7/26/00 |
| 7. THICKNESS OF BURDEN: 10.5 Ft. | 17. ELEVATION TOP OF HOLE: +10.4 Ft. |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % |
| 9. TOTAL DEPTH OF HOLE: 10.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 10.4 | .0 | | | | | 10.4 | |
| 10.1 | .3 | | ASPHALTIC CONCRETE - 3 inches | | | 9.9 | - |
| | | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, trace clay, brown (GP-GM) | 50 | 1 | SPLIT SPOON 8.9 | 21, 15 |
| | | | | 22 | 2 | SPLIT SPOON 7.4 | 10, 8, 6 |
| 5.9 | 4.5 | | | 11 | 3 | SPLIT SPOON 5.9 | 6, 4, 9 |
| 4.4 | 6.0 | | SAND, coarse to medium quartz, little fine quartz sand, little fine gravel, brown (SP) | 22 | 4 | SPLIT SPOON 4.4 | 5, 3, 1 |
| 2.9 | 7.5 | | PEAT, some silt, black to dark brown (PT) | 44 | 5 | SPLIT SPOON 2.9 | WOR, WOH, 1 |
| | | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, trace shell fragments, some fine to medium sand, little silt, light brown to tan (LS) | 33 | 6 | SPLIT SPOON 1.4 | 1, 3, 17 |
| -.1 | 10.5 | | | 67 | 7 | SPLIT SPOON -.1 | 30, 63, 51 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

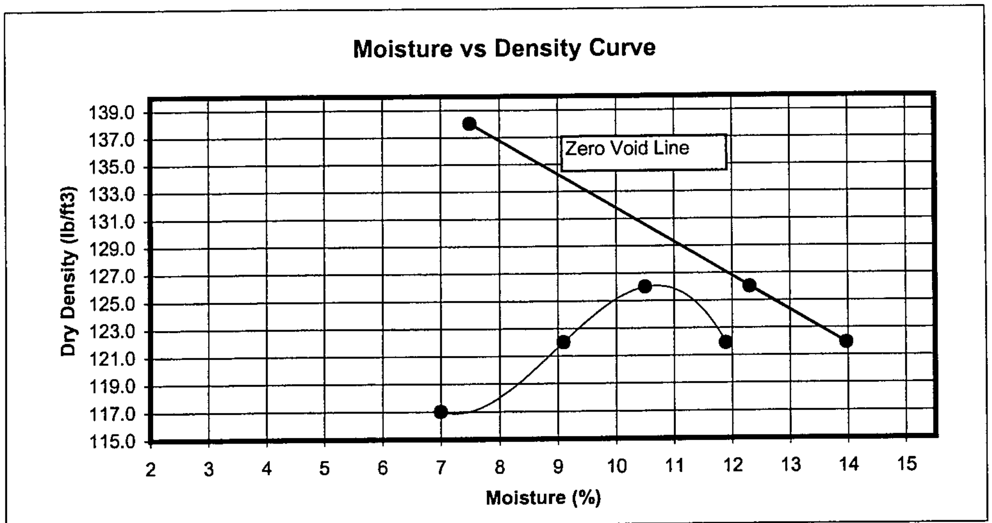
# California Bearing Ratio

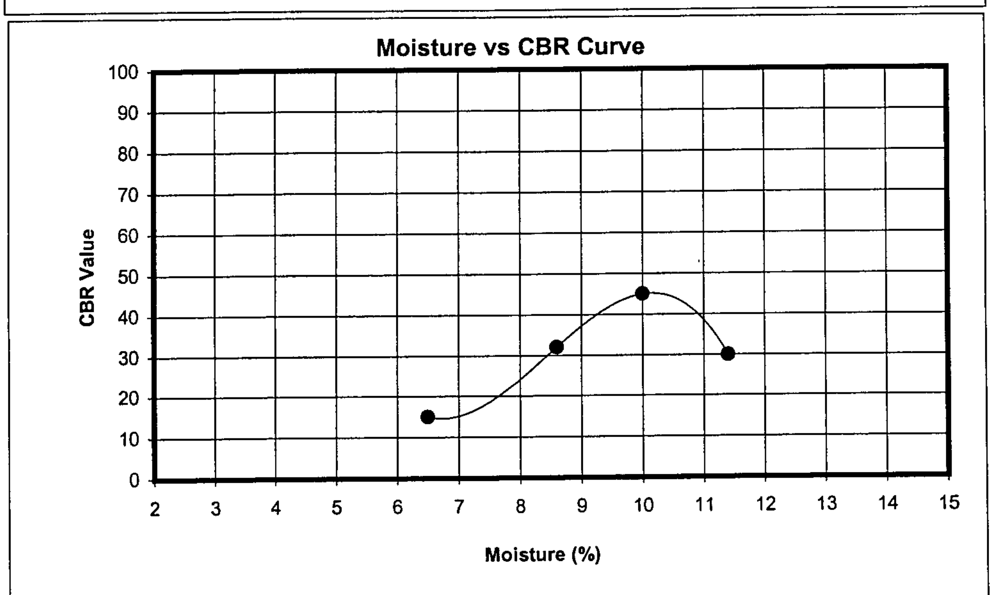
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 6.5 | 117.00 | 15.00 | 93.1 |
| 6 | 8.6 | 122.00 | 32.00 | 99.8 |
| 8 | 10.0 | 126.00 | 45.00 | 94.5 |
| 10 | 11.4 | 121.90 | 30.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
Wet

**SAMPLE LOCATION**
L6.5

**SOIL DESCRIPTION**
Lt tan sand w/ Limerock

**OPTIMUM CBR**
46

**Modified Proctor**
**MAXIMUM DENSITY**
126.1

**OPTIMUM MOISTURE**
10.0%

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

# California Bearing Ratio

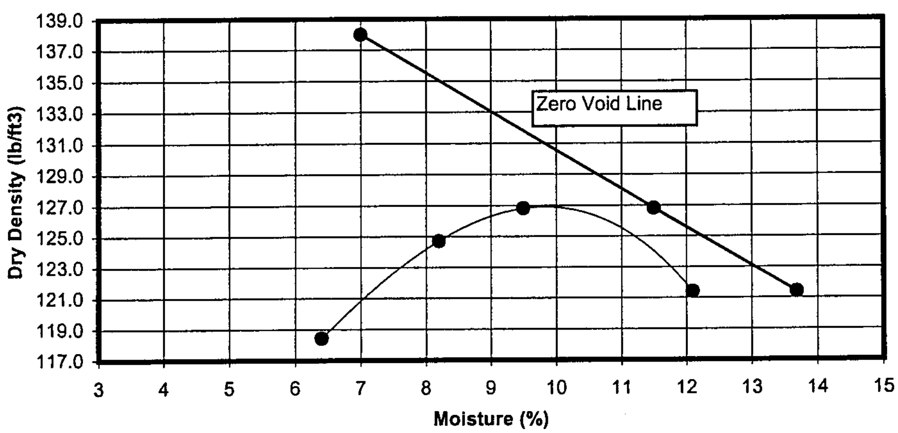
**Tamiami Trail**

**40700-0-2369**

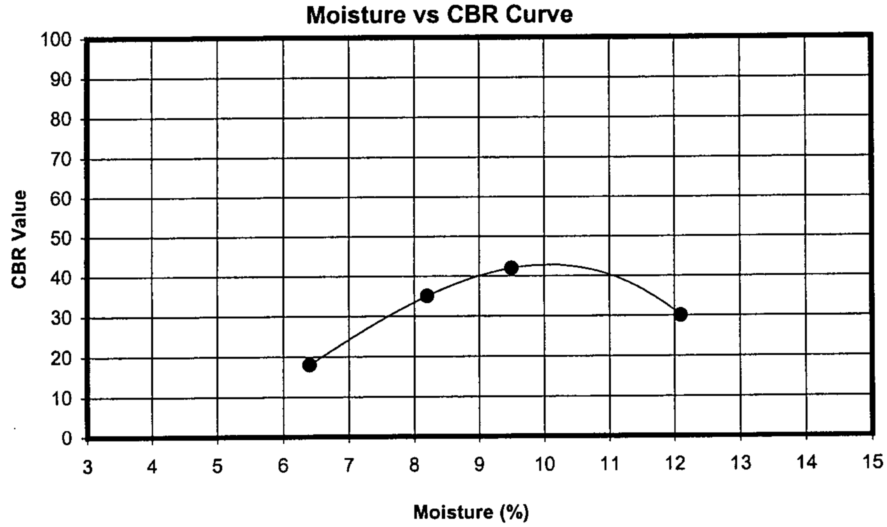
| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 6.4 | 118.40 | 18.00 | 93.2 |
| 6 | 8.2 | 124.70 | 35.00 | 98.2 |
| 8 | 9.5 | 126.80 | 42.00 | 99.8 |
| 10 | 12.1 | 121.40 | 30.00 | 95.6 |

**Note : Moisture Content Before Soaking**

**Moisture vs Density Curve**




**Moisture vs CBR Curve**




**Date**
**18-Sep-00**

**Method**
**DRY**

**SAMPLE LOCATION**
**L6.5**

**SOIL DESCRIPTION**
**Lt. Tan Sand with Limerock**

**OPTIMUM CBR**
**44**

**Modified Proctor**
**MAXIMUM DENSITY**
**127**

**OPTIMUM MOISTURE**
**10%**

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

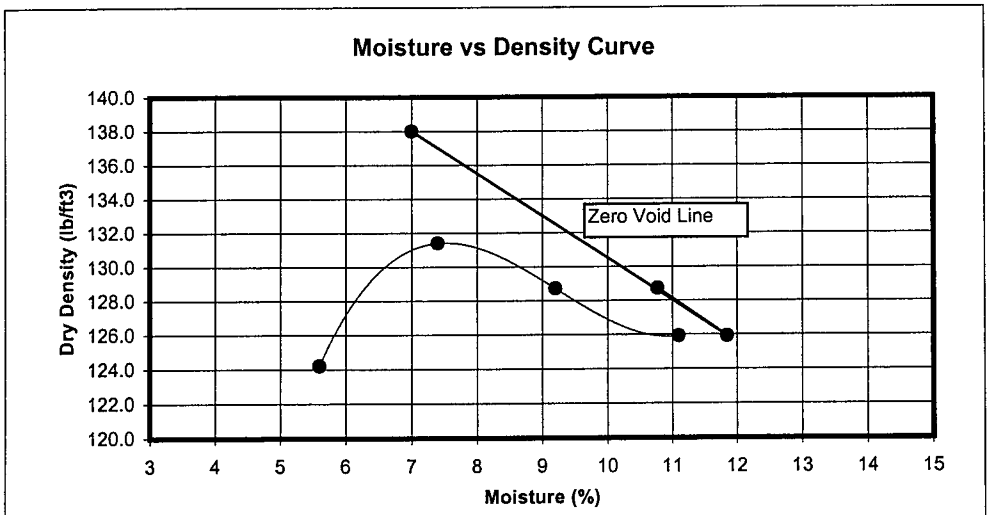
# California Bearing Ratio

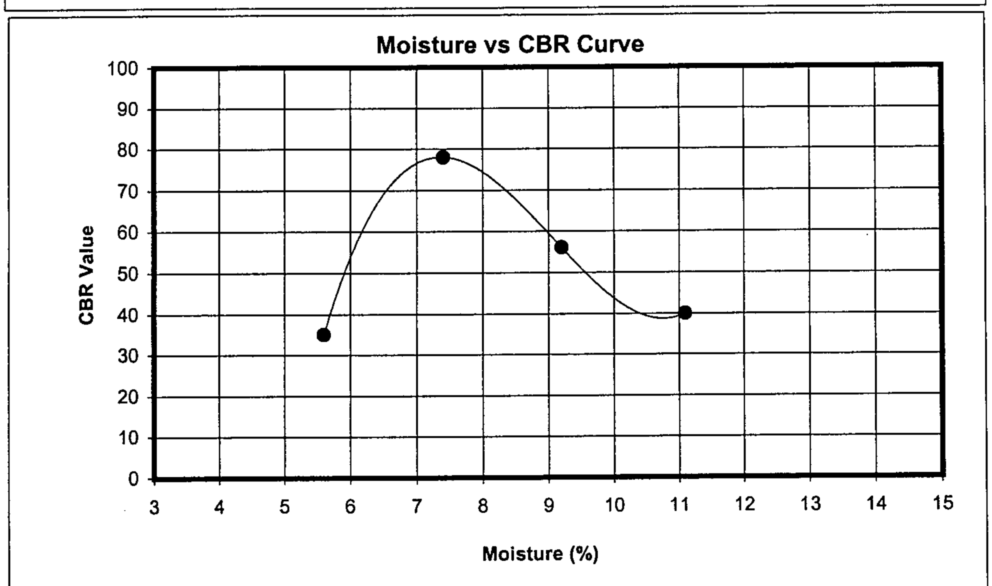
**COE - US 441**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.6 | 124.20 | 35.00 | 94.4 |
| 6 | 7.4 | 131.40 | 78.00 | 99.9 |
| 8 | 9.2 | 128.70 | 56.00 | 97.9 |
| 10 | 11.1 | 125.90 | 40.00 | 95.7 |

**Note : Moisture Content Before Soaking**




**Date**
**18-Sep-00**

**Method**
**DRY**

**SAMPLE LOCATION**
**L10.5**

**SOIL DESCRIPTION**
**Lt. Brown Sand With Limerock**

**OPTIMUM CBR**
**79**

**Modified Proctor**
**MAXIMUM DENSITY**
**131.5**

**OPTIMUM MOISTURE**
**8%**

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

# California Bearing Ratio

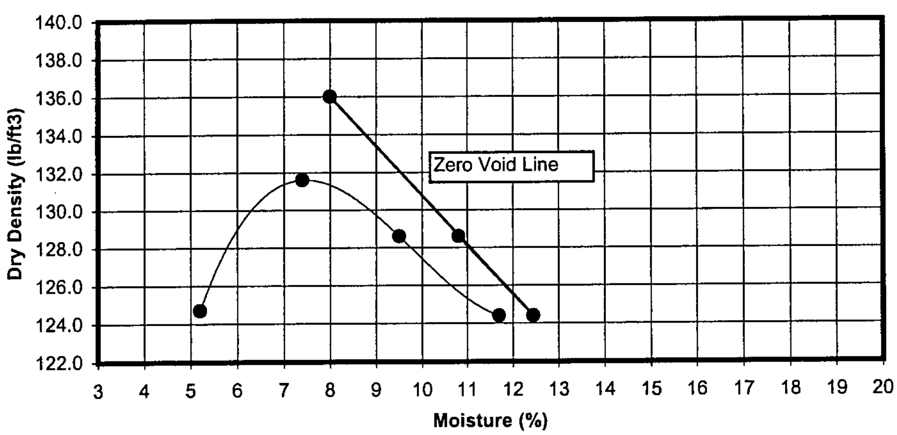
**Tamiami Trail**

**40700-0-2369**

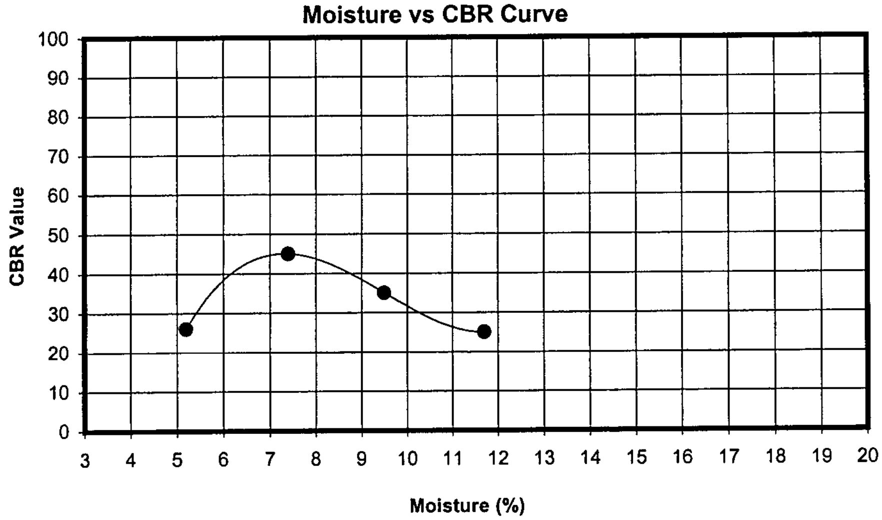
| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.2 | 124.70 | 26.00 | 94.8 |
| 6 | 7.4 | 131.60 | 45.00 | 100.0 |
| 8 | 9.5 | 128.60 | 35.00 | 97.7 |
| 10 | 11.7 | 124.40 | 25.00 | 94.5 |

**Note : Moisture Content Before Soaking**

**Moisture vs Density Curve**




**Moisture vs CBR Curve**




**Date**
18-Sep-00

**Method**
WET

**SAMPLE LOCATION**
L10.5

**SOIL DESCRIPTION**
Lt. Brown Sand with Limerock

**OPTIMUM CBR**
45

**Modified Proctor**
**MAXIMUM DENSITY**
131.6

**OPTIMUM MOISTURE**
8%

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

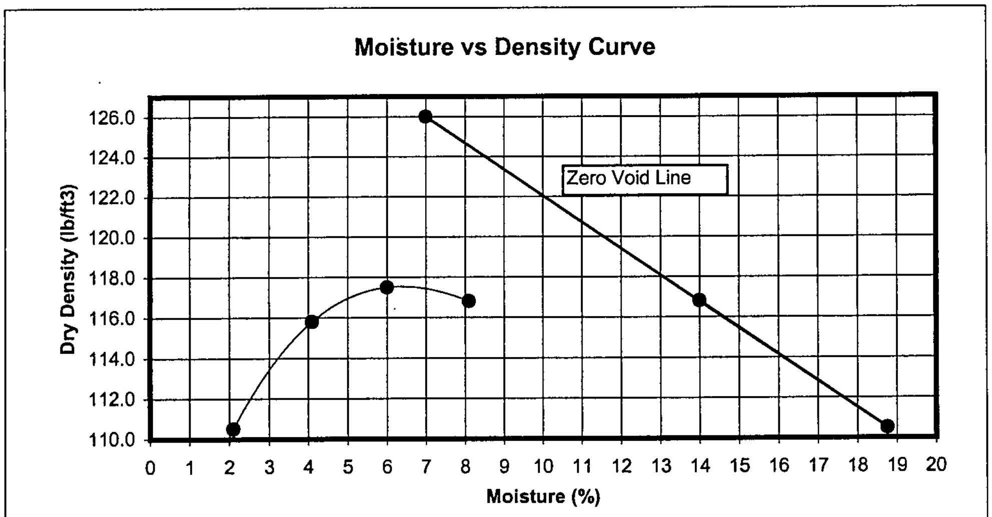
# California Bearing Ratio

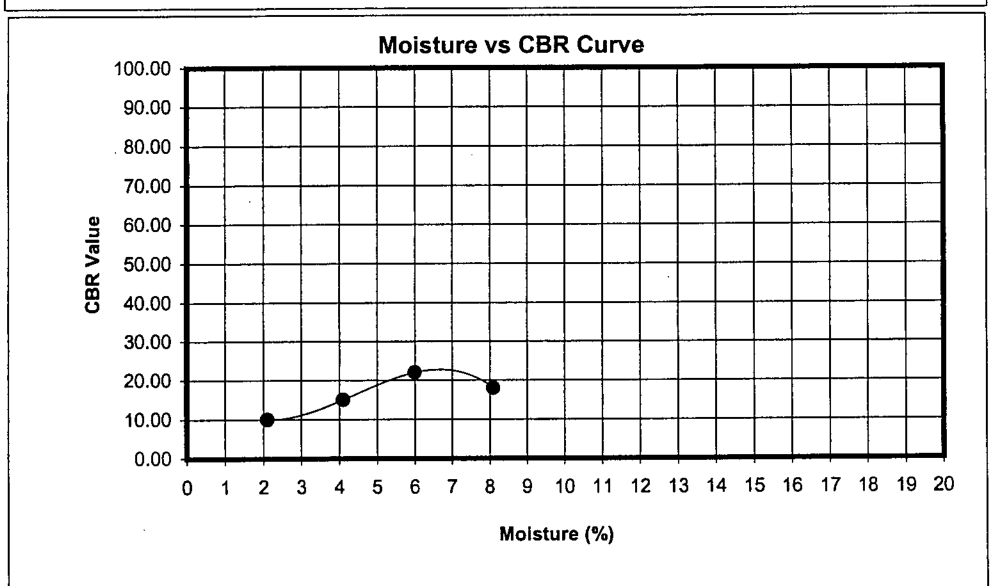
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.1 | 115.80 | 15.00 | 98.1 |
| 6 | 6.0 | 117.50 | 22.00 | 99.6 |
| 8 | 8.1 | 116.80 | 18.00 | 99.0 |
| 10 | 2.1 | 110.50 | 10.00 | 93.6 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
WET

**SAMPLE LOCATION**
L8.5

**SOIL DESCRIPTION**
Lt. Gray Fine to Med. Sandw/ Limerock

**OPTIMUM CBR**
23

**Modified Proctor**
**MAXIMUM DENSITY**
118

**OPTIMUM MOISTURE**
6%

**CHECKED BY:**

Law Engineering and Environmental Services - Miami Lakes - Florida

# California Bearing Ratio

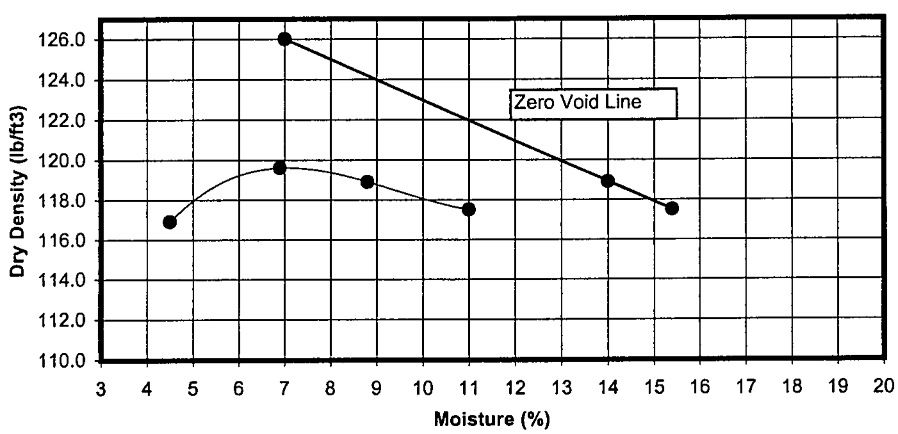
**Tamiami Trail**

**40700-0-2369**

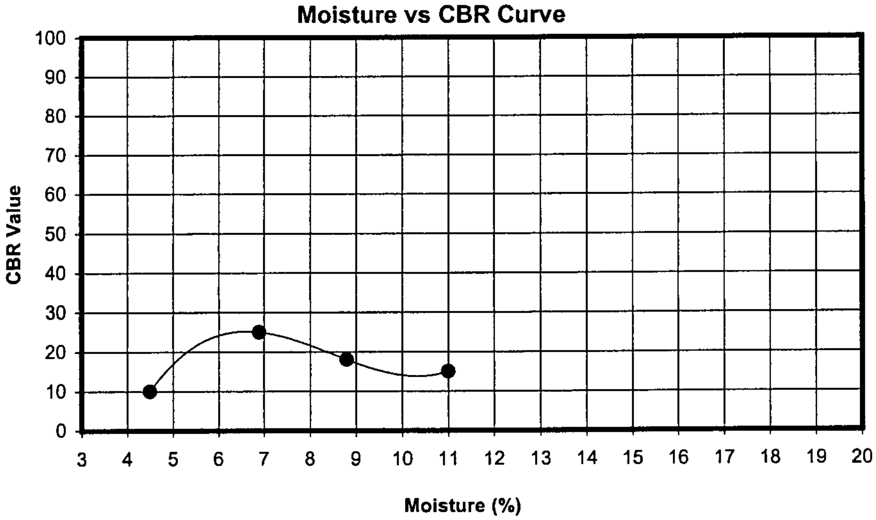
| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.5 | 116.90 | 10.00 | 97.8 |
| 6 | 6.9 | 119.60 | 25.00 | 100.1 |
| 8 | 8.8 | 118.90 | 18.00 | 99.5 |
| 10 | 11.0 | 117.50 | 15.00 | 98.3 |

**Note : Moisture Content Before Soaking**

**Moisture vs Density Curve**




**Moisture vs CBR Curve**




**Date**
18-Sep-00

**Method**
DRY

**SAMPLE LOCATION**
L8.5

**SOIL DESCRIPTION**
Lt. Gray Fine to Med. Sandw/ Limerock

**OPTIMUM CBR**
26

**Modified Proctor**
**MAXIMUM DENSITY**
119.5

**OPTIMUM MOISTURE**
7%

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

SEVERN TRENT SERVICES

STL Miami

LAWENG000282
Ricardo Bernai
Law Engineering (MiamiLakes) √
5845 NW 158th Street
Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74170
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-.5(S-3)
Collected: 07/21/00 10:00
Received: 08/15/00 16:00
Collected by: Client

| PARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| Sulfate | 18 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| Chloride | 16 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| pH | 9.45 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| ASTM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 15552 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 14368 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| | | | | | | | |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

LAWENG000282
Ricardo Bernai
Law Engineering (MiamiLakes) √
5845 NW 158th Street
Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74171
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-.5(S-6)
Collected: 07/21/00 10:15
Received: 08/15/00 16:00
Collected by: Client

| PARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| Sulfate | 40 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| Chloride | 62 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| pH | 7.67 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| ASTM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 2096 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 2096 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

LAWENG000282
Ricardo Bernai
Law Engineering (MiamiLakes) √
5845 NW 158th Street
Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74174
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-2.0(S-3)
Collected: 07/26/00 09:00
Received: 08/15/00 16:00
Collected by: Client

| ARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| ılfate | 26 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| ıloride | 51 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| [ | 9.46 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| ;TM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 5637 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 5637 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

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Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74175
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-2.0(S-4)
Collected: 07/26/00 09:20
Received: 08/15/00 16:00
Collected by: Client

| 'ARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| ulfate | 55 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| 'hloride | 57 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| H | 8.25 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| STM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 4348 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 2941 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

LAWENG000282
Ricardo Bernai
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5845 NW 158th Street
Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74176
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-6.0(S-3)
Collected: 07/27/00 02:05
Received: 08/15/00 16:00
Collected by: Client

| 'ARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| ulfate | 17 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| hloride | 51 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| H | 9.53 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| .STM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 19048 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 19048 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

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Ricardo Bernai
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5845 NW 158th Street
Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74177
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-6.0(S-4)
Collected: 07/27/00 02:30
Received: 08/15/00 16:00
Collected by: Client

| 'ARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| ulfate | 52 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| 'hloride | 48 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| H | 8.29 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| .STM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 2732 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 2639 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

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Page 3
August 17, 2000
Submission # 8000760
Order # 74172
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-8.5(S-3)
Collected: 07/24/00 08:06
Received: 08/15/00 16:00
Collected by: Client

| PARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| Sulfate | 52 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| Chloride | 52 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| pH | 9.59 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| ASTM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 8811 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 8811 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

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Ricardo Bernai
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5845 NW 158th Street
Miami Lakes, FL 33014


August 17, 2000
Submission # 8000760
Order # 74173
FDEP CompQAP# 990102
FL-DOH Certification# E86349, 86413, 86565

Site Location/Project
Tamiami Trail & Krome Avenue .5,8.5,6,2
40700-0-2369

Sample I.D.: CB-8.5(S-5)
Collected: 07/24/00 08:10
Received: 08/15/00 16:00
Collected by: Client

| PARAMETER | RESULT | UNITS | METHOD | DETECTION LIMIT | DATE EXT. | DATE ANALY. | ANALYST |
|---|---|---|---|---|---|---|---|
| Sulfate | 93 | mg/Kg | ASTM D4130 | 1.0 | 08/16/2000 | 08/16/2000 | MC |
| Chloride | 66 | mg/Kg | ASTM D512 | 10.0 | 08/16/2000 | 08/16/2000 | MC |
| pH | 7.95 | | ASTM G-51 | 1.0 | 08/16/2000 | 08/16/2000 | KOD |
| ASTM-G57 Resistivity in SOIL expressed as Ohm*cm | | | MEDF | 1 | | | |
| Resistivity (As Received) | 2833 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |
| Resistivity (Saturated) | 2227 | Ω*cm. | ASTM G-57 | 1.000 | 08/17/2000 | 08/17/2000 | MC |

***BDL: Indicates Analyte is Below Detection Limit***MEDF: Matrix Effected Dilution Factor***
***Work Subcontracted to Outside Labs Denoted by HRS Cert ID in Analyst Field***
***Qualifier following result conforms to FAC 62-160 Table 7******Unless otherwise noted, mg/Kg denotes wet weight***
***62-770: If the MDL using the most sensitive and currently available technology is higher than a specific criterion, the PQL shall be used.
Certs:Al.=#41180, Ct.=#PH0217, Ks.=#E270 + E1245, Ky.=#90087, La.=#9601, Md.=#271, Ma.=#M-FL535
NC.=#539, ND.=#R163, OK.=#9523, SC.=#96023, Tn.=#TN02826

Authorized Laboratory Management

# PRECISION ENVIRONMENTAL LABORATORY
## CHAIN OF CUSTODY RECORD (DEP 62-770.900 (modified form))

10200 USA TODAY WAY, MIRAMAR, FLORIDA 33025
(954) 431-4550 • NATL WATS (800) LAB-8550 • FAX (954) 431-1959

Original - Return w/Report | Yellow - Lab Copy | Pink - Sampler Copy

Submission Code: 00/08-0760
Orders: 0-74170/74177
Entered to lims: A.P.

FDEP Facility No.: ____
Page ____ of ____
Sampling CompQAP NO.: ____
Approval Date: ____

Report To: Ricardo Bernal
Report To Address: 5845 NW 158 Street
Bill To: LAW Gibb
Billing Address: Same
Project Number/Name: 40700-0-2369
Site Location: Tamiami Trail & Krome Avenue .5, 8.5, 6, 2.
Project Contact: Ricardo Bernal | Phone: 305-826-5588 | FAX: (305) 826 1799
Alternate Contact: Tom McDaniel | Phone: 305-826-1799 | FAX:
Sampled By (print): | Sampler's Signature:

| ITEM | SAMPLE ID | DATE COLLECTED | TIME COLLECTED | pH ..... FLD | TEMP °C ..... FLD | COND ..... FLD | MATRIX DW SW GW SED S EFF HW BIO SA | SAMPLE LOCATION/ JOB DESCRIPTION (optional if needed when samples are from different site locations) | # CONTAINERS | ANALYSIS REQUIRED: Corrosion Test for all samples | PH, Chloride, Sulfate, Resistivity | | | | Lot Number of Sampling Containers Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CB-.5 | 7/21 | 10:00 | | | | | | | 74170 | S-3 | | | | |
| 2 | CB-.5 | 7/21 | 10:15 | | | | | | | 74171 | S-6 | | | | |
| 3 | CB-8.5 | 7/24 | 8:06 | | | | | | | 74172 | S-3 | | | | |
| 4 | CB-8.5 | 7/24 | 8:10 | | | | | | | 74173 | S-5 | | | | |
| 5 | CB-2.0 | 7/26 | 9:00 | | | | | | | 74174 | S-3 | | | | |
| 6 | CB-2.0 | 7/26 | 9:20 | | | | | | | 74175 | S-4 | | | | |
| 7 | CB-6.0 | 7/27 | 2:05 | | | | | | | 74176 | S-3 | | | | |
| 8 | CB-6.0 | 7/27 | 2:30 | | | | | | | 74177 | S-4 | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |

PLACE NAME OR METHOD NUMBER OF TESTS NEEDED IN LARGE BOXES BELOW.
(✓) CHECK OFF WHICH SAMPLE ITEMS NEED EACH TEST PERFORMED

Sample Condition as Received: Temp 4.0 | Sealed Yes No (circled: No)

Special Comments: PO# 407-00977-00
Total # of Containers:
QA/QC Report Needed?: Yes No (See price guide for applicable fees)
Report Format: Standard Other (specify)

| (1) Relinquished by Signature: | Date: | (2) Relinquished by Signature: [signature] | Date: 8/15/00 |
|---|---|---|---|
| Company: | Time: | Company: STL | Time: 16:00 |
| (1) Received by Signature: [signature] | Date: 8/15/00 | (2) Received by Signature: A.P | Date: 8/15/00 |
| Company: STL | Time: 16:00 | Company: STL | Time: 16:00 |

DUE DATE REQUESTED:
Confirmation #
Coating Code: ____ Q/L/D
Misc. Charges
SHADED AREAS ARE FOR LAB USE ONLY

# SPT-97 DRIVEN PILE ANALYSES

FLORIDA DEPARTMENT OF TRANSPORTATION
STRUCTURES DESIGN OFFICE
STATIC PILE BEARING CAPACITY ANALYSIS PROGRAM
SPT97 - VERSION 1.2 FEBRUARY, 1997
BASED ON RESEARCH BULLETIN RB-121
"GUIDELINES FOR USE IN THE SOILS INVESTIGATION
AND DESIGN OF FOUNDATIONS FOR
BRIDGE STRUCTURES IN THE STATE OF FLORIDA" AND
RESEARCH STUDY REPORT BY UNIVERSITY OF FLORIDA
"DESIGN OF STEEL PIPE AND H PILES"

NOTE - THIS PROGRAM IS EXPANDED FROM SPT91
IS ALSO KNOWN AS SPT94
TO INCLUDE STEEL H AND PIPE PILES

A. GENERAL INFORMATION

| | |
|---|---|
| **INPUT FILE NAME** | **Tamiami333.in** |
| RUN DATE | 08/24/00 |
| RUN TIME | 16:17:39 |
| PROJECT NUMBER | 40700-0-2369 |
| JOB NAME | Tamiami Trail |
| SUBMITTING ENGINEER | R.Bernal |
| BORING NO. | 333 |
| DRILLING DATE | 2/24/73 |
| STATION NO. | |
| GROUND SURFACE ELEVATION | 18.80 FEET |
| TYPE OF ANALYSIS | 2 - DETERMINATION OF STATIC PILE BEARING CAPACITIES FOR A RANGE OF PILE LENGTHS (CAPACITY VS. TIP ELEVATION) |

B. BORING LOG

| ENTRY NO. | DEPTH (FT) D(I) | ELEVATION (FT) | SPT BLOWS/FT N(I) | SOIL TYPE ST(I) |
|---|---|---|---|---|
| 1 | .1 | 18.7 | 40.0 | 3 |
| 2 | 1.5 | 17.3 | 36.0 | 3 |
| 3 | 3.0 | 15.8 | 72.0 | 3 |
| 4 | 4.5 | 14.3 | 19.0 | 3 |
| 5 | 6.0 | 12.8 | 74.0 | 3 |
| 6 | 7.5 | 11.3 | 59.0 | 3 |
| 7 | 9.0 | 9.8 | 43.0 | 3 |
| 8 | 10.5 | 8.3 | 42.0 | 3 |
| 9 | 12.0 | 6.8 | 28.0 | 3 |
| 10 | 13.5 | 5.3 | 13.0 | 3 |
| 11 | 13.8 | 5.0 | 13.0 | 3 |
| 12 | 13.9 | 4.9 | 13.0 | 5 |
| 13 | 16.5 | 2.3 | 13.0 | 5 |
| 14 | 16.6 | 2.2 | 59.0 | 4 |
| 15 | 20.0 | -1.2 | 59.0 | 4 |
| 16 | 25.0 | -6.2 | 59.0 | 4 |
| 17 | 28.0 | -9.2 | 59.0 | 4 |
| 18 | 29.5 | -10.7 | 43.0 | 4 |
| 19 | 31.0 | -12.2 | 33.0 | 4 |
| 20 | 32.5 | -13.7 | 34.0 | 4 |
| 21 | 34.0 | -15.2 | 59.0 | 4 |
| 22 | 35.5 | -16.7 | 41.0 | 4 |
| 23 | 37.0 | -18.2 | 49.0 | 4 |
| 24 | 38.5 | -19.7 | 34.0 | 4 |
| 25 | 40.0 | -21.2 | 54.0 | 4 |
| 26 | 41.5 | -22.7 | 53.0 | 4 |
| 27 | 43.0 | -24.2 | 59.0 | 4 |
| 28 | 44.0 | -25.2 | 59.0 | 4 |

SOIL TYPE LEGEND
------------------

0 - BOTTOM OF BORING
1 - PLASTIC CLAYS
2 - CLAY/SILT SAND MIXTURES, SILTS & MARLS
3 - CLEAN SAND
4 - SOFT LIMESTONE, VERY SHELLY SANDS
5 - VOID (NO CAPACITY)

**C. PILE INFORMATION**

TEST PILE SECTION ISECT = 1
{concrete pile, square section}
WIDTH OF PILE WP = **18.00 INCHES**

D. PILE CAPACITY VS. PENETRATION

| TEST PILE LENGTH (FT) | PILE TIP ELEV (FT) | ULTIMATE SIDE FRICTION (TONS) | MOBILIZED END BEARING (TONS) | ESTIMATED DAVISSON CAPACITY (TONS) | ALLOWABLE PILE CAPACITY (TONS) | ULTIMATE PILE CAPACITY (TONS) |
|---|---|---|---|---|---|---|
| .1 | 18.7 | .00 | 48.11 | 48.11 | 24.05 | 144.33 |
| 1.1 | 17.7 | 4.75 | 96.29 | 101.04 | 50.52 | 293.62 |
| 2.1 | 16.7 | 8.72 | 96.97 | 105.69 | 52.85 | 299.63 |
| 3.1 | 15.7 | 13.76 | 98.41 | 112.18 | 56.09 | 309.01 |
| 4.1 | 14.7 | 18.21 | 99.21 | 117.42 | 58.71 | 315.85 |
| 5.1 | 13.7 | 20.99 | 99.82 | 120.80 | 60.40 | 320.44 |
| 6.1 | 12.7 | 26.23 | 100.33 | 126.55 | 63.28 | 327.21 |
| 7.1 | 11.7 | 33.46 | 99.50 | 132.95 | 66.48 | 331.94 |
| 8.1 | 10.7 | 41.71 | 96.97 | 138.68 | 69.34 | 332.61 |
| 9.1 | 9.7 | 47.69 | 88.82 | 136.52 | 68.26 | 314.16 |
| 10.1 | 8.7 | 52.54 | 78.68 | 131.23 | 65.61 | 288.59 |
| 11.1 | 7.7 | 57.14 | 68.88 | 126.02 | 63.01 | 263.78 |
| 12.1 | 6.7 | 60.75 | 72.42 | 133.17 | 66.58 | 278.01 |
| 13.1 | 5.7 | 63.23 | 80.91 | 144.14 | 72.07 | 305.96 |
| 14.1 | 4.7 | 64.42 | .00 | 64.42 | 32.21 | 64.42 |
| 15.1 | 3.7 | 64.42 | .00 | 64.42 | 32.21 | 64.42 |
| 16.1 | 2.7 | 64.42 | .00 | 64.42 | 32.21 | 64.42 |
| 17.1 | 1.7 | 66.34 | 117.54 | 183.88 | 91.94 | 418.95 |
| 18.1 | .7 | 69.76 | 118.04 | 187.80 | 93.90 | 423.88 |
| 19.1 | -.3 | 73.17 | 118.63 | 191.81 | 95.90 | 429.07 |
| 20.1 | -1.3 | 76.56 | 119.47 | 196.03 | 98.01 | 434.97 |
| 21.1 | -2.3 | 79.84 | 121.00 | 200.84 | 100.42 | 442.85 |
| 22.1 | -3.3 | 83.05 | 123.25 | 206.30 | 103.15 | 452.80 |
| 23.1 | -4.3 | 86.25 | 126.07 | 212.31 | 106.16 | 464.44 |
| 24.1 | -5.3 | 89.59 | 128.34 | 217.93 | 108.96 | 474.61 |
| 25.1 | -6.3 | 93.12 | 129.54 | 222.66 | 111.33 | 481.75 |
| 26.1 | -7.3 | 96.70 | 129.52 | 226.22 | 113.11 | 485.27 |
| 27.1 | -8.3 | 100.24 | 129.62 | 229.86 | 114.93 | 489.10 |
| 28.1 | -9.3 | 103.78 | 131.38 | 235.16 | 117.58 | 497.93 |
| 29.1 | -10.3 | 106.95 | 134.20 | 241.15 | 120.57 | 509.55 |
| 30.1 | -11.3 | 109.54 | 133.94 | 243.48 | 121.74 | 511.37 |
| 31.1 | -12.3 | 111.72 | 133.21 | 244.93 | 122.47 | 511.36 |
| 32.1 | -13.3 | 113.76 | 133.90 | 247.66 | 123.83 | 515.46 |
| 33.1 | -14.3 | 116.00 | 132.33 | 248.33 | 124.17 | 513.00 |

D. PILE CAPACITY VS. PENETRATION (CONTINUED)

| (FT) | (FT) | (TONS) | (TONS) | (TONS) | (TONS) | (TONS) |
|---|---|---|---|---|---|---|
| 34.1 | -15.3 | 119.14 | 128.16 | 247.29 | 123.65 | 503.60 |
| 35.1 | -16.3 | 122.25 | 127.18 | 249.42 | 124.71 | 503.78 |
| 36.1 | -17.3 | 124.84 | 128.07 | 252.91 | 126.45 | 509.05 |
| 37.1 | -18.3 | 127.65 | 128.67 | 256.32 | 128.16 | 513.65 |

*** ERROR *** PILE TIP TOO NEAR END OF BORING LOG FOR LENGTH = 38.10 FT

NOTES
-------

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED ANALYSIS NO. 1

C. PILE INFORMATION

TEST PILE SECTION ISECT = 1
{concrete pile, square section}
WIDTH OF PILE WP = **24.00 INCHES**

D. PILE CAPACITY VS. PENETRATION

| **TEST PILE LENGTH (FT)** | **PILE TIP ELEV (FT)** | **ULTIMATE SIDE FRICTION (TONS)** | **MOBILIZED END BEARING (TONS)** | **ESTIMATED DAVISSON CAPACITY (TONS)** | **ALLOWABLE PILE CAPACITY (TONS)** | **ULTIMATE PILE CAPACITY (TONS)** |
|---|---|---|---|---|---|---|
| .1 | 18.7 | .00 | 94.26 | 94.26 | 47.13 | 282.79 |
| 1.1 | 17.7 | 6.45 | 182.20 | 188.65 | 94.33 | 553.06 |
| 2.1 | 16.7 | 12.40 | 185.28 | 197.68 | 98.84 | 568.23 |
| 3.1 | 15.7 | 20.11 | 188.20 | 208.31 | 104.16 | 584.72 |
| 4.1 | 14.7 | 26.73 | 188.22 | 214.95 | 107.48 | 591.40 |
| 5.1 | 13.7 | 31.13 | 185.53 | 216.65 | 108.33 | 587.71 |
| 6.1 | 12.7 | 38.59 | 180.44 | 219.03 | 109.51 | 579.90 |
| 7.1 | 11.7 | 47.68 | 170.97 | 218.66 | 109.33 | 560.60 |
| 8.1 | 10.7 | 56.39 | 157.01 | 213.41 | 106.70 | 527.43 |
| 9.1 | 9.7 | 63.59 | 142.95 | 206.54 | 103.27 | 492.44 |
| 10.1 | 8.7 | 70.06 | 140.37 | 210.43 | 105.22 | 491.18 |
| 11.1 | 7.7 | 76.19 | 147.28 | 223.47 | 111.73 | 518.02 |
| 12.1 | 6.7 | 80.99 | 155.45 | 236.44 | 118.22 | 547.34 |
| 13.1 | 5.7 | 84.31 | 165.36 | 249.67 | 124.83 | 580.38 |
| 14.1 | 4.7 | 85.89 | .00 | 85.89 | 42.94 | 85.89 |
| 15.1 | 3.7 | 85.89 | .00 | 85.89 | 42.94 | 85.89 |
| 16.1 | 2.7 | 85.89 | .00 | 85.89 | 42.94 | 85.89 |
| 17.1 | 1.7 | 88.47 | 214.30 | 302.77 | 151.38 | 731.37 |
| 18.1 | .7 | 93.04 | 214.92 | 307.95 | 153.98 | 737.79 |
| 19.1 | -.3 | 97.58 | 215.74 | 313.32 | 156.66 | 744.79 |
| 20.1 | -1.3 | 102.00 | 217.23 | 319.23 | 159.61 | 753.69 |
| 21.1 | -2.3 | 106.19 | 220.09 | 326.29 | 163.14 | 766.47 |
| 22.1 | -3.3 | 110.71 | 221.46 | 332.17 | 166.09 | 775.09 |
| 23.1 | -4.3 | 115.71 | 220.23 | 335.93 | 167.97 | 776.39 |
| 24.1 | -5.3 | 121.04 | 216.93 | 337.97 | 168.99 | 771.84 |
| 25.1 | -6.3 | 126.25 | 212.32 | 338.57 | 169.28 | 763.20 |
| 26.1 | -7.3 | 130.97 | 207.93 | 338.89 | 169.45 | 754.75 |
| 27.1 | -8.3 | 135.69 | 209.06 | 344.75 | 172.37 | 762.87 |
| 28.1 | -9.3 | 140.40 | 211.22 | 351.62 | 175.81 | 774.07 |
| 29.1 | -10.3 | 144.61 | 212.86 | 357.47 | 178.73 | 783.19 |
| 30.1 | -11.3 | 148.02 | 219.27 | 367.29 | 183.65 | 805.83 |
| 31.1 | -12.3 | 150.88 | 227.13 | 378.00 | 189.00 | 832.26 |
| 32.1 | -13.3 | 153.55 | 233.44 | 386.99 | 193.49 | 853.87 |
| 33.1 | -14.3 | 156.51 | 238.11 | 394.61 | 197.31 | 870.83 |

Project No: 40700-0-2369 Tamiami Trail

Boring No: 333

D. PILE CAPACITY VS. PENETRATION (CONTINUED)

| (FT) | (FT) | (TONS) | (TONS) | (TONS) | (TONS) | (TONS) | (TONS) |
|---|---|---|---|---|---|---|---|
| 34.1 | -15.3 | 160.68 | 237.57 | 398.25 | 199.13 | 873.39 | |
| 35.1 | -16.3 | 164.83 | 237.17 | 401.99 | 201.00 | 876.32 | |

*** ERROR *** PILE TIP TOO NEAR END OF BORING LOG FOR LENGTH = 36.10 FT

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.
2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.
3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.
4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED ANALYSIS NO. 2

FLORIDA DEPARTMENT OF TRANSPORTATION
STRUCTURES DESIGN OFFICE
STATIC PILE BEARING CAPACITY ANALYSIS PROGRAM
SPT97 - VERSION 1.2 FEBRUARY, 1997
BASED ON RESEARCH BULLETIN RB-121
"GUIDELINES FOR USE IN THE SOILS INVESTIGATION
AND DESIGN OF FOUNDATIONS FOR
BRIDGE STRUCTURES IN THE STATE OF FLORIDA" AND
RESEARCH STUDY REPORT BY UNIVERSITY OF FLORIDA
"DESIGN OF STEEL PIPE AND H PILES"

NOTE - THIS PROGRAM IS EXPANDED FROM SPT91
IS ALSO KNOWN AS SPT94
TO INCLUDE STEEL H AND PIPE PILES

**A. GENERAL INFORMATION**

| | |
|---|---|
| INPUT FILE NAME | Tamiami 334.in |
| RUN DATE | 08/23/00 |
| RUN TIME | 17:05:48 |
| PROJECT NUMBER | 40700-0-2369 |
| JOB NAME | Tamiami Trail |
| SUBMITTING ENGINEER | R.Bernal |
| BORING NO. | 334 |
| DRILLING DATE | 3/28/73 |
| STATION NO. | |
| GROUND SURFACE ELEVATION | 17.30 FEET |
| TYPE OF ANALYSIS | 2 - DETERMINATION OF STATIC PILE BEARING CAPACITIES FOR A RANGE OF PILE LENGTHS (CAPACITY VS. TIP ELEVATION) |

B. BORING LOG

| ENTRY NO. | DEPTH (FT) D(I) | ELEVATION (FT) | SPT BLOWS/FT N(I) | SOIL TYPE ST(I) |
|---|---|---|---|---|
| 1 | .1 | 17.2 | 26.0 | 3 |
| 2 | 1.5 | 15.8 | 27.0 | 3 |
| 3 | 3.0 | 14.3 | 10.0 | 3 |
| 4 | 4.5 | 12.8 | 8.0 | 3 |
| 5 | 6.0 | 11.3 | 16.0 | 3 |
| 6 | 7.5 | 9.8 | 15.0 | 3 |
| 7 | 9.0 | 8.3 | 27.0 | 3 |
| 8 | 10.5 | 6.8 | 21.0 | 3 |
| 9 | 12.0 | 5.3 | 16.0 | 3 |
| 10 | 13.5 | 3.8 | 15.0 | 3 |
| 11 | 14.9 | 2.4 | 15.0 | 3 |
| 12 | 15.0 | 2.3 | 14.0 | 5 |
| 13 | 16.4 | .9 | 14.0 | 5 |
| 14 | 16.5 | .8 | 59.0 | 3 |
| 15 | 18.0 | -.7 | 59.0 | 3 |
| 16 | 18.1 | -.8 | 59.0 | 4 |
| 17 | 20.0 | -2.7 | 59.0 | 4 |
| 18 | 27.0 | -9.7 | 59.0 | 4 |
| 19 | 28.0 | -10.7 | 59.0 | 4 |
| 20 | 30.0 | -12.7 | 27.0 | 4 |
| 21 | 31.5 | -14.2 | 30.0 | 4 |
| 22 | 33.0 | -15.7 | 59.0 | 4 |
| 23 | 34.5 | -17.2 | 59.0 | 4 |
| 24 | 36.0 | -18.7 | 59.0 | 4 |
| 25 | 37.5 | -20.2 | 59.0 | 4 |
| 26 | 41.5 | -24.2 | 33.0 | 4 |
| 27 | 43.0 | -25.7 | 33.0 | 4 |

SOIL TYPE LEGEND
------------------

0 - BOTTOM OF BORING
1 - PLASTIC CLAYS
2 - CLAY/SILT SAND MIXTURES, SILTS & MARLS
3 - CLEAN SAND
4 - SOFT LIMESTONE, VERY SHELLY SANDS
5 - VOID (NO CAPACITY)

C. PILE INFORMATION

TEST PILE SECTION ISECT = 1
{concrete pile, square section}
WIDTH OF PILE WP = **18.00 INCHES**

**D. PILE CAPACITY VS. PENETRATION**

| TEST PILE LENGTH (FT) | PILE TIP ELEV (FT) | ULTIMATE SIDE FRICTION (TONS) | MOBILIZED END BEARING (TONS) | ESTIMATED DAVISSON CAPACITY (TONS) | ALLOWABLE PILE CAPACITY (TONS) | ULTIMATE PILE CAPACITY (TONS) |
|---|---|---|---|---|---|---|
| .1 | 17.2 | .00 | 19.90 | 19.90 | 9.95 | 59.71 |
| 1.1 | 16.2 | 2.73 | 40.73 | 43.46 | 21.73 | 124.93 |
| 2.1 | 15.2 | 5.41 | 40.92 | 46.33 | 23.17 | 128.17 |
| 3.1 | 14.2 | 7.40 | 40.51 | 47.91 | 23.96 | 128.93 |
| 4.1 | 13.2 | 8.42 | 40.61 | 49.03 | 24.51 | 130.26 |
| 5.1 | 12.2 | 9.23 | 41.14 | 50.37 | 25.18 | 132.64 |
| 6.1 | 11.2 | 10.60 | 41.71 | 52.30 | 26.15 | 135.72 |
| 7.1 | 10.2 | 12.27 | 42.05 | 54.32 | 27.16 | 138.42 |
| 8.1 | 9.2 | 14.12 | 42.22 | 56.34 | 28.17 | 140.77 |
| 9.1 | 8.2 | 16.99 | 41.82 | 58.80 | 29.40 | 142.44 |
| 10.1 | 7.2 | 20.53 | 40.02 | 60.55 | 30.28 | 140.60 |
| 11.1 | 6.2 | 22.90 | 35.61 | 58.51 | 29.25 | 129.72 |
| 12.1 | 5.2 | 23.72 | 43.32 | 67.04 | 33.52 | 153.68 |
| 13.1 | 4.2 | 23.28 | 52.67 | 75.95 | 37.97 | 181.28 |
| 14.1 | 3.2 | 24.28 | 63.80 | 88.08 | 44.04 | 215.67 |
| 15.1 | 2.2 | 29.82 | .00 | 29.82 | 14.91 | 29.82 |
| 16.1 | 1.2 | 29.82 | .00 | 29.82 | 14.91 | 29.82 |
| 17.1 | .2 | 34.03 | 95.61 | 129.65 | 64.82 | 320.88 |
| 18.1 | -.8 | 40.76 | 159.30 | 200.06 | 100.03 | 518.66 |
| 19.1 | -1.8 | 44.30 | 159.30 | 203.60 | 101.80 | 522.20 |
| 20.1 | -2.8 | 47.84 | 159.30 | 207.14 | 103.57 | 525.74 |
| 21.1 | -3.8 | 51.38 | 159.30 | 210.68 | 105.34 | 529.28 |
| 22.1 | -4.8 | 54.92 | 159.30 | 214.22 | 107.11 | 532.82 |
| 23.1 | -5.8 | 58.46 | 159.05 | 217.51 | 108.75 | 535.60 |
| 24.1 | -6.8 | 62.00 | 155.55 | 217.55 | 108.78 | 528.65 |
| 25.1 | -7.8 | 65.54 | 148.22 | 213.76 | 106.88 | 510.21 |
| 26.1 | -8.8 | 69.08 | 140.43 | 209.51 | 104.76 | 490.37 |
| 27.1 | -9.8 | 72.62 | 134.76 | 207.38 | 103.69 | 476.91 |
| 28.1 | -10.8 | 76.16 | 133.72 | 209.88 | 104.94 | 477.33 |
| 29.1 | -11.8 | 79.12 | 135.02 | 214.13 | 107.07 | 484.17 |
| 30.1 | -12.8 | 81.13 | 138.80 | 219.93 | 109.97 | 497.54 |
| 31.1 | -13.8 | 82.82 | 143.26 | 226.08 | 113.04 | 512.60 |
| 32.1 | -14.8 | 84.82 | 146.97 | 231.79 | 115.90 | 525.74 |
| 33.1 | -15.8 | 87.89 | 147.50 | 235.39 | 117.70 | 530.40 |

**D. PILE CAPACITY VS. PENETRATION (CONTINUED)**

| **(FT)** | **(FT)** | **(TONS)** | **(TONS)** | **(TONS)** | **(TONS)** | **(TONS)** | **(TONS)** |
|---|---|---|---|---|---|---|---|
| 34.1 | -16.8 | 91.43 | 145.25 | 236.68 | 118.34 | 527.17 | |
| 35.1 | -17.8 | 94.97 | 141.32 | 236.29 | 118.14 | 518.92 | |
| 36.1 | -18.8 | 98.51 | 135.72 | 234.23 | 117.11 | 505.67 | |

*** ERROR *** PILE TIP TOO NEAR END OF BORING LOG FOR LENGTH = 37.10 FT

**NOTES**

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED ANALYSIS NO. 3

C. PILE INFORMATION

TEST PILE SECTION ISECT = 1
{concrete pile, square section}
WIDTH OF PILE WP = **24.00 INCHES**

D. PILE CAPACITY VS. PENETRATION

| **TEST PILE LENGTH (FT)** | **PILE TIP ELEV (FT)** | **ULTIMATE SIDE FRICTION (TONS)** | **MOBILIZED END BEARING (TONS)** | **ESTIMATED DAVISSON CAPACITY (TONS)** | **ALLOWABLE PILE CAPACITY (TONS)** | **ULTIMATE PILE CAPACITY (TONS)** |
|---|---|---|---|---|---|---|
| .1 | 17.2 | .00 | 34.60 | 34.60 | 17.30 | 103.81 |
| 1.1 | 16.2 | 3.50 | 70.40 | 73.90 | 36.95 | 214.71 |
| 2.1 | 15.2 | 6.69 | 71.21 | 77.90 | 38.95 | 220.32 |
| 3.1 | 14.2 | 8.96 | 71.31 | 80.27 | 40.13 | 222.88 |
| 4.1 | 13.2 | 10.55 | 71.22 | 81.77 | 40.88 | 224.20 |
| 5.1 | 12.2 | 12.02 | 71.24 | 83.26 | 41.63 | 225.73 |
| 6.1 | 11.2 | 14.07 | 71.44 | 85.51 | 42.76 | 228.40 |
| 7.1 | 10.2 | 16.38 | 71.65 | 88.03 | 44.01 | 231.33 |
| 8.1 | 9.2 | 18.97 | 71.50 | 90.48 | 45.24 | 233.49 |
| 9.1 | 8.2 | 23.63 | 68.78 | 92.41 | 46.21 | 229.97 |
| 10.1 | 7.2 | 25.98 | 72.24 | 98.23 | 49.11 | 242.71 |
| 11.1 | 6.2 | 26.25 | 80.15 | 106.40 | 53.20 | 266.69 |
| 12.1 | 5.2 | 26.15 | 91.08 | 117.23 | 58.61 | 299.39 |
| 13.1 | 4.2 | 26.34 | 103.85 | 130.20 | 65.10 | 337.90 |
| 14.1 | 3.2 | 26.89 | 118.41 | 145.30 | 72.65 | 382.13 |
| 15.1 | 2.2 | 39.76 | .00 | 39.76 | 19.88 | 39.76 |
| 16.1 | 1.2 | 39.76 | .00 | 39.76 | 19.88 | 39.76 |
| 17.1 | .2 | 45.47 | 171.86 | 217.33 | 108.67 | 561.05 |
| 18.1 | -.8 | 54.35 | 283.20 | 337.55 | 168.77 | 903.95 |
| 19.1 | -1.8 | 59.07 | 283.20 | 342.27 | 171.13 | 908.67 |
| 20.1 | -2.8 | 63.79 | 283.20 | 346.99 | 173.49 | 913.39 |
| 21.1 | -3.8 | 68.51 | 283.17 | 351.68 | 175.84 | 918.02 |
| 22.1 | -4.8 | 73.23 | 279.88 | 353.11 | 176.55 | 912.87 |
| 23.1 | -5.8 | 77.95 | 271.13 | 349.08 | 174.54 | 891.35 |
| 24.1 | -6.8 | 82.67 | 260.57 | 343.24 | 171.62 | 864.39 |
| 25.1 | -7.8 | 87.39 | 251.77 | 339.16 | 169.58 | 842.70 |
| 26.1 | -8.8 | 92.11 | 249.09 | 341.19 | 170.60 | 839.36 |
| 27.1 | -9.8 | 96.83 | 249.09 | 345.91 | 172.96 | 844.08 |
| 28.1 | -10.8 | 101.54 | 249.09 | 350.63 | 175.32 | 848.82 |
| 29.1 | -11.8 | 105.49 | 250.29 | 355.79 | 177.89 | 856.37 |
| 30.1 | -12.8 | 108.17 | 254.11 | 362.28 | 181.14 | 870.51 |
| 31.1 | -13.8 | 110.43 | 259.13 | 369.55 | 184.78 | 887.81 |
| 32.1 | -14.8 | 113.09 | 261.95 | 375.04 | 187.52 | 898.94 |
| 33.1 | -15.8 | 117.19 | 259.75 | 376.93 | 188.47 | 896.43 |

**D. PILE CAPACITY VS. PENETRATION** (CONTINUED)

| (FT) | (FT) | (TONS) | (TONS) | (TONS) | (TONS) | (TONS) | (TONS) |
|---|---|---|---|---|---|---|---|
| 34.1 | -16.8 | | 121.91 | 253.83 | 375.74 | 187.87 | 883.41 |

*** ERROR *** PILE TIP TOO NEAR END OF BORING LOG FOR LENGTH = 35.10 FT

NOTES

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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.

PROBLEM COMPLETED ANALYSIS NO. 4

# DRILLED SHAFT
# AXIAL CAPACITY ANALYSES

# DRILLED SHAFT AXIAL COMPRESSION AND TENSION CAPACITIES

TAMIAMI - TRAIL BRIDGES

Law Project No. 40700-0-2369

Boring No.: B-334

S.F.= 3.00 for allowable or service design

Pile Size: 3.00 feet
Pile Size: 914.4 mm

fs(sand) = N/50 (ksf)
fs(Rock) = 4+ N/2.5; Peak (ksf)
fs(Rock) =* 0.5(4 + N/2.5); Residual (ksf)

| Elev. ft | Depth ft | Layer Thick. ft | *Rock=1 Sand=0 | Rock Avg. N | Sand Avg. N | fs Rock (ksf) | fs Sand (ksf) | shear strength (ksf) | Ultimate Compression Capacity, tons | Ultimate Tension Capacity, tons | Service Compression Capacity, tons | Service tension Capacity, tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.8 | 0.0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17.3 | 1.5 | 1.50 | 0.0 | 0 | 26 | 0 | 0.52 | 0.52 | 3.68 | 1.84 | 1.23 | 0.61 |
| 15.8 | 3.0 | 1.50 | 0.0 | 0 | 27 | 0 | 0.54 | 0.54 | 7.49 | 3.75 | 2.50 | 1.25 |
| 14.3 | 4.5 | 1.50 | 0.0 | 0 | 10 | 0 | 0.2 | 0.2 | 8.91 | 4.45 | 2.97 | 1.48 |
| 12.8 | 6.0 | 1.50 | 0.0 | 0 | 8 | 0 | 0.16 | 0.16 | 10.04 | 5.02 | 3.35 | 1.67 |
| 11.3 | 7.5 | 1.50 | 0.0 | 0 | 16 | 0 | 0.32 | 0.32 | 12.30 | 6.15 | 4.10 | 2.05 |
| 9.8 | 9.0 | 1.50 | 0.0 | 0 | 15 | 0 | 0.3 | 0.3 | 14.42 | 7.21 | 4.81 | 2.40 |
| 8.3 | 10.5 | 1.50 | 0.0 | 0 | 27 | 0 | 0.54 | 0.54 | 18.24 | 9.12 | 6.08 | 3.04 |
| 6.8 | 12.0 | 1.50 | 0.0 | 0 | 21 | 0 | 0.42 | 0.42 | 21.21 | 10.60 | 7.07 | 3.53 |
| 5.3 | 13.5 | 1.50 | 0.0 | 0 | 16 | 0 | 0.32 | 0.32 | 23.47 | 11.73 | 7.82 | 3.91 |
| 3.8 | 15.0 | 1.50 | 0.0 | 0 | 15 | 0 | 0.3 | 0.3 | 25.59 | 12.79 | 8.53 | 4.26 |
| 2.3 | 16.5 | 1.50 | 0.0 | 0 | 14 | 0 | 0.28 | 0.28 | 27.57 | 13.78 | 9.19 | 4.59 |
| 0.8 | 18.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 183.08 | 91.54 | 61.03 | 30.51 |
| -0.7 | 19.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 338.58 | 169.29 | 112.86 | 56.43 |
| -1 | 19.8 | 0.30 | 1.0 | 45 | 0 | 22 | 0 | 22 | 369.69 | 184.84 | 123.23 | 61.61 |
| -1.1 | 19.9 | 0.10 | 1.0 | 45 | 0 | 22 | 0 | 22 | 380.05 | 190.03 | 126.68 | 63.34 |
| -3.2 | 22.0 | 2.10 | 1.0 | 45 | 0 | 22 | 0 | 22 | 597.77 | 298.88 | 199.26 | 99.63 |
| -8.2 | 27.0 | 5.00 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1116.13 | 558.06 | 372.04 | 186.02 |
| -9.7 | 28.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1271.64 | 635.82 | 423.88 | 211.94 |
| -11.2 | 30.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1427.15 | 713.57 | 475.72 | 237.86 |
| -12.7 | 31.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1582.65 | 791.33 | 527.55 | 263.78 |
| -14.2 | 33.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1738.16 | 869.08 | 579.39 | 289.69 |
| -15.7 | 34.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1893.67 | 946.84 | 631.22 | 315.61 |
| -17.2 | 36.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2049.18 | 1024.59 | 683.06 | 341.53 |
| -18.7 | 37.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2204.69 | 1102.34 | 734.90 | 367.45 |
| -20.2 | 39.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2360.20 | 1180.10 | 786.73 | 393.37 |
| -22.7 | 41.5 | 2.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2463.87 | 1231.94 | 821.29 | 410.65 |
| -24.2 | 43.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2515.71 | 1257.85 | 838.57 | 419.28 |

# DRILLED SHAFT AXIAL COMPRESSION AND TENSION CAPACITIES
## TAMIAMI - TRAIL BRIDGES
## Law Project No. 40700-0-2369

Boring No.: B-334

S.F.= 3.00 for allowable or service design

fs(sand) = N/50 (ksf)
fs(Rock) = 4+ N/2.5; Peak (ksf)
fs(Rock) =* 0.5(4 + N/2.5); Residual (ksf)

Pile Size: 4.00 feet
Pile Size: 1219.2 mm

| Elev. ft | Depth ft | Layer Thick. ft | *Rock=1 Sand=0 | Rock Avg. N | Sand Avg. N | fs Rock (ksf) | fs Sand (ksf) | shear strength (ksf) | Ultimate Compression Capacity, tons | Ultimate Tension Capacity, tons | Service Compression Capacity, tons | Service tension Capacity, tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.8 | 0.0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17.3 | 1.5 | 1.50 | 0.0 | 0 | 26 | 0 | 0.52 | 0.52 | 4.90 | 2.45 | 1.63 | 0.82 |
| 15.8 | 3.0 | 1.50 | 0.0 | 0 | 27 | 0 | 0.54 | 0.54 | 9.99 | 5.00 | 3.33 | 1.67 |
| 14.3 | 4.5 | 1.50 | 0.0 | 0 | 10 | 0 | 0.2 | 0.2 | 11.88 | 5.94 | 3.96 | 1.98 |
| 12.8 | 6.0 | 1.50 | 0.0 | 0 | 8 | 0 | 0.16 | 0.16 | 13.38 | 6.69 | 4.46 | 2.23 |
| 11.3 | 7.5 | 1.50 | 0.0 | 0 | 16 | 0 | 0.32 | 0.32 | 16.40 | 8.20 | 5.47 | 2.73 |
| 9.8 | 9.0 | 1.50 | 0.0 | 0 | 15 | 0 | 0.3 | 0.3 | 19.23 | 9.61 | 6.41 | 3.20 |
| 8.3 | 10.5 | 1.50 | 0.0 | 0 | 27 | 0 | 0.54 | 0.54 | 24.32 | 12.16 | 8.11 | 4.05 |
| 6.8 | 12.0 | 1.50 | 0.0 | 0 | 21 | 0 | 0.42 | 0.42 | 28.27 | 14.14 | 9.42 | 4.71 |
| 5.3 | 13.5 | 1.50 | 0.0 | 0 | 16 | 0 | 0.32 | 0.32 | 31.29 | 15.65 | 10.43 | 5.22 |
| 3.8 | 15.0 | 1.50 | 0.0 | 0 | 15 | 0 | 0.3 | 0.3 | 34.12 | 17.06 | 11.37 | 5.69 |
| 2.3 | 16.5 | 1.50 | 0.0 | 0 | 14 | 0 | 0.28 | 0.28 | 36.76 | 18.38 | 12.25 | 6.13 |
| 0.8 | 18.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 244.10 | 122.05 | 81.37 | 40.68 |
| -0.7 | 19.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 451.45 | 225.72 | 150.48 | 75.24 |
| -1 | 19.8 | 0.30 | 1.0 | 45 | 0 | 22 | 0 | 22 | 492.92 | 246.46 | 164.31 | 82.15 |
| -1.1 | 19.9 | 0.10 | 1.0 | 45 | 0 | 22 | 0 | 22 | 506.74 | 253.37 | 168.91 | 84.46 |
| -3.2 | 22.0 | 2.10 | 1.0 | 45 | 0 | 22 | 0 | 22 | 797.02 | 398.51 | 265.67 | 132.84 |
| -8.2 | 27.0 | 5.00 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1488.17 | 744.09 | 496.06 | 248.03 |
| -9.7 | 28.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1695.52 | 847.76 | 565.17 | 282.59 |
| -11.2 | 30.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1902.86 | 951.43 | 634.29 | 317.14 |
| -12.7 | 31.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2110.21 | 1055.10 | 703.40 | 351.70 |
| -14.2 | 33.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2317.55 | 1158.78 | 772.52 | 386.26 |
| -15.7 | 34.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2524.90 | 1262.45 | 841.63 | 420.82 |
| -17.2 | 36.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2732.24 | 1366.12 | 910.75 | 455.37 |
| -18.7 | 37.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2939.59 | 1469.79 | 979.86 | 489.93 |
| -20.2 | 39.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3146.93 | 1573.47 | 1048.98 | 524.49 |
| -22.7 | 41.5 | 2.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3285.16 | 1642.58 | 1095.05 | 547.53 |
| -24.2 | 43.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3354.28 | 1677.14 | 1118.09 | 559.05 |

# DRILLED SHAFT AXIAL COMPRESSION AND TENSION CAPACITIES
TAMIAMI - TRAIL BRIDGES
Law Project No. 40700-0-2369

Boring No.: B-334

S.F.= 3.00 for allowable or service design

fs(sand) = N/50 (ksf)
fs(Rock) = 4+ N/2.5; Peak (ksf)
fs(Rock) =* 0.5(4 + N/2.5); Residual (ksf)

Pile Size: 5.00 feet
Pile Size: 1524 mm

| Elev. ft | Depth ft | Layer Thick. ft | *Rock=1 Sand=0 | Rock Avg. N | Sand Avg. N | fs Rock (ksf) | fs Sand (ksf) | shear strength (ksf) | Ultimate Compression Capacity, tons | Ultimate Tension Capacity, tons | Service Compression Capacity, tons | Service tension Capacity, tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.8 | 0.0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17.3 | 1.5 | 1.50 | 0.0 | 0 | 26 | 0 | 0.52 | 0.52 | 6.13 | 3.06 | 2.04 | 1.02 |
| 15.8 | 3.0 | 1.50 | 0.0 | 0 | 27 | 0 | 0.54 | 0.54 | 12.49 | 6.24 | 4.16 | 2.08 |
| 14.3 | 4.5 | 1.50 | 0.0 | 0 | 10 | 0 | 0.2 | 0.2 | 14.84 | 7.42 | 4.95 | 2.47 |
| 12.8 | 6.0 | 1.50 | 0.0 | 0 | 8 | 0 | 0.16 | 0.16 | 16.73 | 8.36 | 5.58 | 2.79 |
| 11.3 | 7.5 | 1.50 | 0.0 | 0 | 16 | 0 | 0.32 | 0.32 | 20.50 | 10.25 | 6.83 | 3.42 |
| 9.8 | 9.0 | 1.50 | 0.0 | 0 | 15 | 0 | 0.3 | 0.3 | 24.03 | 12.02 | 8.01 | 4.01 |
| 8.3 | 10.5 | 1.50 | 0.0 | 0 | 27 | 0 | 0.54 | 0.54 | 30.39 | 15.20 | 10.13 | 5.07 |
| 6.8 | 12.0 | 1.50 | 0.0 | 0 | 21 | 0 | 0.42 | 0.42 | 35.34 | 17.67 | 11.78 | 5.89 |
| 5.3 | 13.5 | 1.50 | 0.0 | 0 | 16 | 0 | 0.32 | 0.32 | 39.11 | 19.56 | 13.04 | 6.52 |
| 3.8 | 15.0 | 1.50 | 0.0 | 0 | 15 | 0 | 0.3 | 0.3 | 42.65 | 21.32 | 14.22 | 7.11 |
| 2.3 | 16.5 | 1.50 | 0.0 | 0 | 14 | 0 | 0.28 | 0.28 | 45.95 | 22.97 | 15.32 | 7.66 |
| 0.8 | 18.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 305.13 | 152.56 | 101.71 | 50.85 |
| -0.7 | 19.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 564.31 | 282.15 | 188.10 | 94.05 |
| -1 | 19.8 | 0.30 | 1.0 | 45 | 0 | 22 | 0 | 22 | 616.14 | 308.07 | 205.38 | 102.69 |
| -1.1 | 19.9 | 0.10 | 1.0 | 45 | 0 | 22 | 0 | 22 | 633.42 | 316.71 | 211.14 | 105.57 |
| -3.2 | 22.0 | 2.10 | 1.0 | 45 | 0 | 22 | 0 | 22 | 996.28 | 498.14 | 332.09 | 166.05 |
| -8.2 | 27.0 | 5.00 | 1.0 | 45 | 0 | 22 | 0 | 22 | 1860.21 | 930.11 | 620.07 | 310.04 |
| -9.7 | 28.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2119.40 | 1059.70 | 706.47 | 353.23 |
| -11.2 | 30.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2378.58 | 1189.29 | 792.86 | 396.43 |
| -12.7 | 31.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2637.76 | 1318.88 | 879.25 | 439.63 |
| -14.2 | 33.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 2896.94 | 1448.47 | 965.65 | 482.82 |
| -15.7 | 34.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3156.12 | 1578.06 | 1052.04 | 526.02 |
| -17.2 | 36.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3415.30 | 1707.65 | 1138.43 | 569.22 |
| -18.7 | 37.5 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3674.48 | 1837.24 | 1224.83 | 612.41 |
| -20.2 | 39.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 3933.66 | 1966.83 | 1311.22 | 655.61 |
| -22.7 | 41.5 | 2.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 4106.45 | 2053.23 | 1368.82 | 684.41 |
| -24.2 | 43.0 | 1.50 | 1.0 | 45 | 0 | 22 | 0 | 22 | 4192.84 | 2096.42 | 1397.61 | 698.81 |

# DRILLED SHAFT AXIAL COMPRESSION AND TENSION CAPACITIES

TAMIAMI - TRAIL BRIDGES

Law Project No. 40700-0-2369

Boring No.: B-333

S.F.= 3.00 for allowable or service design

Pile Size: 3.00 feet
Pile Size: 914.4 mm

fs(sand) = N/50 (ksf)
fs(Rock) = 4+ N/2.5; Peak (ksf)
fs(Rock) =* 0.5(4 + N/2.5); Residual (ksf)

| Elev. ft | Depth ft | Layer Thick. ft | *Rock=1 Sand=0 | Rock Avg. N | Sand Avg. N | fs Rock (ksf) | fs Sand (ksf) | shear strength (ksf) | Ultimate Compression Capacity, tons | Ultimate Tension Capacity, tons | Service Compression Capacity, tons | Service tension Capacity, tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.8 | 0.0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17.3 | 1.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 4.95 | 2.47 | 1.65 | 0.82 |
| 15.8 | 3.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 9.90 | 4.95 | 3.30 | 1.65 |
| 14.3 | 4.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 14.84 | 7.42 | 4.95 | 2.47 |
| 12.8 | 6.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 19.79 | 9.90 | 6.60 | 3.30 |
| 11.3 | 7.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 24.74 | 12.37 | 8.25 | 4.12 |
| 9.8 | 9.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 29.69 | 14.84 | 9.90 | 4.95 |
| 8.3 | 10.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 34.64 | 17.32 | 11.55 | 5.77 |
| 6.8 | 12.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 39.58 | 19.79 | 13.19 | 6.60 |
| 5.3 | 13.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 44.53 | 22.27 | 14.84 | 7.42 |
| 3.8 | 15.0 | 1.50 | 0.0 | 0 | 13 | 0 | 0.26 | 0.26 | 46.37 | 23.18 | 15.46 | 7.73 |
| 2.3 | 16.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 218.84 | 109.42 | 72.95 | 36.47 |
| 0.8 | 18.0 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 391.32 | 195.66 | 130.44 | 65.22 |
| -0.7 | 19.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 563.79 | 281.89 | 187.93 | 93.96 |
| -1 | 19.8 | 0.30 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 598.28 | 299.14 | 199.43 | 99.71 |
| -1.1 | 19.9 | 0.10 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 609.78 | 304.89 | 203.26 | 101.63 |
| -3.2 | 22.0 | 2.10 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 851.25 | 425.62 | 283.75 | 141.87 |
| -8.2 | 27.0 | 5.00 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1426.16 | 713.08 | 475.39 | 237.69 |
| -9.2 | 28.0 | 1.00 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1541.14 | 770.57 | 513.71 | 256.86 |
| -10.7 | 29.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1713.61 | 856.81 | 571.20 | 285.60 |
| -12.2 | 31.0 | 1.50 | 1.0 | 43 | 0 | 21.2 | 0 | 21.2 | 1863.47 | 931.73 | 621.16 | 310.58 |
| -13.7 | 32.5 | 1.50 | 1.0 | 33 | 0 | 17.2 | 0 | 17.2 | 1985.05 | 992.52 | 661.68 | 330.84 |
| -15.2 | 34.0 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 2109.45 | 1054.73 | 703.15 | 351.58 |
| -16.7 | 35.5 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 2233.86 | 1116.93 | 744.62 | 372.31 |
| -18.2 | 37.0 | 1.50 | 1.0 | 41 | 0 | 20.4 | 0 | 20.4 | 2378.06 | 1189.03 | 792.69 | 396.34 |
| -19.7 | 38.5 | 1.50 | 1.0 | 49 | 0 | 23.6 | 0 | 23.6 | 2544.88 | 1272.44 | 848.29 | 424.15 |
| -21.2 | 40.0 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 2502.46 | 1251.23 | 834.15 | 417.08 |
| -22.7 | 41.5 | 1.50 | 1.0 | 54 | 0 | 25.6 | 0 | 25.6 | 2725.83 | 1362.92 | 908.61 | 454.31 |
| -24.2 | 43.0 | 1.50 | 1.0 | 53 | 0 | 25.2 | 0 | 25.2 | 2680.59 | 1340.30 | 893.53 | 446.77 |
| -25.7 | 44.5 | 1.50 | 1.0 | 53 | 0 | 25.2 | 0 | 25.2 | 2723.00 | 1361.50 | 907.67 | 453.83 |

# DRILLED SHAFT AXIAL COMPRESSION AND TENSION CAPACITIES
TAMIAMI - TRAIL BRIDGES
Law Project No. 40700-0-2369

Boring No.: B-333

S.F.= 3.00 for allowable or service design

Pile Size: 5.00 feet
Pile Size: 1524 mm

fs(sand) = N/50 (ksf)
fs(Rock) = 4+ N/2.5; Peak (ksf)
fs(Rock) =* 0.5(4 + N/2.5); Residual (ksf)

| Elev. ft | Depth ft | Layer Thick. ft | *Rock=1 Sand=0 | Rock Avg. N | Sand Avg. N | fs Rock (ksf) | fs Sand (ksf) | shear strength (ksf) | Ultimate Compression Capacity, tons | Ultimate Tension Capacity, tons | Service Compression Capacity, tons | Service tension Capacity, tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.8 | 0.0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17.3 | 1.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 8.25 | 4.12 | 2.75 | 1.37 |
| 15.8 | 3.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 16.49 | 8.25 | 5.50 | 2.75 |
| 14.3 | 4.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 24.74 | 12.37 | 8.25 | 4.12 |
| 12.8 | 6.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 32.99 | 16.49 | 11.00 | 5.50 |
| 11.3 | 7.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 41.23 | 20.62 | 13.74 | 6.87 |
| 9.8 | 9.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 49.48 | 24.74 | 16.49 | 8.25 |
| 8.3 | 10.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 57.73 | 28.86 | 19.24 | 9.62 |
| 6.8 | 12.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 65.97 | 32.99 | 21.99 | 11.00 |
| 5.3 | 13.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 74.22 | 37.11 | 24.74 | 12.37 |
| 3.8 | 15.0 | 1.50 | 0.0 | 0 | 13 | 0 | 0.26 | 0.26 | 77.28 | 38.64 | 25.76 | 12.88 |
| 2.3 | 16.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 364.74 | 182.37 | 121.58 | 60.79 |
| 0.8 | 18.0 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 652.19 | 326.10 | 217.40 | 108.70 |
| -0.7 | 19.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 939.65 | 469.82 | 313.22 | 156.61 |
| -1 | 19.8 | 0.30 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 997.14 | 498.57 | 332.38 | 166.19 |
| -1.1 | 19.9 | 0.10 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1016.30 | 508.15 | 338.77 | 169.38 |
| -3.2 | 22.0 | 2.10 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1418.74 | 709.37 | 472.91 | 236.46 |
| -8.2 | 27.0 | 5.00 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 2376.93 | 1188.46 | 792.31 | 396.15 |
| -9.2 | 28.0 | 1.00 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 2568.56 | 1284.28 | 856.19 | 428.09 |
| -10.7 | 29.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 2856.02 | 1428.01 | 952.01 | 476.00 |
| -12.2 | 31.0 | 1.50 | 1.0 | 43 | 0 | 21.2 | 0 | 21.2 | 3105.78 | 1552.89 | 1035.26 | 517.63 |
| -13.7 | 32.5 | 1.50 | 1.0 | 33 | 0 | 17.2 | 0 | 17.2 | 3308.41 | 1654.20 | 1102.80 | 551.40 |
| -15.2 | 34.0 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 3515.75 | 1757.88 | 1171.92 | 585.96 |
| -16.7 | 35.5 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 3723.10 | 1861.55 | 1241.03 | 620.52 |
| -18.2 | 37.0 | 1.50 | 1.0 | 41 | 0 | 20.4 | 0 | 20.4 | 3963.43 | 1981.71 | 1321.14 | 660.57 |
| -19.7 | 38.5 | 1.50 | 1.0 | 49 | 0 | 23.6 | 0 | 23.6 | 4241.46 | 2120.73 | 1413.82 | 706.91 |
| -21.2 | 40.0 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 4170.77 | 2085.39 | 1390.26 | 695.13 |
| -22.7 | 41.5 | 1.50 | 1.0 | 54 | 0 | 25.6 | 0 | 25.6 | 4543.05 | 2271.53 | 1514.35 | 757.18 |
| -24.2 | 43.0 | 1.50 | 1.0 | 53 | 0 | 25.2 | 0 | 25.2 | 4467.66 | 2233.83 | 1489.22 | 744.61 |
| -25.7 | 44.5 | 1.50 | 1.0 | 53 | 0 | 25.2 | 0 | 25.2 | 4538.34 | 2269.17 | 1512.78 | 756.39 |

# DRILLED SHAFT AXIAL COMPRESSION AND TENSION CAPACITIES

## TAMIAMI - TRAIL BRIDGES

## Law Project No. 40700-0-2369

Boring No.: B-333

S.F.= 3.00 for allowable or service design

Pile Size: 4.00 feet
Pile Size: 1219.2 mm

fs(sand) = N/50 (ksf)
fs(Rock) = 4+ N/2.5; Peak (ksf)
fs(Rock) =* 0.5(4 + N/2.5); Residual (ksf)

| Elev. ft | Depth ft | Layer Thick. ft | *Rock=1 Sand=0 | Rock Avg. N | Sand Avg. N | fs Rock (ksf) | fs Sand (ksf) | shear strength (ksf) | Ultimate Compression Capacity, tons | Ultimate Tension Capacity, tons | Service Compression Capacity, tons | Service tension Capacity, tons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.8 | 0.0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17.3 | 1.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 6.60 | 3.30 | 2.20 | 1.10 |
| 15.8 | 3.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 13.19 | 6.60 | 4.40 | 2.20 |
| 14.3 | 4.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 19.79 | 9.90 | 6.60 | 3.30 |
| 12.8 | 6.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 26.39 | 13.19 | 8.80 | 4.40 |
| 11.3 | 7.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 32.99 | 16.49 | 11.00 | 5.50 |
| 9.8 | 9.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 39.58 | 19.79 | 13.19 | 6.60 |
| 8.3 | 10.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 46.18 | 23.09 | 15.39 | 7.70 |
| 6.8 | 12.0 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 52.78 | 26.39 | 17.59 | 8.80 |
| 5.3 | 13.5 | 1.50 | 0.0 | 0 | 35 | 0 | 0.7 | 0.7 | 59.38 | 29.69 | 19.79 | 9.90 |
| 3.8 | 15.0 | 1.50 | 0.0 | 0 | 13 | 0 | 0.26 | 0.26 | 61.83 | 30.91 | 20.61 | 10.30 |
| 2.3 | 16.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 291.79 | 145.90 | 97.26 | 48.63 |
| 0.8 | 18.0 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 521.76 | 260.88 | 173.92 | 86.96 |
| -0.7 | 19.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 751.72 | 375.86 | 250.57 | 125.29 |
| -1 | 19.8 | 0.30 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 797.71 | 398.86 | 265.90 | 132.95 |
| -1.1 | 19.9 | 0.10 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 813.04 | 406.52 | 271.01 | 135.51 |
| -3.2 | 22.0 | 2.10 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1134.99 | 567.50 | 378.33 | 189.17 |
| -8.2 | 27.0 | 5.00 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 1901.54 | 950.77 | 633.85 | 316.92 |
| -9.2 | 28.0 | 1.00 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 2054.85 | 1027.43 | 684.95 | 342.48 |
| -10.7 | 29.5 | 1.50 | 1.0 | 51 | 0 | 24.4 | 0 | 24.4 | 2284.82 | 1142.41 | 761.61 | 380.80 |
| -12.2 | 31.0 | 1.50 | 1.0 | 43 | 0 | 21.2 | 0 | 21.2 | 2484.62 | 1242.31 | 828.21 | 414.10 |
| -13.7 | 32.5 | 1.50 | 1.0 | 33 | 0 | 17.2 | 0 | 17.2 | 2646.73 | 1323.36 | 882.24 | 441.12 |
| -15.2 | 34.0 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 2812.60 | 1406.30 | 937.53 | 468.77 |
| -16.7 | 35.5 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 2978.48 | 1489.24 | 992.83 | 496.41 |
| -18.2 | 37.0 | 1.50 | 1.0 | 41 | 0 | 20.4 | 0 | 20.4 | 3170.74 | 1585.37 | 1056.91 | 528.46 |
| -19.7 | 38.5 | 1.50 | 1.0 | 49 | 0 | 23.6 | 0 | 23.6 | 3393.17 | 1696.58 | 1131.06 | 565.53 |
| -21.2 | 40.0 | 1.50 | 1.0 | 34 | 0 | 17.6 | 0 | 17.6 | 3336.62 | 1668.31 | 1112.21 | 556.10 |
| -22.7 | 41.5 | 1.50 | 1.0 | 54 | 0 | 25.6 | 0 | 25.6 | 3634.44 | 1817.22 | 1211.48 | 605.74 |
| -24.2 | 43.0 | 1.50 | 1.0 | 53 | 0 | 25.2 | 0 | 25.2 | 3574.12 | 1787.06 | 1191.37 | 595.69 |
| -25.7 | 44.5 | 1.50 | 1.0 | 53 | 0 | 25.2 | 0 | 25.2 | 3630.67 | 1815.34 | 1210.22 | 605.11 |

Hole No.DCB-10.0

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|
| 1. PROJECT Tamiami Trail | | 10. SIZE AND TYPE OF BIT 3 7/8" Casing & Roller Bit | |
| 2. LOCATION (Coordinates or Station) X=767,146 Y=518,943 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD 29 Horizontal Datum: FLE NAD 27 | |
| 3. DRILLING AGENCY LAW Engineering and Environmental Services, Inc. | | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-55 | |
| 4. HOLE NO. (As shown on drawing title and file number) DCB-10.0 | | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 7 undisturbed: 0 | |
| 5. NAME OF DRILLER W. Candelaria | | 14. TOTAL NUMBER OF CORE BOXES | |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | | 15. ELEVATION GROUND WATER | |
| | | 16. DATE HOLE STARTED 7/27/00 COMPLETED 7/27/00 | |
| 7. THICKNESS OF BURDEN 10.5 Ft. | | 17. ELEVATION TOP OF HOLE +10.7 Ft. | |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | | 18. TOTAL CORE RECOVERY FOR BORING See Below % | |
| 9. TOTAL DEPTH OF HOLE 10.5 Ft. | | 19. SIGNATURE OF Civil Engineer Ruben Ponciano | |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 10.7 | .0 | | | | | 10.7 | |
| 10.3 | .4 | | | | | 10.2 | - |
| | | | GRAVEL, coarse to fien limestone, some medium to fine quartz sand, little silt, brown to light brown (GP-GM) | 44 | 1 | SPLIT SPOON 9.2 | 20 22 25 |
| | | | | 28 | 2 | SPLIT SPOON 7.7 | 13 6 6 |
| | | | | 0 | 3 | SPLIT SPOON 6.2 | 3 2 4 |
| 4.7 | 6.0 | | | 44 | 4 | SPLIT SPOON 4.7 | 2 1 WOH |
| 3.2 | 7.5 | | PEAT, some silt, dark brown to black (PT) | 22 | 5 | SPLIT SPOON 3.2 | 1 37 50/3 |
| | | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, some medium to fine quartz sand, little silt, trace clay, light brown to tan (LS) | 0 | 6 | SPLIT SPOON 1.7 | |
| .2 | 10.5 | | | 89 | 7 | SPLIT SPOON .2 | 25 27 27 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) WOH - Weight of Hammer | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

| PROJECT | HOLE NUMBER |
|---|---|
| Tamiami Trail | DCB-10.0 |

| DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 3 7/8" Casing & Roller Bit |
| 2. LOCATION *(Coordinates or Station)*: X=763,884 Y=518,987 | 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY: LAW Engineering and Environmental Services, Inc. | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 |
| 4. HOLE NO. *(As shown on drawing title and file number)*: CB-10.6 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER: W. Candelaria | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE STARTED 7/26/00 COMPLETED 7/26/00 |
| 7. THICKNESS OF BURDEN: 10.5 Ft. | 17. ELEVATION TOP OF HOLE: +12.5 Ft. |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % |
| 9. TOTAL DEPTH OF HOLE: 10.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 12.5 | .0 | | | | | 12.5 | |
| 12.2 | .3 | | ASPHALTIC CONCRETE - 3 inches | | | 12.0 | - |
| | | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, trace clay, light brown to brown (GP-GM) | 67 | 1 | SPLIT SPOON 11.0 | 40<br>48 |
| | | | | 61 | 2 | SPLIT SPOON 9.5 | 59<br>61/1 |
| | | | | 50 | 3 | SPLIT SPOON 8.0 | 22<br>11<br>39 |
| | | | | 22 | 4 | SPLIT SPOON 6.5 | 6<br>23<br>14 |
| | | | | 50 | 5 | SPLIT SPOON 5.0 | 16<br>19<br>16 |
| 5.0 | 7.5 | | PEAT, little silt, black (PT) | 22 | 6 | SPLIT SPOON 3.5 | 1<br>2<br>4 |
| 4.0 | 8.5 | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, some fine quartz sand, little silt, light brown to tan (LS) | 67 | 7 | SPLIT SPOON 2.0 | 30<br>30<br>15 |
| 2.0 | 10.5 | | Notes:<br>1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) | |

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

**Hole No. L 0.5**

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT Tamiami Trail | 10. SIZE AND TYPE OF BIT 3 1/4" I. D. Augers |
| 2. LOCATION (Coordinates or Station) X=818,353 Y=519,391 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY U. S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-45 |
| 4. HOLE NO. (As shown on drawing title and file number) L-0.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 14 undisturbed: 0 |
| 5. NAME OF DRILLER Kevin C. | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE STARTED 8/8/00 COMPLETED 8/8/00 |
| 7. THICKNESS OF BURDEN 20.5 Ft. | 17. ELEVATION TOP OF HOLE +15.7 Ft. |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING See Below % |
| 9. TOTAL DEPTH OF HOLE 20.5 Ft. | 19. SIGNATURE OF Civil Engineer Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 15.7 | .0 | | | | | 15.7 | |
| | | | GRAVEL, coarse to fine limestone, some silt, little medium to fine quartz sand, brown (GP-GM) | 33 | 1 | SPLIT SPOON 14.2 | 4 / 4 / 3 |
| | | | | 50 | 2 | SPLIT SPOON 12.7 | 7 / 4 / 12 |
| | | | | 44 | 3 | SPLIT SPOON 11.2 | 6 / 9 / 5 |
| | | | | 33 | 4 | SPLIT SPOON 9.7 | 13 / 14 / 10 |
| 8.2 | 7.5 | | | 50 | 5 | SPLIT SPOON 8.2 | 3 / 4 / 4 |
| 6.2 | 9.5 | | SILT, trace rock fragments, trace medium to fine quartz sand, trace fine gravel, light brown (ML) | 78 | 6 | SPLIT SPOON 6.7 | 1 / 2 / 2 |
| | | | PEAT, some silt, black to light brown (PT) | 78 | 7 | SPLIT SPOON 5.2 | 1 / 2 / 1 |
| 3.4 | 12.2 | | | 89 | 8 | SPLIT SPOON 3.7 | 1 / 1 / 1 |
| | | | LIMESTONE, moderately weathered, medium hard, numerous sand filled solution cavities, little fine to medium quartz sand, little silt, light brown to tan (LS) | 55 | 9 | SPLIT SPOON 2.2 | 1 / 4 / 5 |
| | | | | 55 | 10 | SPLIT SPOON .7 | 6 / 10 / 14 |
| | | | | 50 | 11 | SPLIT SPOON -.8 | 13 / 8 / 8 |
| | | | | 61 | 12 | SPLIT SPOON -2.3 | 9 / 7 / 9 |
| | | | | 17 | 13 | SPLIT SPOON -3.8 | 13 / 50/5 |
| -4.8 | 20.5 | | | 17 | 14 | SPLIT SPOON -4.8 | 50/3 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT Tamiami Trail HOLE NUMBER L-0.5

# DRILLING LOG

| | | |
|---|---|---|
| DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1 |
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 3 1/4" Augers | |
| 2. LOCATION (Coordinates or Station): X=807,341 Y=519,296 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD 29 Horizontal Datum: FLE NAD 27 | |
| 3. DRILLING AGENCY: U. S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45 | |
| 4. HOLE NO. (As shown on drawing title and file number): L-2.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 0 | |
| 5. NAME OF DRILLER: Kevin C. | 14. TOTAL NUMBER OF CORE BOXES | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER | |
| | 16. DATE HOLE: STARTED 8/8/00 COMPLETED 8/8/00 | |
| 7. THICKNESS OF BURDEN: 10.5 Ft. | 17. ELEVATION TOP OF HOLE: +9.3 Ft. | |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % | |
| 9. TOTAL DEPTH OF HOLE: 10.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ruben Ponciano | |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/.5' |
|---|---|---|---|---|---|---|---|
| 9.3 | .0 | | | | | 9.3 | |
| 7.6 | 1.7 | | GRAVEL, coarse to fine limestone, some silt, trace fine quartz sand, brown (GP-GM) | 44 | 1 | SPLIT SPOON 7.8 | 8 12 4 |
| 5.8 | 3.5 | | PEAT, some silt, black (PT) | 33 | 2 | SPLIT SPOON 6.3 | 1 4 3 |
| 4.8 | 4.5 | | SILT, trace clay, beige (ML) | 33 | 3 | SPLIT SPOON 4.8 | 3 2 1 |
| 3.3 | 6.0 | | PEAT, little silt, black (PT) | 67 | 4 | SPLIT SPOON 3.3 | 1 2 2 |
| | | | LIMESTONE, moderately weathered, medium hard, numerous solution sand filled cavities, some medium to fine quartz sand, little silt, light brown to tan (LS) | 61 | 5 | SPLIT SPOON 1.8 | 7 17 27 |
| | | | | 78 | 6 | SPLIT SPOON .3 | 20 24 27 |
| -1.2 | 10.5 | | | 83 | 7 | SPLIT SPOON -1.2 | 17 14 15 |

Notes:
1. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.)

Scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

**Hole No.L-4.5**

# DRILLING LOG

DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1

1. PROJECT: Tamiami Trail
2. LOCATION (Coordinates or Station): X=796,613 Y=519,304
3. DRILLING AGENCY: U. S. Drilling
4. HOLE NO. (As shown on drawing title and file number): L-4.5
5. NAME OF DRILLER: Kevin C.
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 20.5 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 20.5 Ft.
10. SIZE AND TYPE OF BIT: 3 1/4" T. D. Augers
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD 29 Horizontal Datum: FLE NAD 27
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 14 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 8/8/00 COMPLETED 8/8/00
17. ELEVATION TOP OF HOLE: +17.7 Ft.
18. TOTAL CORE RECOVERY FOR BORING: See Below %
19. SIGNATURE OF Civil Engineer: Ruben Ponciano

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/.5' |
|---|---|---|---|---|---|---|---|
| 17.7 | .0 | | | | | 17.7 | |
| | | | GRAVEL, coarse to fine limestone, little medium to fine quartz sand, little silt, brown to tan (GP-GM) | 50 | 1 | SPLIT SPOON 16.2 | 13, 50/1 |
| | | | | 28 | 2 | SPLIT SPOON 14.7 | 38, 16, 5 |
| | | | | 0 | 3 | SPLIT SPOON 13.2 | 1, 3, 2 |
| | | | | 11 | 4 | SPLIT SPOON 11.7 | 1, 4, 9 |
| | | | | 50 | 5 | SPLIT SPOON 10.2 | 8, 5, 2 |
| | | | | 0 | 6 | SPLIT SPOON 8.7 | 2, 2, 2 |
| | | | | 44 | 7 | SPLIT SPOON 7.2 | 2, 3, 2 |
| 6.2 | 11.5 | | | 33 | 8 | SPLIT SPOON 5.7 | 6, 3, 1 |
| 4.7 | 13.0 | | PEAT, little silt, black (PT) | 28 | 9 | SPLIT SPOON 4.2 | 1, WOH, 1 |
| 2.7 | 15.0 | | SAND, coarse to medium quartz, little silt, brown (SP) | 55 | 10 | SPLIT SPOON 2.7 | 2, 3, 3 |
| | | | LIMESTONE, moderately weathered, medium hard, little medium to fine quartz sand, trace clay, porous, light brown to tan (LS) | 44 | 11 | SPLIT SPOON 1.2 | 13, 36, 7 |
| | | | | 0 | 12 | SPLIT SPOON -.3 | 6, 2, 4 |
| | | | | 55 | 13 | SPLIT SPOON -1.8 | 8, 8, 11 |
| -2.8 | 20.5 | | | 55 | 14 | SPLIT SPOON -2.8 | 18, 50/1 |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

Notes:
1. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.)

WOH - Weight of Hammer

**Hole No.L-6.5**

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT Tamiami Trail | 10. SIZE AND TYPE OF BIT 3 1/4" I. D. Augers |
| 2. LOCATION *(Coordinates or Station)* X=785,790 Y=519,212 | 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY U.S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-45 |
| 4. HOLE NO. *(As shown on drawing title and file number)* L-6.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER Kevin C. | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE STARTED 8/8/00 COMPLETED 8/8/00 |
| 7. THICKNESS OF BURDEN 10.5 Ft. | 17. ELEVATION TOP OF HOLE +9.6 Ft. |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING See Below % |
| 9. TOTAL DEPTH OF HOLE 10.5 Ft. | 19. SIGNATURE OF Civil Engineer Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 9.6 | .0 | | | | | 9.6 | |
| | | | GRAVEL, coarse to fine limestone, little fine quartz sand, little silt, brown to light brown (GP-GM) | 78 | 1 | SPLIT SPOON 8.1 | 18 22 14 |
| | | | | 67 | 2 | SPLIT SPOON 6.6 | 10 12 7 |
| 5.1 | 4.5 | | | 22 | 3 | SPLIT SPOON 5.1 | 4 2 1 |
| 3.6 | 6.0 | | PEAT, some silt, black (PT) | 61 | 4 | SPLIT SPOON 3.6 | 1 1 WOH |
| | | | LIMESTONE, moderately weathered, medium hard, porous, little medium to fine sand, little silt, brown to tan (LS) | 22 | 5 | SPLIT SPOON 2.1 | 1 WOH 27 |
| | | | | 44 | 6 | SPLIT SPOON .6 | 21 20 17 |
| -.9 | 10.5 | | | 28 | 7 | SPLIT SPOON -.9 | 8 11 50/2 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) WOH - Weight of Hammer | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

**Hole No.L-8.5**

| DRILLING LOG | DIVISION South Atlantic | INSTALLATION Jacksonville District | SHEET 1 OF 1 |
|---|---|---|---|
| 1. PROJECT Tamiami Trail | | 10. SIZE AND TYPE OF BIT 3 1/4" I. D. Augers | |
| 2. LOCATION (Coordinates or Station) X=775,087 Y=519,232 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD 29 Horizontal Datum: FLE NAD 27 | |
| 3. DRILLING AGENCY U. S. Drilling | | 12. MANUFACTURER'S DESIGNATION OF DRILL CME-45 | |
| 4. HOLE NO. (As shown on drawing title and file number) L-8.5 | | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN disturbed: 14 undisturbed: 0 | |
| 5. NAME OF DRILLER Kevin C. | | 14. TOTAL NUMBER OF CORE BOXES | |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED | | 15. ELEVATION GROUND WATER | |
| | | 16. DATE HOLE STARTED 8/8/00 COMPLETED 8/8/00 | |
| 7. THICKNESS OF BURDEN 21 Ft. | | 17. ELEVATION TOP OF HOLE +16.4 Ft. | |
| 8. DEPTH DRILLED INTO ROCK 0 Ft. | | 18. TOTAL CORE RECOVERY FOR BORING See Below % | |
| 9. TOTAL DEPTH OF HOLE 21.0 Ft. | | 19. SIGNATURE OF Civil Engineer Ruben Ponciano | |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 16.4 | .0 | | | | | 16.4 | |
| | | | SAND, fine to medium quartz, trace silt, trace fine gravel size limemstone fragments, brown (SP) | 67 | 1 | SPLIT SPOON 14.9 | 2 / 3 / 1 |
| | | | | 44 | 2 | SPLIT SPOON 13.4 | 3 / 3 / 3 |
| 13.4 | 3.0 | | GRAVEL, coarse to fine limestone, little silt, trace clay, medium to fine quartz sand, dark brown to brown (GP-GM) | 33 | 3 | SPLIT SPOON 11.9 | 2 / 3 / 4 |
| | | | | 17 | 4 | SPLIT SPOON 10.4 | 1 / WOR / 3 |
| | | | | 44 | 5 | SPLIT SPOON 8.9 | 3 / 3 / 4 |
| | | | | 17 | 6 | SPLIT SPOON 7.4 | 3 / 4 / 4 |
| | | | | 33 | 7 | SPLIT SPOON 5.9 | 4 / 3 / 2 |
| 5.9 | 10.5 | | PEAT, some silt, black (PT) | 89 | 8 | SPLIT SPOON 4.4 | 1 / WOH / WOH |
| | | | | 22 | 9 | SPLIT SPOON 2.9 | 1 / WOH / 1 |
| 2.4 | 14.0 | | LIMESTONE, moderately weathered, medium hard, porous, little fine quartz sand, little silt, brown to tan (LS) | 89 | 10 | SPLIT SPOON 1.4 | 12 / 15 / 50/3 |
| | | | | 44 | 11 | SPLIT SPOON -.1 | 23 / 50/4 |
| | | | | 55 | 12 | SPLIT SPOON -1.6 | 15 / 15 / 15 |
| | | | | NR | 13 | SPLIT SPOON -3.1 | 1 / WOH / 3 |
| -4.6 | 21.0 | | | 22 | 14 | SPLIT SPOON -4.6 | 13 / 14 / 15 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) WOR - Weight of Rod WOH - Weight of Hammer | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT Tamiami Trail HOLE NUMBER L-8.5

**Hole No.L-10.5**

# DRILLING LOG

| | |
|---|---|
| DIVISION: South Atlantic | INSTALLATION: Jacksonville District — SHEET 1 OF 1 |
| 1. PROJECT: Tamiami Trail | 10. SIZE AND TYPE OF BIT: 3 1/4" I.D. Augers |
| 2. LOCATION (Coordinates or Station): X=763,924 Y=519,239 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD 29 Horizontal Datum: FLE NAD 27 |
| 3. DRILLING AGENCY: U. S. Drilling | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 |
| 4. HOLE NO. (As shown on drawing title and file number): L-10.5 | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 7 undisturbed: 0 |
| 5. NAME OF DRILLER: Kevin C. | 14. TOTAL NUMBER OF CORE BOXES |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED | 15. ELEVATION GROUND WATER |
| | 16. DATE HOLE: STARTED 8/8/00 COMPLETED 8/8/00 |
| 7. THICKNESS OF BURDEN: 9.5 Ft. | 17. ELEVATION TOP OF HOLE: +9.5 Ft. |
| 8. DEPTH DRILLED INTO ROCK: 0 Ft. | 18. TOTAL CORE RECOVERY FOR BORING: See Below % |
| 9. TOTAL DEPTH OF HOLE: 9.5 Ft. | 19. SIGNATURE OF Civil Engineer: Ruben Ponciano |

| ELEV. | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | CORE REC % | SAMPLE NUMBER | REMARKS Bit or Barrel | BLOWS/ .5' |
|---|---|---|---|---|---|---|---|
| 9.5 | .0 | | | | | 9.5 | |
| | | | GRAVEL, coarse to fine limestone, some medium to fine quartz sand, little silt, brown (GP-GM) | 55 | 1 | SPLIT SPOON 8.0 | 2 3 5 |
| | | | | 33 | 2 | SPLIT SPOON 6.5 | 9 11 17 |
| | | | | 67 | 3 | SPLIT SPOON 5.0 | 8 7 6 |
| | | | | 28 | 4 | SPLIT SPOON 3.5 | 9 12 8 |
| 2.0 | 7.5 | | | 33 | 5 | SPLIT SPOON 2.0 | 7 6 8 |
| | | | LIMESTONE, moderately weathered, medium hard, porous, some medium to fine quartz sand, trace silt, light brown to tan (LS) | 33 | 6 | SPLIT SPOON .5 | 29 50/3 |
| .0 | 9.5 | | | 0 | 7 | SPLIT SPOON .0 | 50/1 |
| | | | Notes: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. | | | 140# Hammer with 30" drop used on a 2.0" split spoon (1 3/8" I.D. X 2" O.D.) | |

Depth scale: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20, 22.5

# U.S. CORP OF ENGINEERS DRILLING LOGS

Hole No. CB-S333-3

| DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 of 1 sheets |
|---|---|---|---|
| 1. PROJECT: C&SF Structure 333 | | 10. SIZE AND TYPE OF BIT: See remarks | |
| 2. LOCATION (Coordinates or Station): X=607,251 Y=519,143 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL | |
| 3. DRILLING AGENCY: Corps of Engineers | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague and Henwood 40C | |
| 4. HOLE NO. (As shown on drawing title and file number): CB-S333-3 | | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED | |
| 5. NAME OF DRILLER: C. Mason | | 14. TOTAL NUMBER CORE BOXES: 2 | |
| 6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: +6.7 | |
| 7. THICKNESS OF OVERBURDEN | | 16. DATE HOLE: STARTED 2-12-73 COMPLETED 2-14-73 | |
| 8. DEPTH DRILLED INTO ROCK | | 17. ELEVATION TOP OF HOLE: +18.8 | |
| 9. TOTAL DEPTH OF HOLE: 44.0' | | 18. TOTAL CORE RECOVERY FOR BORING: 38 % | |
| | | 19. SIGNATURE OF INSPECTOR: GEOLOGIST: T. Novak | |

| ELEVATION | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | % CORE RECOVERY | BOX OR SAMPLE NO. | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) |
|---|---|---|---|---|---|---|
| | | | | | | BIT OR BARREL |
| +18.8 | 0.0 | | | | | +18.8 Bls/0.5 Ft. |
| | | LEVEE FILL | SAND, fine to coarse, carbonate, high percentage of fines, limestone lenses, slightly silty, brown, fill. | 30 | 1 | SPLIT SPOON +17.3 12/16/24 |
| | | | | 35 | 2 | " " +15.8 28/14/22 |
| | | | | 30 | 3 | " " +14.3 24/43/29 |
| | | | | 20 | 4 | " " +12.8 29/10/9 |
| | | | | 20 | 5 | " " +11.3 26/52/22 |
| | | | | 35 | 6 | " " +9.8 16/81/60 |
| | | | | 30 | 7 | " " +8.3 30/20/23 |
| | | | | 30 | 8 | " " +6.8 21/22/20 |
| | | | | 5 | 9 | " " +5.3 18/15/13 |
| +4.8 | 14.0 | | | | | |
| | | | PEAT, soft, fibrous, spongy, slightly silty, dark brown to black (PT) | 20 | 10 | " " +3.8 4/5/8 |
| | | | Sandy with limestone lenses From +3.3 to +2.3 | 30 | 11, 12 | " " +2.3 22/49/37 |
| +2.3 | 16.5 | | | | | |
| | | | LIMESTONE, medium hard, open solution holes, oolitic | 10 | 13 | " " +1.3 21/120 |
| | | | buff, reworked limestone conglomerate From +1.3 to -1.2 | 100 | | DIAMOND 4" x 5-1/2" +0.3 D.T. 15 min; HP 50 psi |
| -1.2 | 20.0 | | | 100 | | DIAMOND 4" x 5-1/2" D.T. 45 min. H.P. 50 psi |
| | | | Solution holes filled with soft, porous sandstone | | | |
| -3.2 | 22.0 | | | | | -3.7 |
| | | | SANDSTONE, soft, very calcareous, carbonate and quartz. | 90 | | DIAMOND 4" x 5-1/2" D.T. 30 min. H.P. 50 psi |
| -5.7 | 24.5 | | | | | |
| | | | LIMESTONE, hard, massive, fossiliferous, numerous small solution cavities | | | |
| -7.7 | 26.5 | | | | | |
| | | | SANDSTONE, soft, very calcareous, very porous, weakly cemented, light brown to buff | | | -8.7 |
| | | | | 70 | | SPLIT SPOON -10.2 36/36/28 |
| -10.2 | 29.0 | | | | | |
| | | | SAND, fine to medium, quartz, numerous fines, some carbonate sand, light gray (SP-SM) | 50 | 14 | " " -11.7 13/25/18 |
| | | | | 0 | | " " -13.2 12/15/18 |
| | | | Limestone lenses From -10.2 to -13.2 | 90 | 15 | " " -14.7 3/14/20 |
| | | | | 50 | 16 | " " -16.2 17/30/41 |
| | | | | 0 | | " " -17.7 7/18/23 |
| | | | | 30 | 17 | " " -19.2 8/21/28 |
| | | | | 45 | 18 | " " -20.7 9/16/18 |
| | | | | 20 | 19 | " " -22.2 15/27/27 |
| | | | | 30 | 20 | " " -23.7 18/24/29 |
| | | | | 30 | 21 | " " -25.2 14/36/52 |
| -25.2 | 44.0 | | | | | |
| | | | NOTES. 1. Set 6" casing to +1.3 2. Set NX casing to -19.7 3. 70% water loss at +1.3 4. Grouted hole upon completion | | | 140# Hammer with 30" drop used on 2.0' split spoon (1-3/8" I.D. X 2" O.D.) |

ENG FORM 1836-A | PROJECT: C&SF Structure 333 | HOLE NO. CB-S333-3

Hole No. CB-S334-2

| DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 of 1 sheets |
|---|---|---|---|
| 1. PROJECT: C&SF Structure 334 | | 10. SIZE AND TYPE OF BIT: See Remarks | |
| 2. LOCATION (Coordinates or Station): X=665,013 Y=519,092 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL | |
| 3. DRILLING AGENCY: Corps of Engineers | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague and Henwood | |
| 4. HOLE NO. (As shown on drawing title and file number): CB-S334-2 | | 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED | |
| 5. NAME OF DRILLER: C. Mason | | 14. TOTAL NUMBER CORE BOXES: 2 | |
| 6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: +5.4 | |
| 7. THICKNESS OF OVERBURDEN | | 16. DATE HOLE: STARTED 3-23-73 COMPLETED 3-28-73 | |
| 8. DEPTH DRILLED INTO ROCK | | 17. ELEVATION TOP OF HOLE: +17.3 | |
| 9. TOTAL DEPTH OF HOLE: 43.0' | | 18. TOTAL CORE RECOVERY FOR BORING: 57 % | |
| | | 19. GEOLOGIST: T. NOVAK | |

| ELEVATION | DEPTH | LEGEND | CLASSIFICATION OF MATERIALS (Description) | % CORE RECOVERY | BOX OR SAMPLE NO. | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) |
|---|---|---|---|---|---|---|
| | | | | | | BIT OR BARREL |
| +17.3 | 0.0 | | | | | +17.3 Bls/0.5 ft. |
| | | FILL | ROAD FILL, fine to coarse sand, fine to coarse gravel, and limestone cobbles, silty, calcareous, slightly plastic fines, light brown | 40 | 1 | SPLIT SPOON +15.8 10/14/12 |
| | | | | 40 | 2 | " " +14.3 7/11/16 |
| | | | | 10 | 3 | " " +12.8 7/7/3 |
| | | | | 0 | | " " +11.3 2/2/6 |
| | | | | 10 | 4 | " " +9.8 6/8/8 |
| | | | | 10 | 5 | " " +8.3 9/9/6 |
| | | | | 30 | 6 | " " +6.8 8/13/14 |
| | | | | 40 | 7 | " " +5.3 11/11/10 |
| | | | | 10 | 8 | " " +3.8 7/9/7 |
| | | | | 0 | | " " +2.3 9/7/8 |
| +1.8 | 15.5 | | | 80 | 9 | " " +0.8 5/6/8 |
| +0.7 | 16.6 | | PEAT, fibrous, spongy, black (PT) | | | |
| -0.7 | 18.0 | | SAND, fine to coarse, carbonate, numerous fines, limestone frag. silty dark brown (SP) | 80 | 10 | " " -0.7 14/27/32 |
| -2.4 | 19.7 | | LIMESTONE, medium hard, oolitic, sand filled solution holes, buff | 95 | | " " -2.2 40/33/27 |
| | | | | 60 | | -2.4 " " 100 |
| | | | LIMESTONE, hard, reworked limestone conglomerate | 100 | | DIAMOND 4"X5-1/2" -3.2 D.T. 35 min H.P. 50 psi |
| -4.2 | 21.5 | | | | | |
| | | | LIMESTONE, hard, fossiliferous, porous, many solution cavities, buff, pockets of medium hard sandy limestone from -4.2 to -6.7. | 85 | | DIAMOND 4" X 5-1/2" D.T. 75 min. H.P. 50 psi. -6.2 |
| | | | | 90 | | SPLIT SPOON -7.2 39/114 |
| | | | | 95 | | DIAMOND 4" X 5-1/2" D.T. 35 min. H.P. 50 psi. -9.7 |
| -9.7 | 27.0 | | | | | |
| | | | LIMESTONE, medium hard, very sandy, poorly cemented from -12.7 to -18.2, Fossiliferous | 90 | | SPLIT SPOON -11.2 27/56/23 |
| | | | | 40 | | " " -12.7 24/39/56 |
| | | | | 20 | | " " -14.2 14/14/13 |
| | | | | 40 | | " " -15.7 18/12/18 |
| | | | | 60 | | " " -17.2 10/10/57 |
| | | | | 100 | | " " -18.2 33/127 |
| | | | Hard, porous, chalky, from -18.2 to -19.2 | 100 | | DIAMOND NX -19.2 D.T. 10 min H.P. 50 psi. |
| | | | | 90 | | SPLIT SPOON -20.7 48/52/141 |
| | | | hard from -20.7 to -21.2 | 60 | | -21.2 DIAMOND NX |
| | | | | 75 | | SPLIT SPOON -22.7 4/43/21 |
| | | | | 60 | | " " -24.2 34/25/42 |
| | | | | 85 | | " " -25.7 33/29/14 |
| -25.7 | 43.0 | | | | | |
| | | | NOTES: 1. Set NX casing to -12.7 Set 6-inch casing to -2.2 2. 100% water loss at -6.2 3. Grouted hole upon completion. | | | 140# hammer with 30" drop used on 2' split spoon (1-3/8" I.D. X 2" O.D.) |

# SUMMARY OF GROUNDWATER ELEVATIONS

Summary of Groundwater Elevations - July - August, 2000
Tamiami trail Project
Miami - Dade County, Florida
LAW Project No. 40700-0-2369

| Boring No. | NORTHING (Y) | EASTING (x) | Ground Surface Elevation Feet | Depth GW Feet | Groundwater Elevation Feet |
|---|---|---|---|---|---|
| US41 Hwy / Asphaltic Concrete | | | | | |
| DCB-0.5 | 519141.5 | 818062 | 11.1 | 2.66 | 8.44 |
| DCB-2.0 | 519086.2 | 810051.5 | 10 | 3 | 7 |
| DCB-2.5 | 519100.2 | 807337.8 | 10.1 | 4.5 | 5.6 |
| DCB-4.0 | 519034.4 | 799367.9 | 10.6 | 3 | 7.6 |
| DCB-6.0 | 518997.6 | 788503.3 | 10.6 | 3.5 | 7.1 |
| DCB-6.5 | 519016.1 | 785802.5 | 9.7 | 2.92 | 6.78 |
| DCB-8.0 | 518964 | 777834.2 | 10.6 | 3.25 | 7.35 |
| DCB-8.5 | 518977.3 | 775094.8 | 10.4 | 3 | 7.4 |
| DCB-10.0 | 518942.9 | 767146.4 | 10.7 | 3 | 7.7 |
| DCB-10.6 | 518987.2 | 763883.8 | 12.5 | 3.1 | 9.4 |
| Dirt Road | | | | | |
| L - 2.5 | 519295.8 | 807341.1 | 9.3 | 2.8 | 6.5 |
| L - 6.5 | 519211.5 | 785789.8 | 9.6 | 3 | 6.6 |
| L - 10.5 | 519238.5 | 763923.9 | 9.5 | 3.4 | 6.1 |
| Top of Levee | | | | | |
| L - 0.5 | 519391.2 | 818353.4 | 15.7 | 9.5 | 6.2 |
| L - 4.5 | 519303.8 | 76613 | 17.7 | 9 | 8.7 |
| L - 8.5 | 519232.4 | 775086.7 | 16.4 | 7 | 9.4 |

# SUMMARY OF LABORATORY TEST RESULTS

Laboratory Test Results
Tamiami Trail Project
Miami-Dade County, Florida
Corps of Engineers - Jacksonville District
LAW Project no. 40700-0-2369

| BORING NO. | SAMPLE INTERVAL (ft.) | NATURAL MOISTURE CONTENT % | ORGANIC CONTENT % | LBR VALUE % | WET CBR VALUE % | DRY CBR VALUE % | RESISTIVITY (Saturated) OHM-CM | CHLORIDES mg/Kg | SULFATE mg/Kg | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| DCB - 0.5* | 0.5 - 1.0 | 9.48 | - | NA | - | - | - | - | - | - |
| DCB - 0.5* | 1.0 - 6.0 | - | - | - | 36 | 40 | - | - | - | - |
| DCB - 0.5 | 3.0 - 4.5 | - | - | - | - | - | 14368 | 16 | 18 | 9.45 |
| DCB - 0.5 | 4.5 - 6.0 | 23.17 | - | - | - | - | - | - | - | - |
| DCB - 0.5 | 7.5 - 9.0 | - | 38.2 | - | - | - | 2096 | 62 | 40 | 7.67 |
| DCB - 2.0* | 0.5 - 1.5 | 11.12 | - | NA | - | - | - | - | - | - |
| DCB - 2.0* | 1.5 - 3.0 | 14.56 | - | - | - | - | - | - | - | - |
| DCB - 2.0* | 1.0 - 6.0 | - | - | - | 35 | 70 | - | - | - | - |
| DCB - 2.0 | 3.0 - 4.5 | - | - | - | - | - | 5637 | 51 | 26 | 9.46 |
| DCB - 2.0 | 4.5 - 6.0 | - | 41.9 | - | - | - | 2941 | 57 | 55 | 8.25 |
| DCB - 4.0* | 1.5 - 6.0 | - | - | - | 45 | 55 | - | - | - | - |
| DCB - 6.0 | 3.0 - 4.5 | - | - | - | - | - | 19048 | 51 | 17 | 9.53 |
| DCB - 6.0 | 4.5 - 6.0 | - | 31.2 | - | - | - | 2639 | 48 | 52 | 8.29 |
| DCB - 6.5* | 1.0 - 6.0 | - | - | - | NA | - | - | - | - | - |
| DCB - 8.5* | 0.5 - 1.5 | 6.55 | - | 95 | - | - | - | - | - | - |
| DCB - 8.5* | 1.5 - 3.0 | 6.94 | - | - | - | - | - | - | - | - |
| DCB - 8.5* | 1.0 - 6.5 | - | - | - | 45 | 76 | - | - | - | - |
| DCB - 8.5 | 3.0 - 4.5 | - | - | - | - | - | 8811 | 52 | 52 | 9.59 |
| DCB - 8.5 | 6.0 - 7.5 | - | 40.1 | - | - | - | 2227 | 66 | 93 | 7.95 |
| DCB -10.0** | 0.0 - 1.5 | 7.48 | - | - | - | - | - | - | - | - |
| DCB -10.0** | 1.0 - 1.5 | - | - | 105 | - | - | - | - | - | - |
| DCB -10.0* | 1.5 - 6.0 | - | - | - | 60 | 80 | - | - | - | - |
| DCB -10.0* | 4.5 - 6.0 | 19.57 | - | - | - | - | - | - | - | - |

* LBR/CBR Samples collected from Boring location and companion borings.
** LBR Sample collected from companion borings.
NA Not Analyzed

g:/env/rponciano/tamiamisoilresults.xls

Laboratory Test Results
Tamiami Trail Project
Miami-Dade County, Florida
Corps of Engineers - Jacksonville District
LAW Project no. 40700-0-2369

| BORING NO. | SAMPLE INTERVAL (ft.) | NATURAL MOISTURE CONTENT % | ORGANIC CONTENT % | LBR VALUE % | WET CBR VALUE % | DRY CBR VALUE % | RESISTIVITY (Saturated) OHM-CM | CHLORIDES mg/Kg | SULFATE mg/Kg | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| L - 0.5* | 1.0 - 7.0 | - | - | - | 55 | 19 | - | - | - | - |
| L - 2.5* | 1.0 - 4.0 | - | - | - | 25 | 45 | - | - | - | - |
| L - 4.5* | 1.0 - 7.0 | - | - | - | 23 | 25 | - | - | - | - |
| L - 6.5* | 1.0 - 3.5 | - | - | - | 46 | 44 | - | - | - | - |
| L - 8.5* | 1.0 - 7.0 | - | - | - | 23 | 26 | - | - | - | - |
| L -10.5* | 1.0 - 3.5 | - | - | - | 45 | 79 | - | - | - | - |

* LBR/CBR Samples collected from Boring location and companion borings.

** LBR Sample collected from companion borings.

NA Not Analyzed

g:/env/rponciano/tamiamisoilresults.xls

# LABORATORY ANALYSIS

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
5845 NW 158TH STREET
MIAMI LAKES, FL. 33014

# MOISTURE CONTENT DETERMINATION

**PROJECT NAME:** Tamiami Trail

**PROJECT No.:** 40700-0-2369

**LOCATION OF PROJECT:** US-41 Roadway and Shoulders

**DATE:** 10/17/00

**TESTED BY:** Jay Sajadi

**DESCRIPTION OF SOIL:**

| BORING No. | DCB-0.5 | DCB-0.5 | CB-2.0 | CB-2.0 | DCB-8.5 |
|---|---|---|---|---|---|
| SAMPLE No. | S-1 | S-4 | S-1 | S-2 | S-1 |
| DEPTH | 0-1.5 | 4.5-6.0 | 0-1.5 | 1.5-3.0 | 0-1.5 |
| WT. OF CUP + SOIL | 162.43 | 150.41 | 117.82 | 142.05 | 147.42 |
| WT. OF CUP | 8.5 | 8.36 | 8.39 | 8.44 | 8.19 |
| WT. OF WET SOIL | 153.93 | 142.05 | 109.43 | 133.61 | 139.23 |
| WT. OF CUT + DRY SOIL | 149.1 | 123.69 | 106.87 | 125.07 | 138.86 |
| WT. OF DRY SOIL | 140.6 | 115.33 | 98.48 | 116.63 | 130.67 |
| WT. OF WATER | 13.33 | 26.72 | 10.95 | 16.98 | 8.56 |
| % MOISTURE CONTENT | 9.48% | 23.17% | 11.12% | 14.56% | 6.55% |

Respectfully submitted,

**Law Engineering and Environmental Services, Inc.**

Ruben Ponciano

Checked by: FA

Date: 10-17-00

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
5845 NW 158TH STREET
MIAMI LAKES, FL. 33014

# MOISTURE CONTENT DETERMINATION

**PROJECT NAME:** Tamiami Trail

**PROJECT No.:** 40700-0-2369

**LOCATION OF PROJECT:** US-41 Roadway and Shoulders

**DATE:** 10/17/00

**TESTED BY:** Jay Sajadi

**DESCRIPTION OF SOIL:** ______

| BORING No. | DCB-8.5 | DCB-10 | DCB-10 | | |
|---|---|---|---|---|---|
| SAMPLE No. | S-2 | S-1 | S-4 | | |
| DEPTH | 1.5-3 | 0-1.5 | 4.5-6 | | |
| WT. OF CUP + SOIL | 123.69 | 165.91 | 193.52 | | |
| WT. OF CUP | 8.25 | 8.33 | 8.37 | | |
| WT. OF WET SOIL | 115.44 | 157.58 | 185.15 | | |
| WT. OF CUT + DRY SOIL | 116.2 | 154.94 | 163.22 | | |
| WT. OF DRY SOIL | 107.95 | 146.61 | 154.85 | | |
| WT. OF WATER | 7.49 | 10.97 | 30.3 | | |
| % MOISTURE CONTENT | 6.94% | 7.48% | 19.57% | | |

Respectfully submitted,

**Law Engineering and**
**Environmental Services, Inc.**

Ruben Ponciano

Checked by: FA

Date: 10-17-00

LAW
LAWGIBB Group Member

5845 NW 158th Street
Miami Lakes, Florida 33014
Phone: 305-826-5588
Fax: 305-826-1799

| | | | |
|---|---|---|---|
| Project Name: | Tamiami Trail | Project No.: | 40700-0-2369 |
| Sample No.: | DCB.5 (7.5-9.0) | Date: | 8/25/00 |

# Worksheet for Organic Content (FM 1-T267)

| | |
|---|---|
| Technician: | W. Spence |
| Crubicle Number: | SC |
| Date / Time Sample Placed in Furnace: | 9-14-00; 8:30am |
| A) Weight of Crucible & Oven-Dried Sample: | 55.75 |
| B) Weight of Crucible & Sample After Ignition: | 50.77 |
| C) Weight of Crubicle: | 42.71 |
| D) Weight of Oven-Dried Soil = (A-C): | 13.04 |
| E) Weight loss due to Ignition (A-B): | 4.98 |
| F) Percent Organics (E/D x 100%): | 38.2 |

Respectfully Submitted,

**Law Engineering and**
**Environmental Services, Inc.**

Checked By: FA
Date: 8-26-00

David L. Brown
David L. Brown C.E.T. 98099

LAW
LAWGIBB Group Member

5845 NW 158th Street
Miami Lakes, Florida 33014
Phone: 305-826-5588
Fax: 305-826-1799

| | | | |
|---|---|---|---|
| Project Name: | Tamiami Trail | Project No.: | 40700-0-2369 |
| Sample No.: | DCB 2.0 (4.5'-6.0') | Date: | 8/25/00 |

## Worksheet for Organic Content (FM 1-T267)

| | |
|---|---|
| Technician: | W. Spence |
| Crubicle Number: | G |
| Date / Time Sample Placed in Furnace: | 9-14-00; 10:00am |
| A) Weight of Crucible & Oven-Dried Sample: | 77.31 |
| B) Weight of Crucible & Sample After Ignition: | 74.61 |
| C) Weight of Crubicle: | 70.86 |
| D) Weight of Oven-Dried Soil = (A-C): | 6.45 |
| E) Weight loss due to Ignition (A-B): | 2.7 |
| F) Percent Organics (E/D x 100%): | 41.9 |

Respectfully Submitted,

**Law Engineering and**
**Environmental Services, Inc.**

Checked By: FA
Date: 8-26-00

David L. Brown
David L. Brown C.E.T. 98099

LAW
LAWGIBB Group Member

5845 NW 158th Street
Miami Lakes, Florida 33014
Phone: 305-826-5588
Fax: 305-826-1799

| | | | |
|---|---|---|---|
| Project Name: | Tamiami Trail | Project No.: | 40700-0-2369 |
| Sample No.: | DCB 6.0 (4.5'-6.0') | Date: | 8/25/00 |

## Worksheet for Organic Content (FM 1-T267)

| | |
|---|---|
| Technician: | W. Spence |
| Crubicle Number: | CL |
| Date / Time Sample Placed in Furnace: | 9-14-00; 10:00am |
| A) Weight of Crucible & Oven-Dried Sample: | 89.72 |
| B) Weight of Crucible & Sample After Ignition: | 85.16 |
| C) Weight of Crubicle: | 75.1 |
| D) Weight of Oven-Dried Soil = (A-C): | 14.62 |
| E) Weight loss due to Ignition (A-B): | 4.56 |
| F) Percent Organics (E/D x 100%): | 31.2 |

Respectfully Submitted,

**Law Engineering and Environmental Services, Inc.**

Checked By: FA
Date: 8-26-00

David L. Brown
David L. Brown C.E.T. 98099

LAW
LAWGIBB Group Member

5845 NW 158th Street
Miami Lakes, Florida 33014
Phone: 305-826-5588
Fax: 305-826-1799

| | | | |
|---|---|---|---|
| Project Name: | Tamiami Trail | Project No.: | 40700-0-2369 |
| Sample No.: | DCB 8.5 (6'-7.5') | Date: | 8/25/00 |

# Worksheet for Organic Content (FM 1-T267)

| | |
|---|---|
| Technician: | W. Spence |
| Crubicle Number: | D |
| Date / Time Sample Placed in Furnace: | 9-14-00; 8:30am |
| A) Weight of Crucible & Oven-Dried Sample: | 95.21 |
| B) Weight of Crucible & Sample After Ignition: | 89.22 |
| C) Weight of Crubicle: | 80.27 |
| D) Weight of Oven-Dried Soil = (A-C): | 14.94 |
| E) Weight loss due to Ignition (A-B): | 5.99 |
| F) Percent Organics (E/D x 100%): | 40.1 |

Respectfully Submitted,

**Law Engineering and**
**Environmental Services, Inc.**

Checked By: FA
Date: 8-26-00

David L. Brown C.E.T. 98099

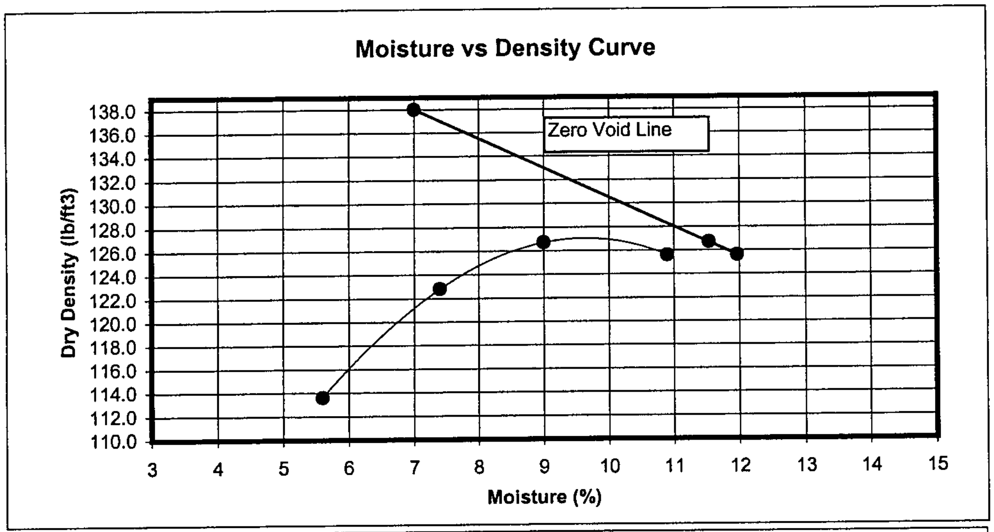
# California Bearing Ratio

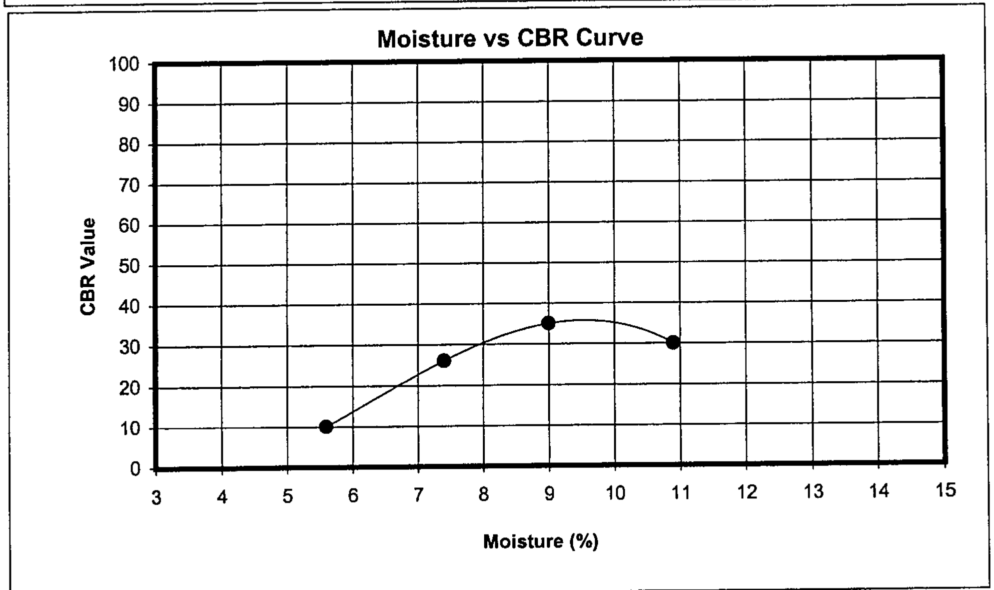
**PBSJ**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.6 | 113.60 | 10.00 | 89.4 |
| 6 | 7.4 | 122.80 | 26.00 | 96.6 |
| 8 | 9.0 | 126.70 | 35.00 | 99.7 |
| 10 | 10.9 | 125.60 | 30.00 | 98.8 |

**Note : Moisture Content Before Soaking**




**Date**
6-Aug-00

**Method**
WET

**SAMPLE LOCATION**
DCB-.5

**SOIL DESCRIPTION**
Subgrade

**OPTIMUM CBR**
36

**Modified Proctor**
**MAXIMUM DENSITY**
127.1

**OPTIMUM MOISTURE**
9.5%

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

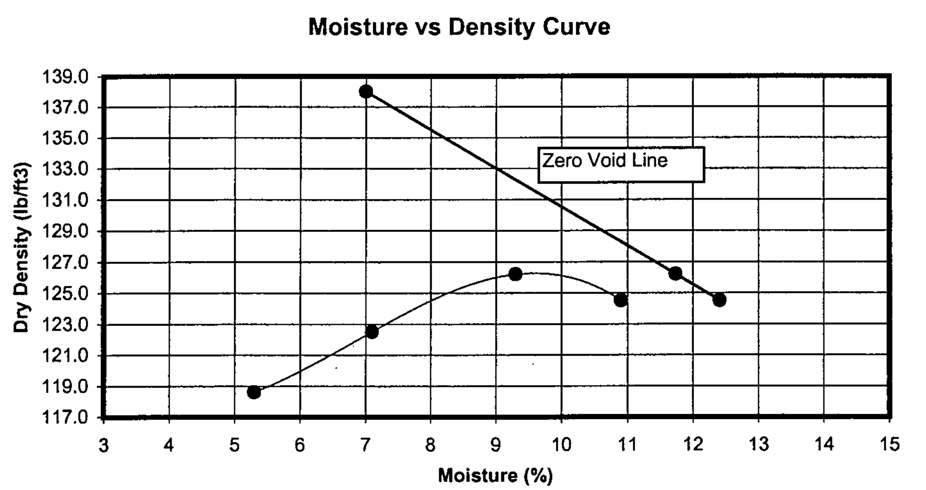
# California Bearing Ratio

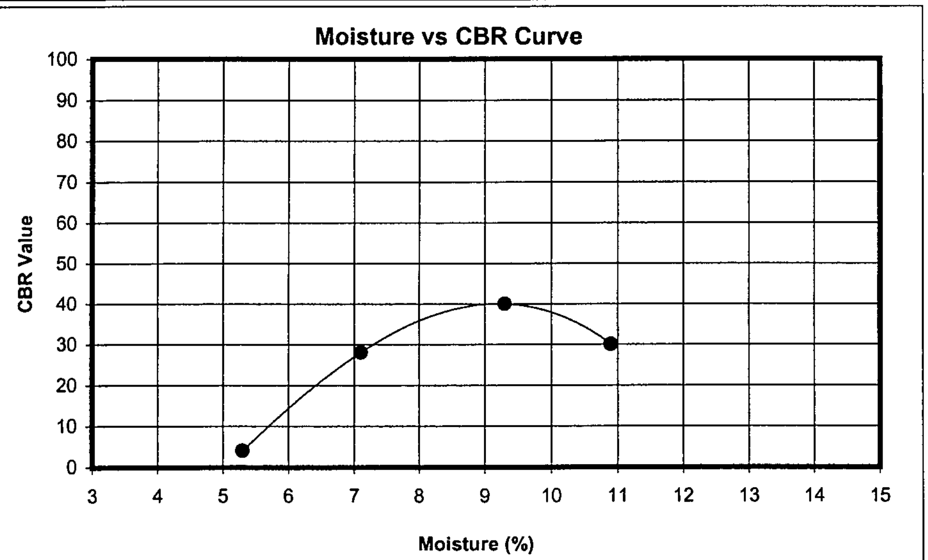
**PBSJ**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.3 | 118.60 | 4.00 | 94.1 |
| 6 | 7.1 | 122.50 | 28.00 | 97.2 |
| 8 | 9.3 | 126.20 | 40.00 | 100.2 |
| 10 | 10.9 | 124.50 | 30.00 | 98.8 |

**Note : Moisture Content Before Soaking**




**Date**
7-Aug-00

**Method**
DRY

**SAMPLE LOCATION**
DCB-.5

**SOIL DESCRIPTION**
Subgrade

**OPTIMUM CBR**
40

**Modified Proctor**
**MAXIMUM DENSITY**
126

**OPTIMUM MOISTURE**
9.5%

**CHECKED BY:**

FAK

Law Engineering and Environmental Services - Miami Lakes - Florida

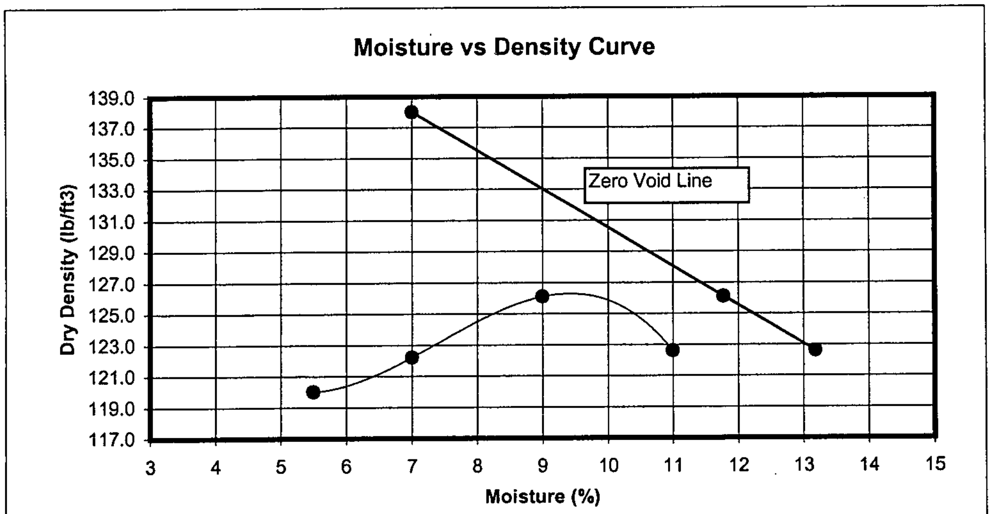
# California Bearing Ratio

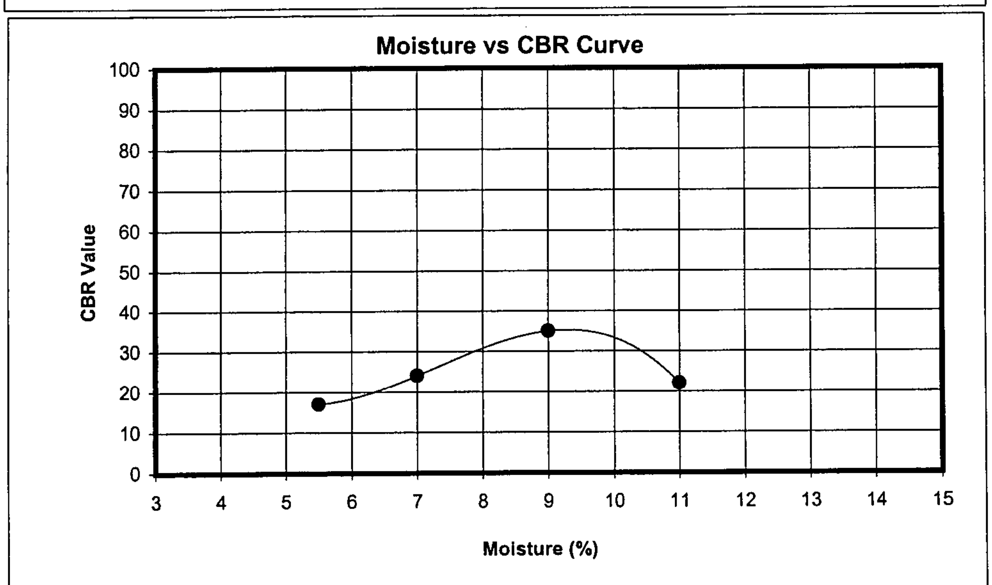
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.5 | 120.00 | 17.00 | 95.0 |
| 6 | 7.0 | 122.20 | 24.00 | 96.8 |
| 8 | 9.0 | 126.10 | 35.00 | 99.8 |
| 10 | 11.0 | 122.60 | 22.00 | 97.1 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
WET

**SAMPLE LOCATION**
DCB-2.0

**SOIL DESCRIPTION**
Brown Sand w/ Limerock

**OPTIMUM CBR**
35

**Modified Proctor**
**MAXIMUM DENSITY**
126.3

**OPTIMUM MOISTURE**
10%

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

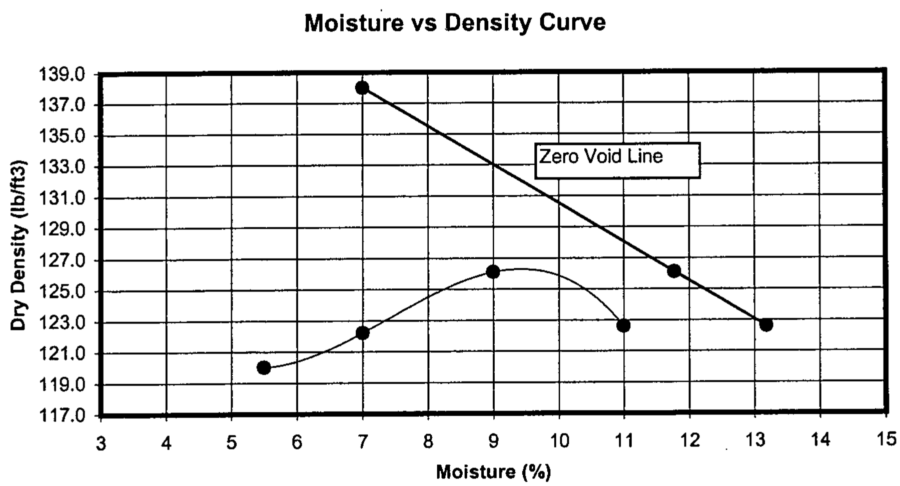
# California Bearing Ratio

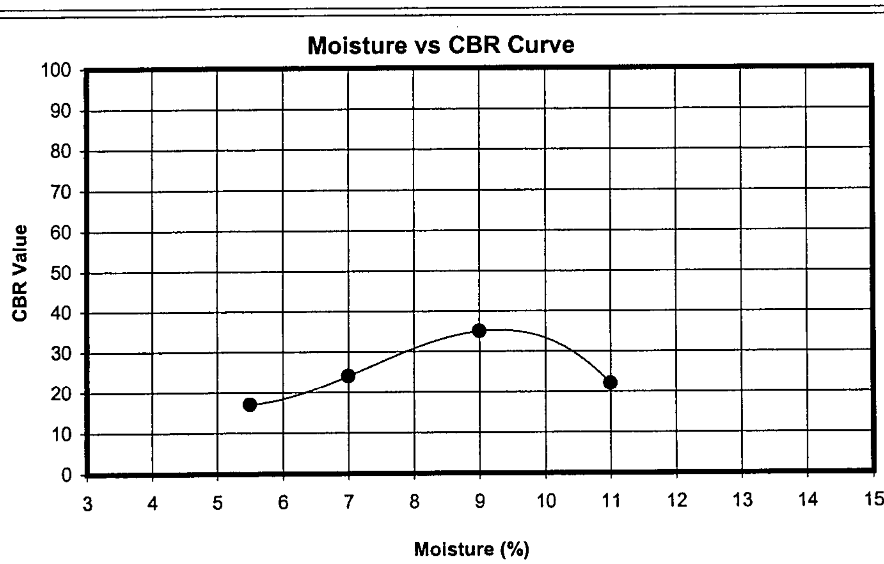
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.5 | 120.00 | 17.00 | 95.0 |
| 6 | 7.0 | 122.20 | 24.00 | 96.8 |
| 8 | 9.0 | 126.10 | 35.00 | 99.8 |
| 10 | 11.0 | 122.60 | 22.00 | 97.1 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
WET

**SAMPLE LOCATION**
DCB-2.0

**SOIL DESCRIPTION**
Brown Sand w/ Limerock

**OPTIMUM CBR**
35

**Modified Proctor**
**MAXIMUM DENSITY**
126.3

**OPTIMUM MOISTURE**
10%

**CHECKED BY:**
TA

Law Engineering and Environmental Services - Miami Lakes - Florida

# California Bearing Ratio

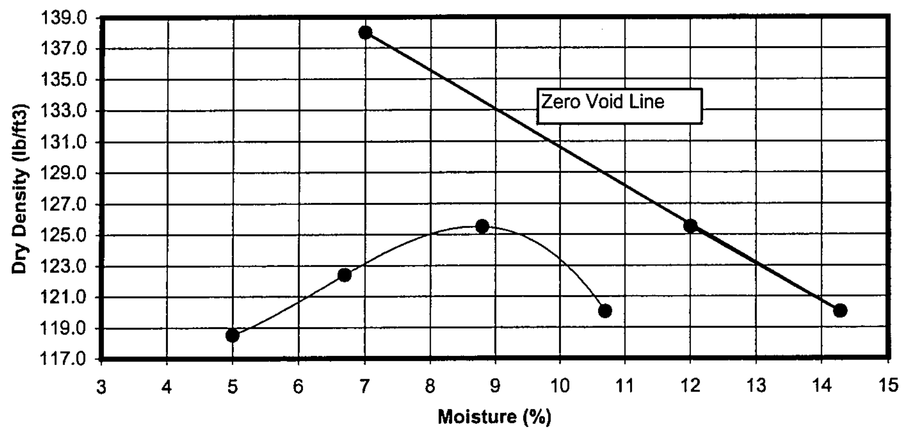
**Tamiami Trail**

**40700-0-2369**

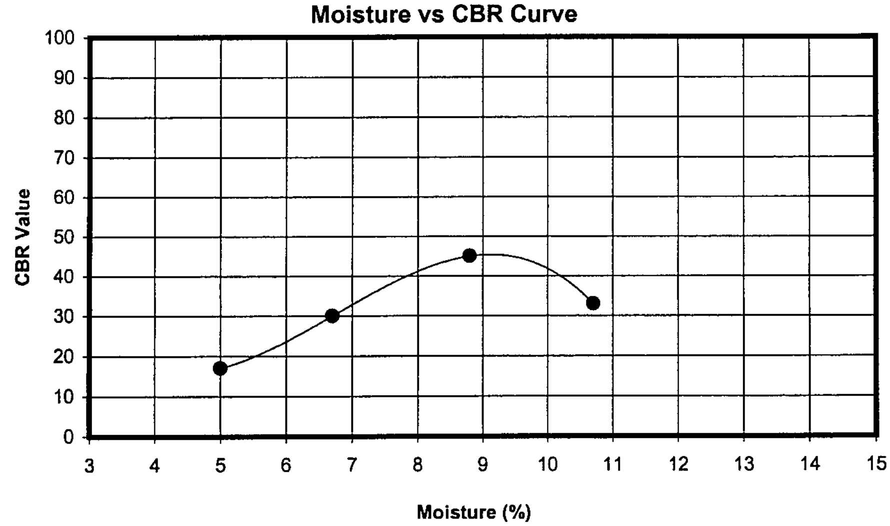
| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.0 | 118.50 | 17.00 | 94.4 |
| 6 | 6.7 | 122.40 | 30.00 | 97.5 |
| 8 | 8.8 | 125.50 | 45.00 | 100.0 |
| 10 | 10.7 | 120.00 | 33.00 | 95.6 |

**Note : Moisture Content Before Soaking**

**Moisture vs Density Curve**




**Moisture vs CBR Curve**




**Date**
**18-Sep-00**

**Method**
**WET**

**SAMPLE LOCATION**
**DCB-4.0**

**SOIL DESCRIPTION**
**Brown Sand w/ Limerock**

**OPTIMUM CBR**
**45**

**Modified Proctor**
**MAXIMUM DENSITY**
**125.5**

**OPTIMUM MOISTURE**
**9%**

**CHECKED BY:**
FA

Law Engineering and Environmental Services - Miami Lakes - Florida

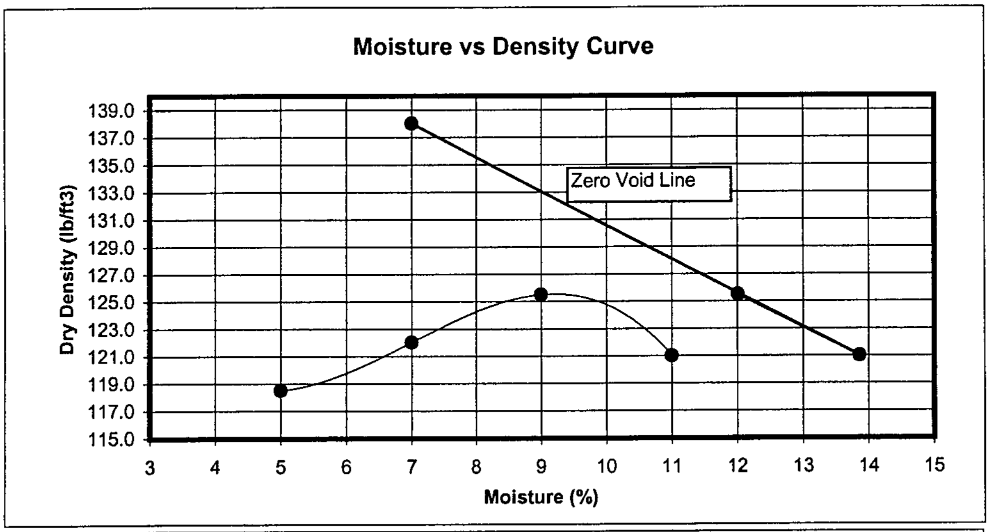
# California Bearing Ratio

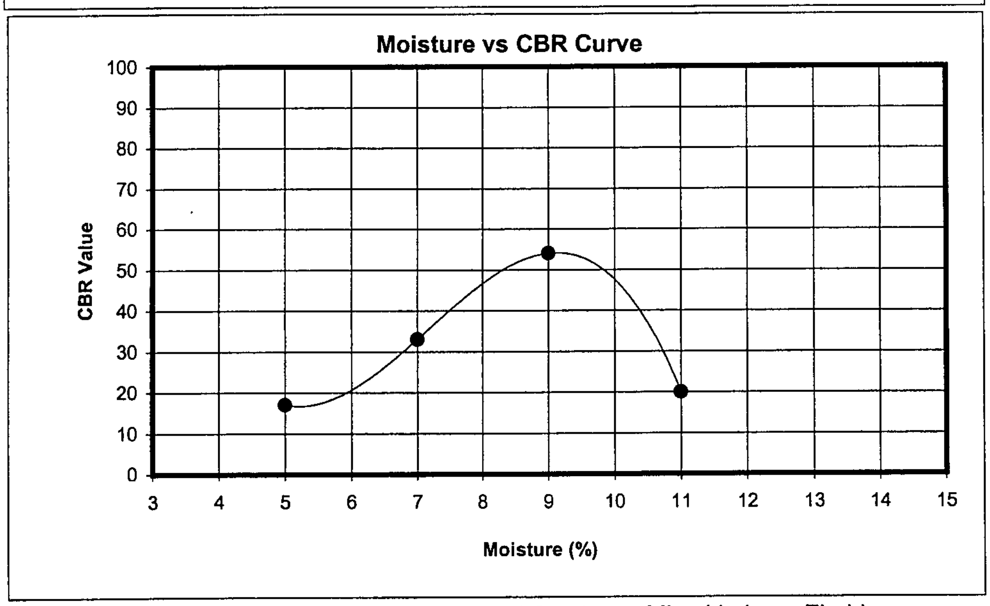
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.0 | 118.50 | 17.00 | 93.1 |
| 6 | 7.0 | 122.00 | 33.00 | 99.8 |
| 8 | 9.0 | 125.50 | 54.00 | 94.5 |
| 10 | 11.0 | 121.00 | 20.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
Dry

**SAMPLE LOCATION**
DCB-4.0

**SOIL DESCRIPTION**
Lt brown sand with limerock

**OPTIMUM CBR**
55

**Modified Proctor**
**MAXIMUM DENSITY**
126

**OPTIMUM MOISTURE**
9%

FA

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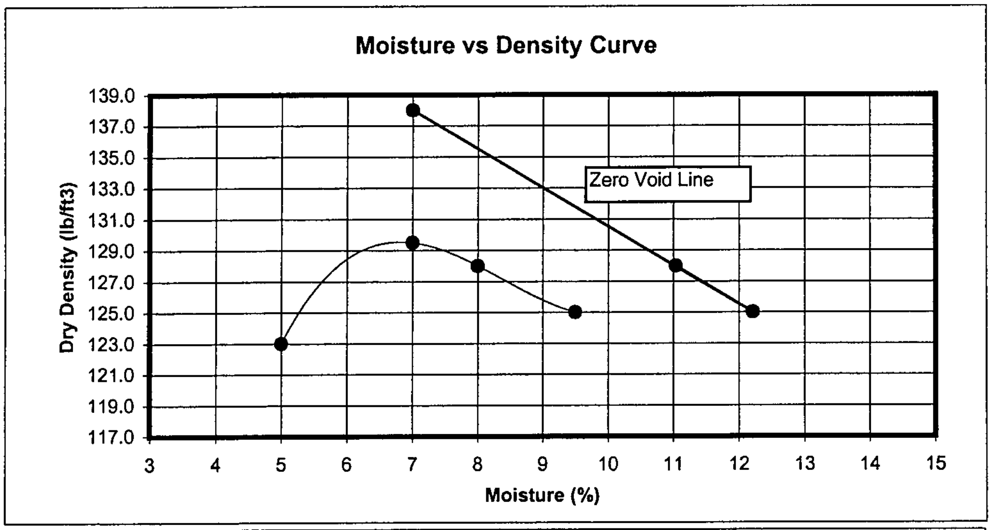
# Limerock Bearing Ratio

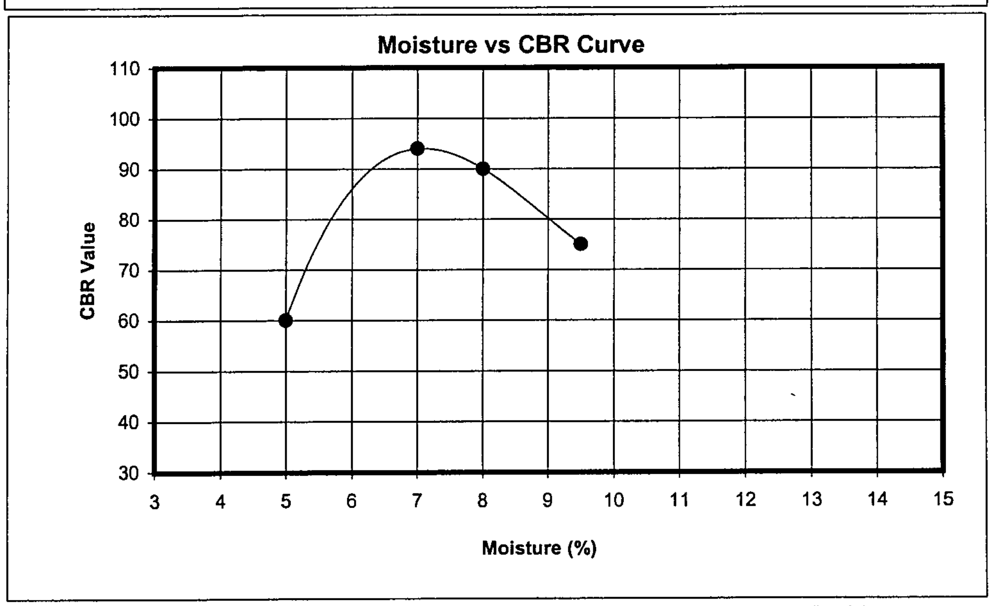
**COE - US 41 - W.B. Lane**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 5.0 | 123.00 | 60.00 | 94.6 |
| 6 | 7.0 | 129.50 | 94.00 | 99.6 |
| 8 | 8.0 | 128.00 | 90.00 | 98.5 |
| 10 | 9.5 | 125.00 | 75.00 | 96.2 |

**Note : Moisture Content Before Soaking**




**Date**
**7-Aug-00**

**SAMPLE LOCATION**
**DCB-8.5**

**SOIL DESCRIPTION**
**Base Rock**

**OPTIMUM CBR**
**95**

**Modified Proctor**
**MAXIMUM DENSITY**
**130**

**OPTIMUM MOISTURE**
**7.0%**

**CHECKED BY:**

Law Engineering and Environmental Services - Miami Lakes - Florida

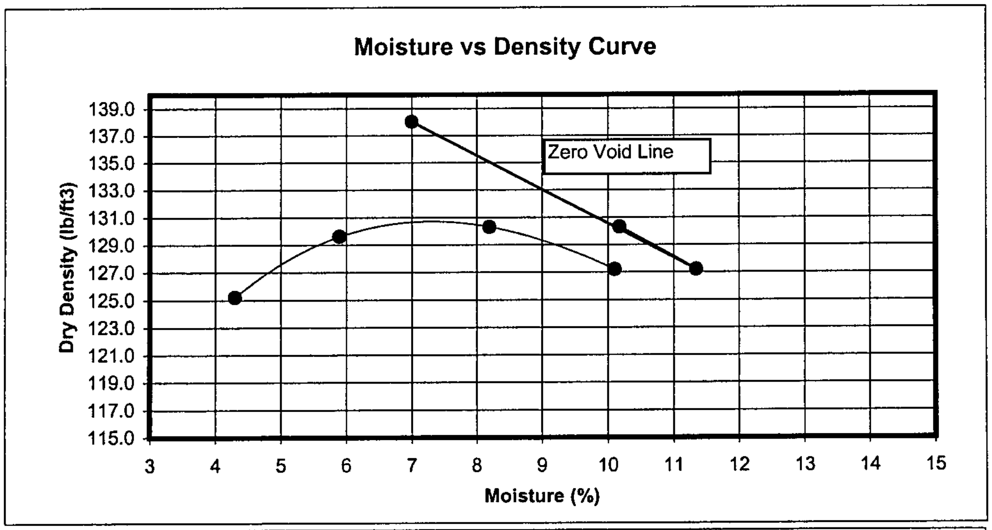
# California Bearing Ratio

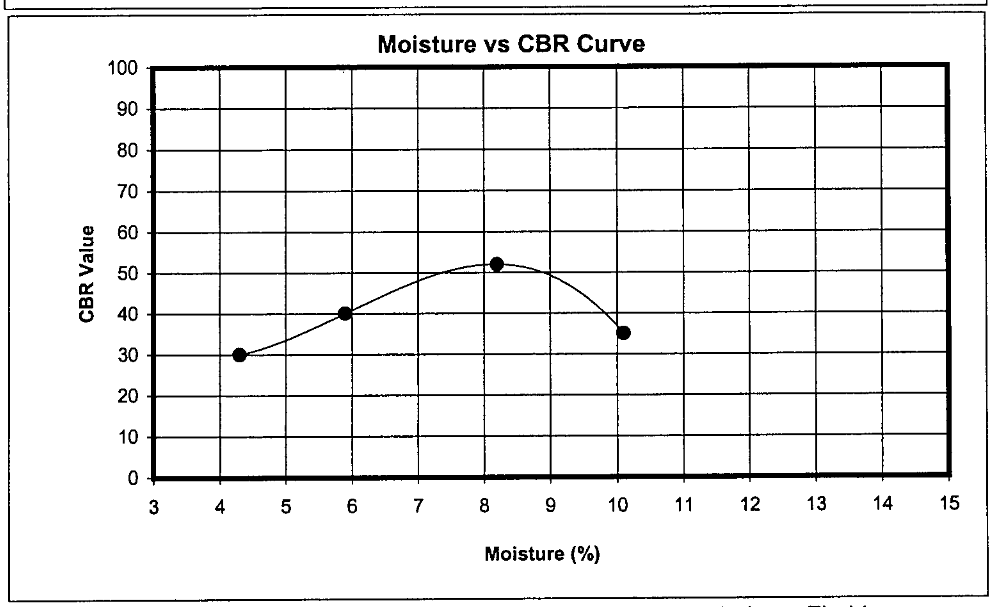
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.3 | 125.20 | 30.00 | 93.1 |
| 6 | 5.9 | 129.60 | 40.00 | 99.8 |
| 8 | 8.2 | 130.30 | 52.00 | 94.5 |
| 10 | 10.1 | 127.20 | 35.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
17-Aug-00

**Method**
Wet

**SAMPLE LOCATION**
DCB 8.5

**SOIL DESCRIPTION**
Subgrade

**OPTIMUM CBR**
45

**Modified Proctor**
**MAXIMUM DENSITY**
130.7

**OPTIMUM MOISTURE**
7.5%

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

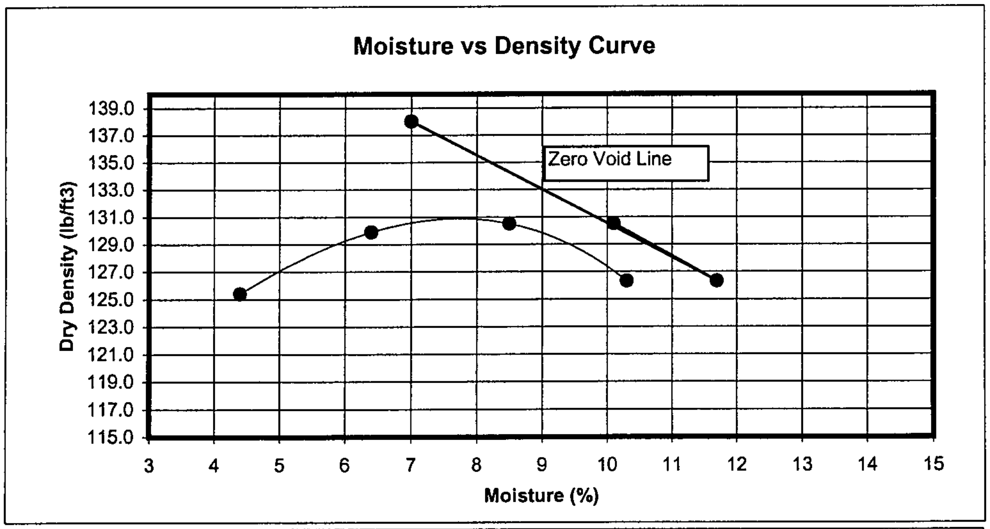
# California Bearing Ratio

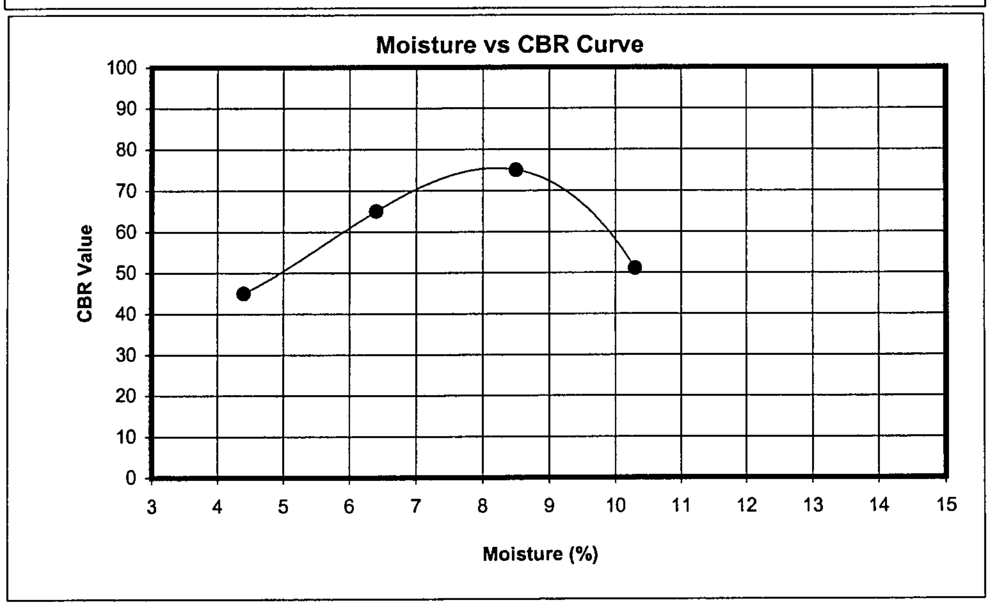
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.4 | 125.40 | 45.00 | 93.1 |
| 6 | 6.4 | 129.90 | 65.00 | 99.8 |
| 8 | 8.5 | 130.50 | 75.00 | 94.5 |
| 10 | 10.3 | 126.30 | 51.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Aug-00

**Method**
Dry

**SAMPLE LOCATION**
DCB 8.5

**SOIL DESCRIPTION**
Subgrade

**OPTIMUM CBR**
76

**Modified Proctor**
**MAXIMUM DENSITY**
130.9

**OPTIMUM MOISTURE**
7.5%

FK

Law Engineering and Environmental Services - Miami Lakes - Florida

# Limerock Bearing Ratio

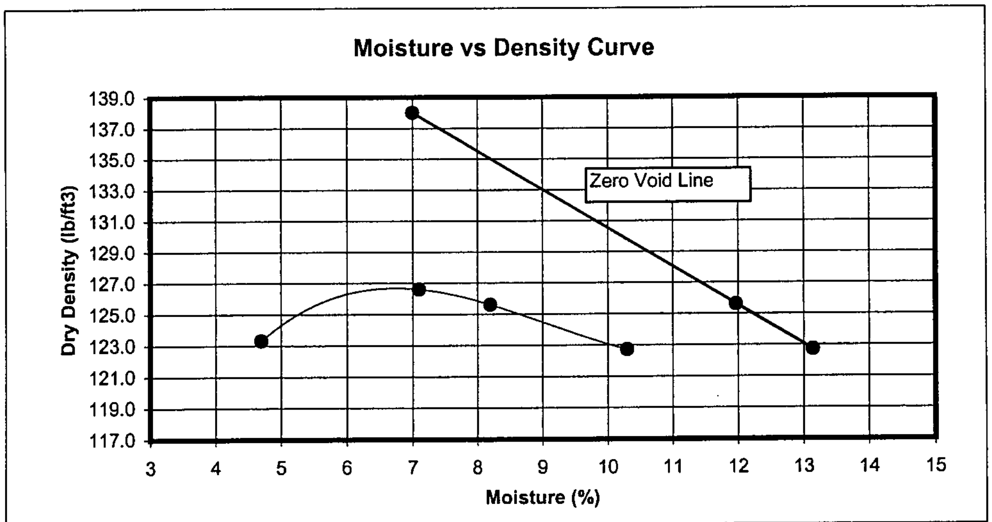
**Tamiami Trail**

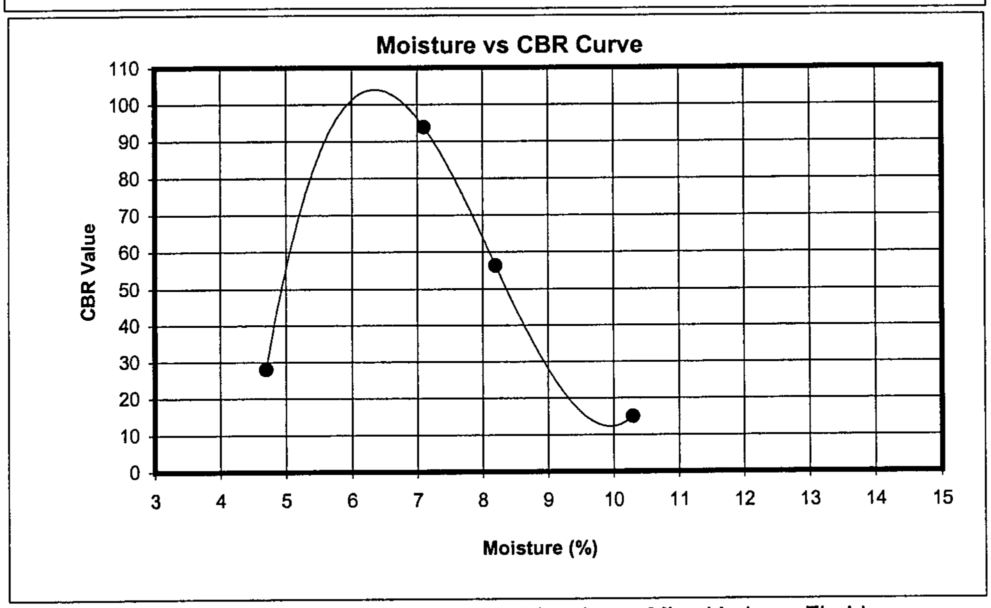
**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.7 | 123.30 | 28.00 | 97.3 |
| 6 | 7.1 | 126.60 | 93.80 | 99.9 |
| 8 | 8.2 | 125.60 | 56.30 | 99.1 |
| 10 | 10.3 | 122.70 | 15.00 | 96.8 |

**Note : Moisture Content Before Soaking**

**Date**
**11-Aug-00**




**SAMPLE LOCATION**
**DCB-10**

**SOIL DESCRIPTION**
**Subgrade**

**OPTIMUM CBR**
**105**

**Modified Proctor**
**MAXIMUM DENSITY**
**126.7**

**OPTIMUM MOISTURE**
**6.5%**

**CHECKED BY:**

Law Engineering and Environmental Services - Miami Lakes - Florida

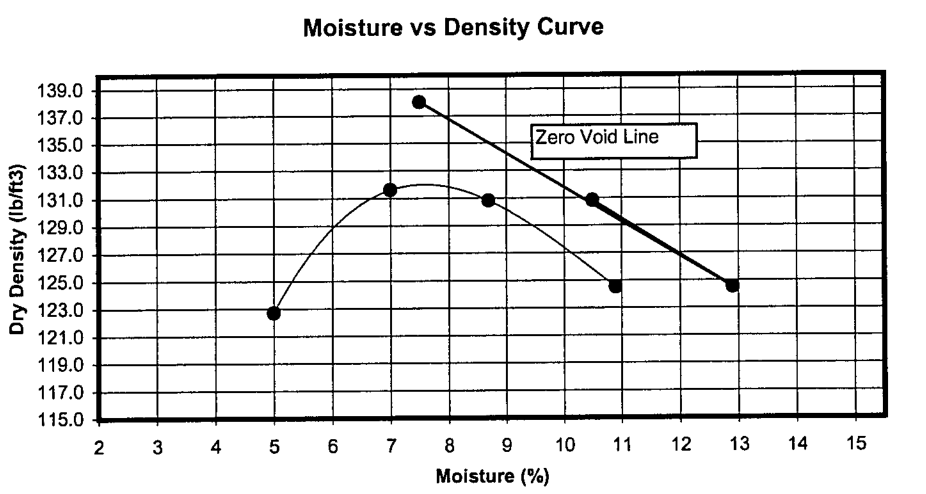
# California Bearing Ratio

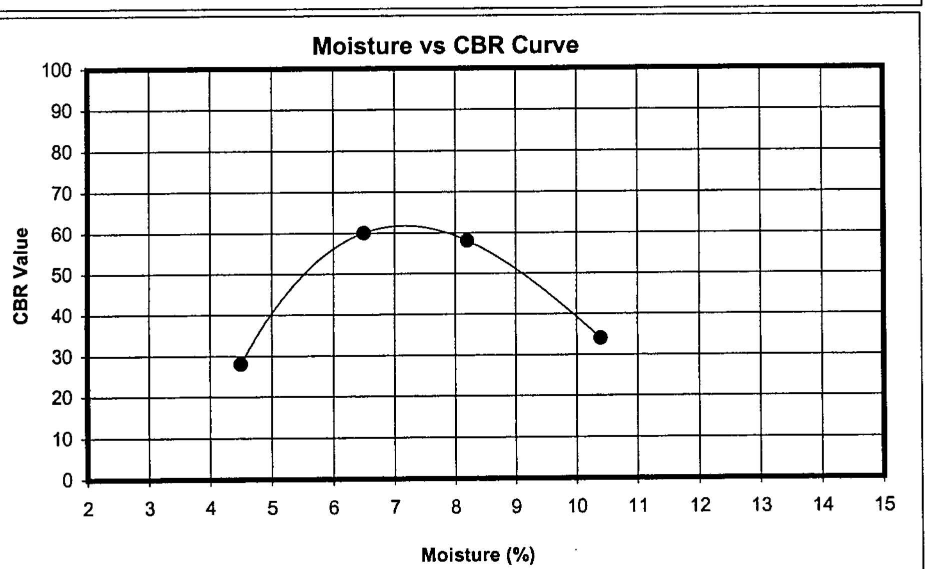
**COE - US 441**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.5 | 122.70 | 28.00 | 93.1 |
| 6 | 6.5 | 131.60 | 60.00 | 99.8 |
| 8 | 8.2 | 130.80 | 58.00 | 94.5 |
| 10 | 10.4 | 124.50 | 34.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
7-Aug-00

**Method**
Wet

**SAMPLE LOCATION**
DCB 10.0

**SOIL DESCRIPTION**
Subgrade

**OPTIMUM CBR**
60

**Modified Proctor**
**MAXIMUM DENSITY**
131.8

**OPTIMUM MOISTURE**
7.0%

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

# California Bearing Ratio

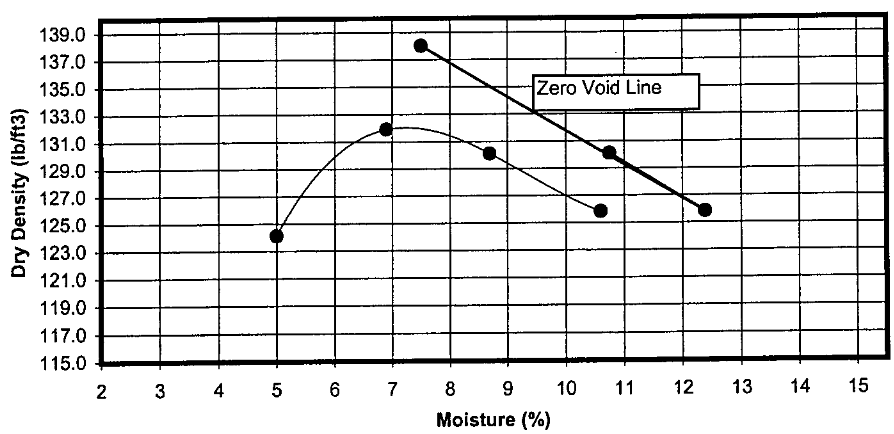
## Tamiami Trail

## 40700-0-2369

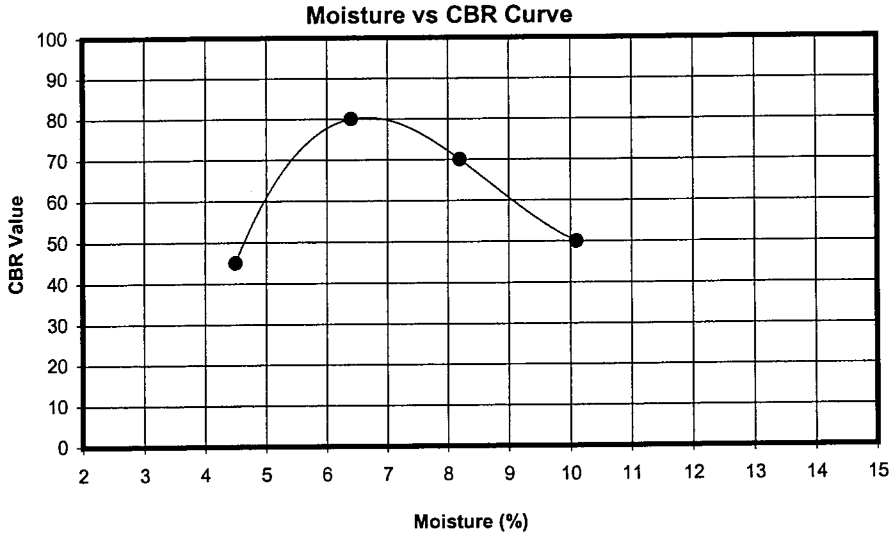
| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 4.5 | 124.10 | 45.00 | 93.1 |
| 6 | 6.4 | 131.90 | 80.00 | 99.8 |
| 8 | 8.2 | 130.10 | 70.00 | 94.5 |
| 10 | 10.1 | 125.80 | 50.00 | 99.2 |

**Note : Moisture Content Before Soaking**

**Moisture vs Density Curve**




**Moisture vs CBR Curve**




**Date**
**8-Aug-00**

**Method**
**Dry**

**SAMPLE LOCATION**
**DCB 10.0**

**SOIL DESCRIPTION**
**Subgrade**

**OPTIMUM CBR**
**80**

**Modified Proctor**
**MAXIMUM DENSITY**
**132**

**OPTIMUM MOISTURE**
**6.5%**

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

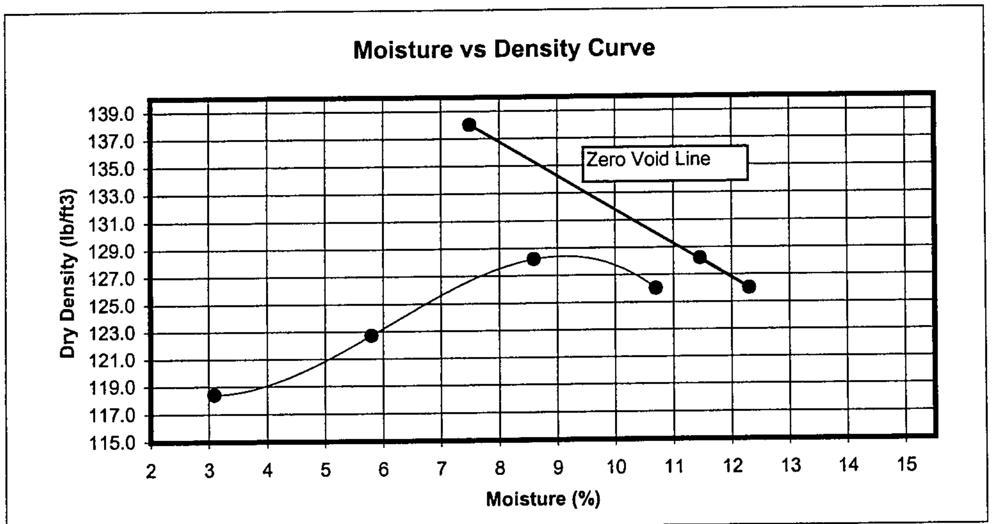
# California Bearing Ratio

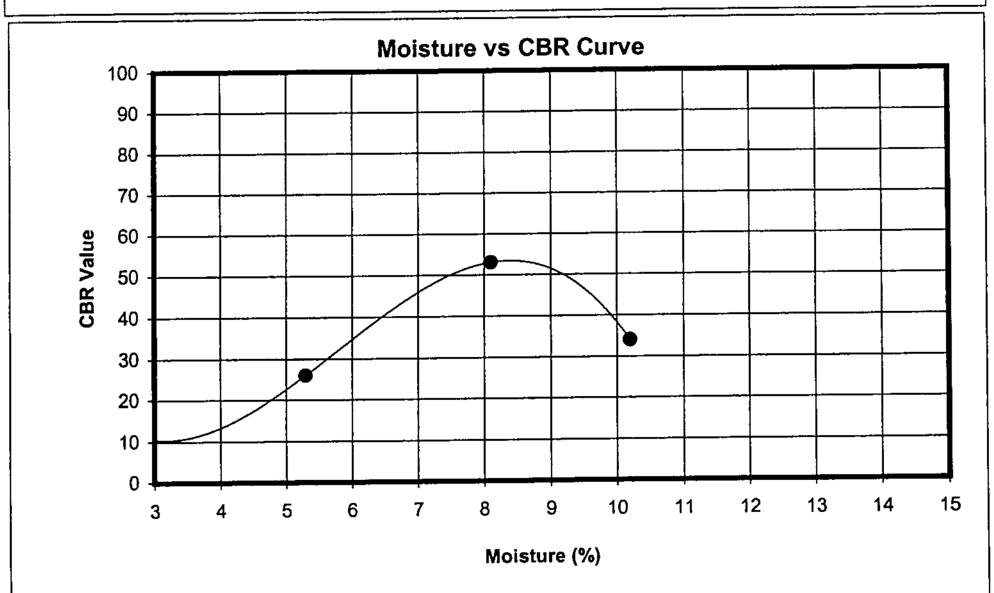
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 2.6 | 118.40 | 12.00 | 93.1 |
| 6 | 5.3 | 122.70 | 26.00 | 99.8 |
| 8 | 8.1 | 128.20 | 53.00 | 94.5 |
| 10 | 10.2 | 126.00 | 34.00 | 99.2 |

**Note : Moisture Content Before Soaking**




Law Engineering and Environmental Services - Miami Lakes - Florida

**Date**
18-Sep-00

**Method**
Wet

**SAMPLE LOCATION**
L.5

**SOIL DESCRIPTION**
Subgrade

**OPTIMUM CBR**
55

**Modified Proctor**
**MAXIMUM DENSITY**
128.5

**OPTIMUM MOISTURE**
8.5%

FM

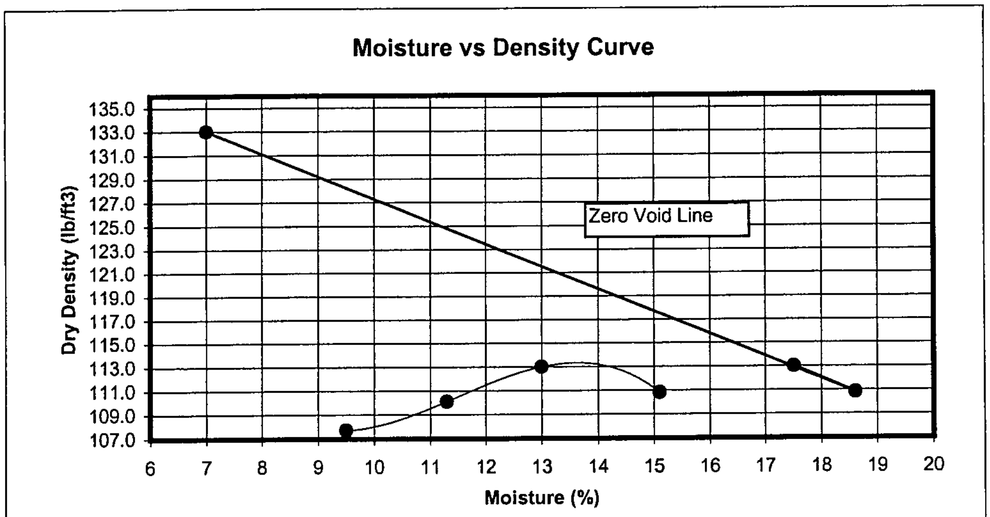
# California Bearing Ratio

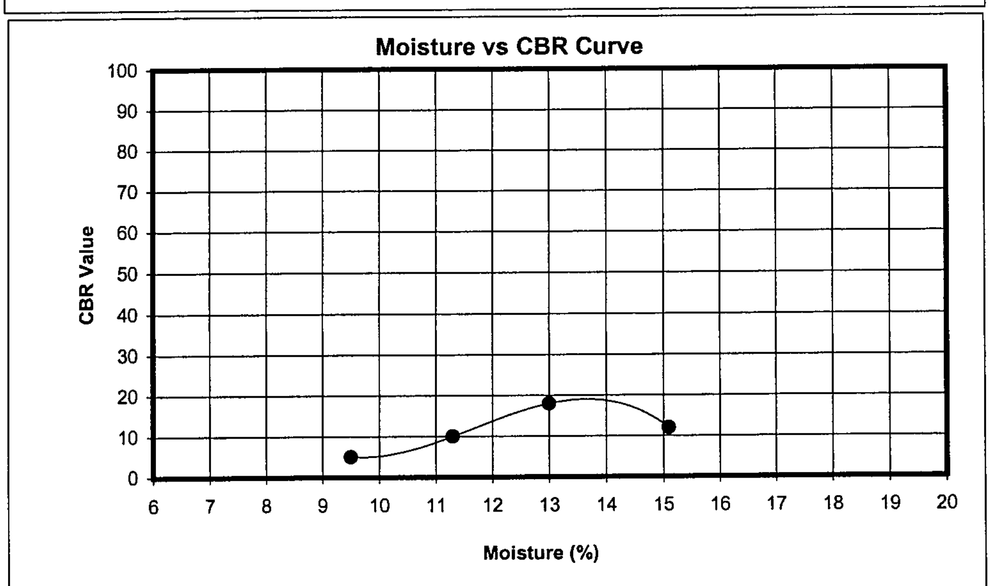
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 9.5 | 107.70 | 5.00 | 93.1 |
| 6 | 11.3 | 110.10 | 10.00 | 99.8 |
| 8 | 13.0 | 113.00 | 18.00 | 94.5 |
| 10 | 15.1 | 110.80 | 12.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
**18-Sep-00**

**Method**
**Dry**

**SAMPLE LOCATION**
**L.5**

**SOIL DESCRIPTION**
**Lt gray fine to med sand w/ Limerock**

**OPTIMUM CBR**
**19**

**Modified Proctor**
**MAXIMUM DENSITY**
**113.4**

**OPTIMUM MOISTURE**
**13.5%**

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

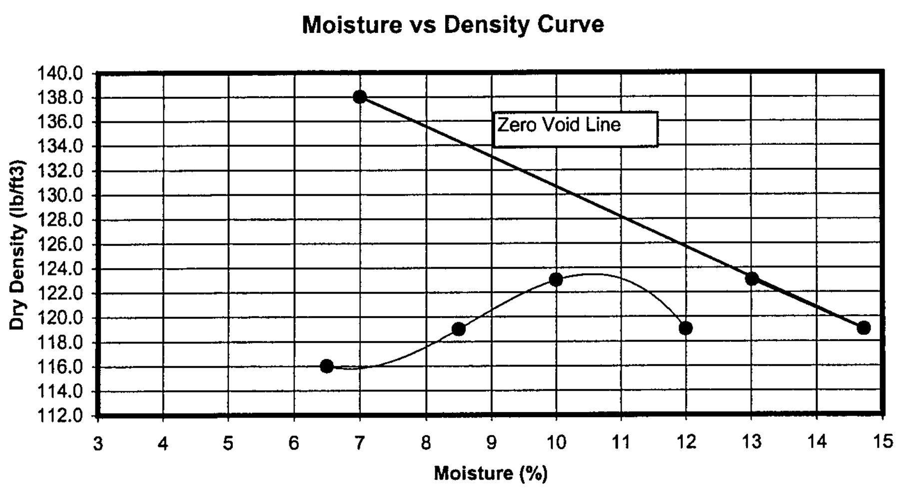
# California Bearing Ratio

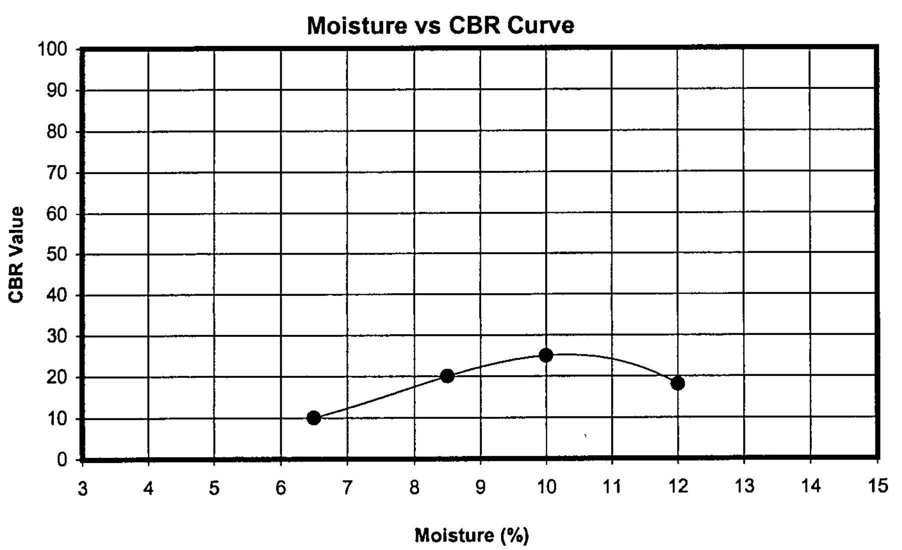
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 6.5 | 116.00 | 10.00 | 93.1 |
| 6 | 8.5 | 119.00 | 20.00 | 99.8 |
| 8 | 10.0 | 123.00 | 25.00 | 94.5 |
| 10 | 12.0 | 119.00 | 18.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
Wet

**SAMPLE LOCATION**
L2.5

**SOIL DESCRIPTION**
Sandy Limerock

**OPTIMUM CBR**
25

**Modified Proctor**
**MAXIMUM DENSITY**
123

**OPTIMUM MOISTURE**
10.5%

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

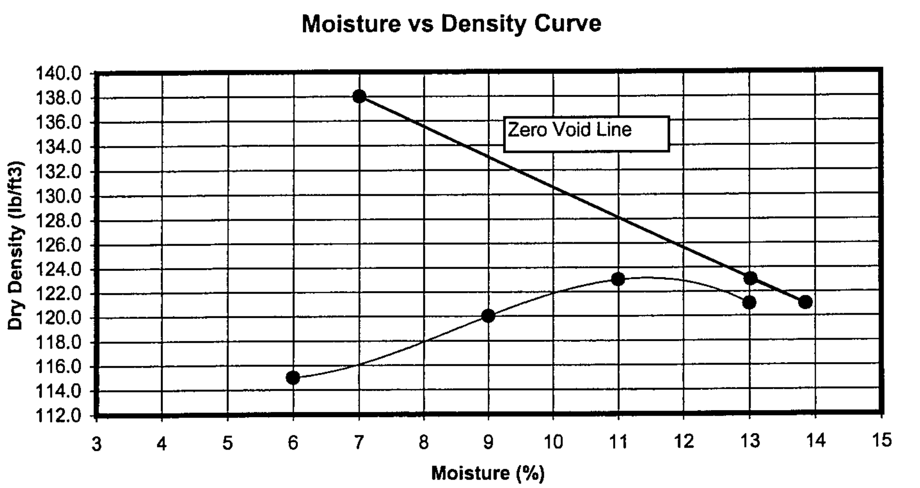
# California Bearing Ratio

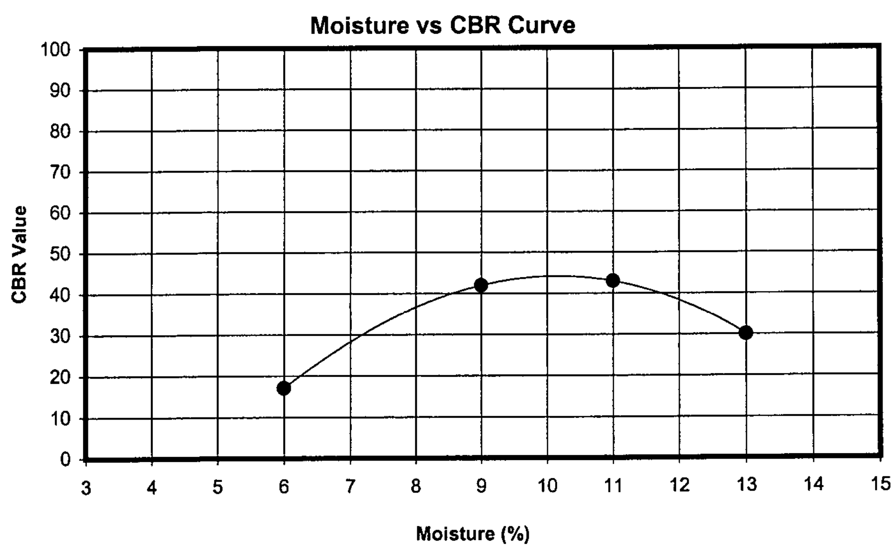
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 6.0 | 115.00 | 17.00 | 93.1 |
| 6 | 9.0 | 120.00 | 42.00 | 99.8 |
| 8 | 11.0 | 123.00 | 43.00 | 94.5 |
| 10 | 13.0 | 121.00 | 30.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
Dry

**SAMPLE LOCATION**
L2.5

**SOIL DESCRIPTION**
Sandy Limerock

**OPTIMUM CBR**
45

**Modified Proctor**
**MAXIMUM DENSITY**
123

**OPTIMUM MOISTURE**
11.5%

FM

Law Engineering and Environmental Services - Miami Lakes - Florida

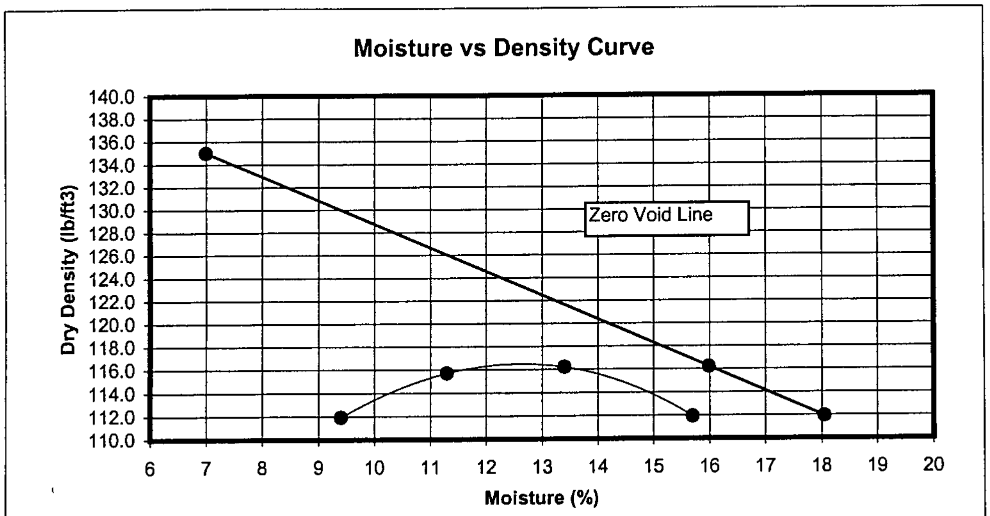
# California Bearing Ratio

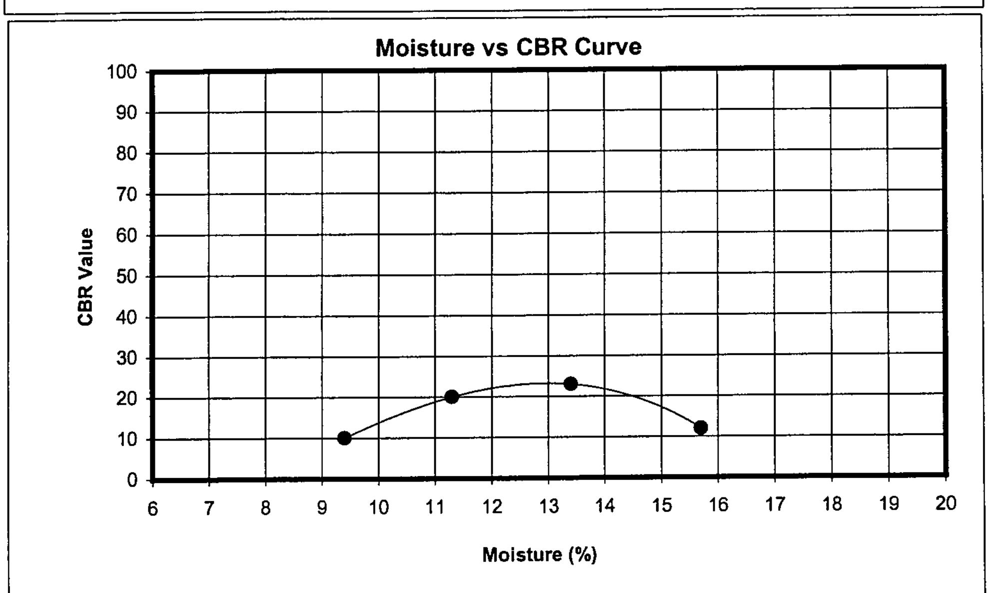
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 9.4 | 111.90 | 10.00 | 93.1 |
| 6 | 11.3 | 115.70 | 20.00 | 99.8 |
| 8 | 13.4 | 116.20 | 23.00 | 94.5 |
| 10 | 15.7 | 111.90 | 12.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
Wet

**SAMPLE LOCATION**
L4.5

**SOIL DESCRIPTION**
Lt gray Sand w/ Limerock

**OPTIMUM CBR**
23

**Modified Proctor**
**MAXIMUM DENSITY**
116.5

**OPTIMUM MOISTURE**
12.5%

FA

Law Engineering and Environmental Services - Miami Lakes - Florida

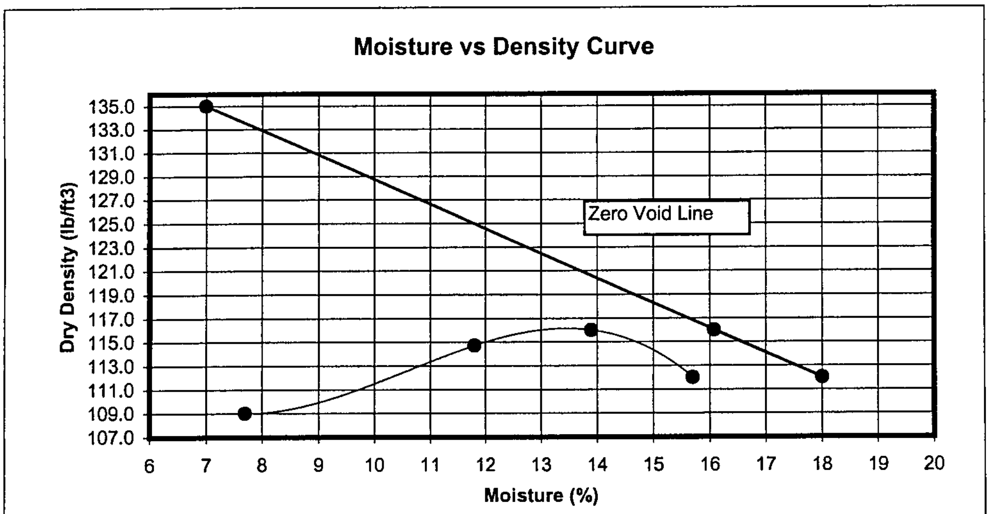
# California Bearing Ratio

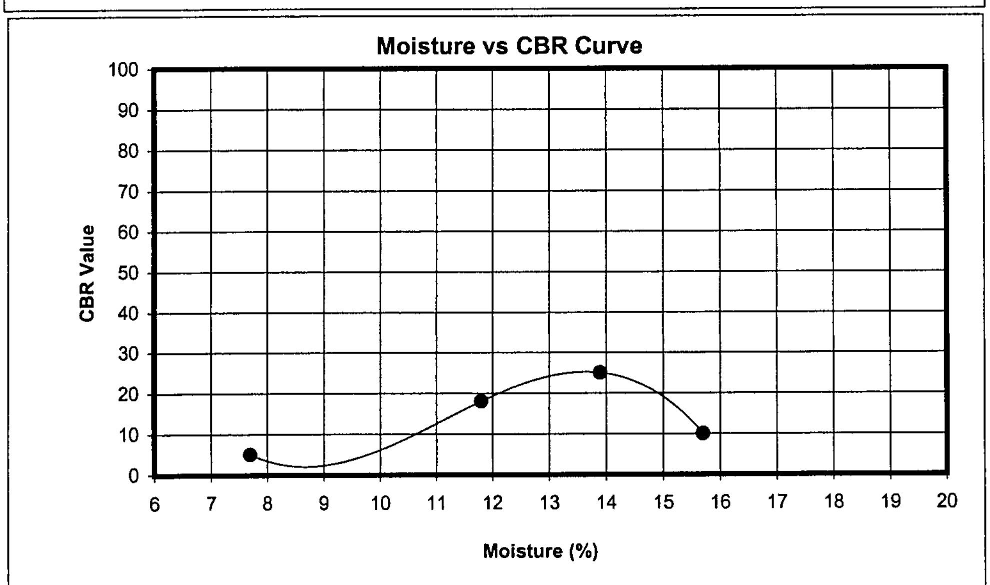
**Tamiami Trail**

**40700-0-2369**

| Sample Number | Moisture (%) | Dry Density (lb/ft3) | CBR (%) | Compaction (%) |
|---|---|---|---|---|
| 4 | 7.7 | 109.00 | 5.00 | 93.1 |
| 6 | 11.8 | 114.70 | 18.00 | 99.8 |
| 8 | 13.9 | 116.00 | 25.00 | 94.5 |
| 10 | 15.7 | 112.00 | 10.00 | 99.2 |

**Note : Moisture Content Before Soaking**




**Date**
18-Sep-00

**Method**
Dry

**SAMPLE LOCATION**
L4.5

**SOIL DESCRIPTION**
Lt gray Sand w/ Limerock

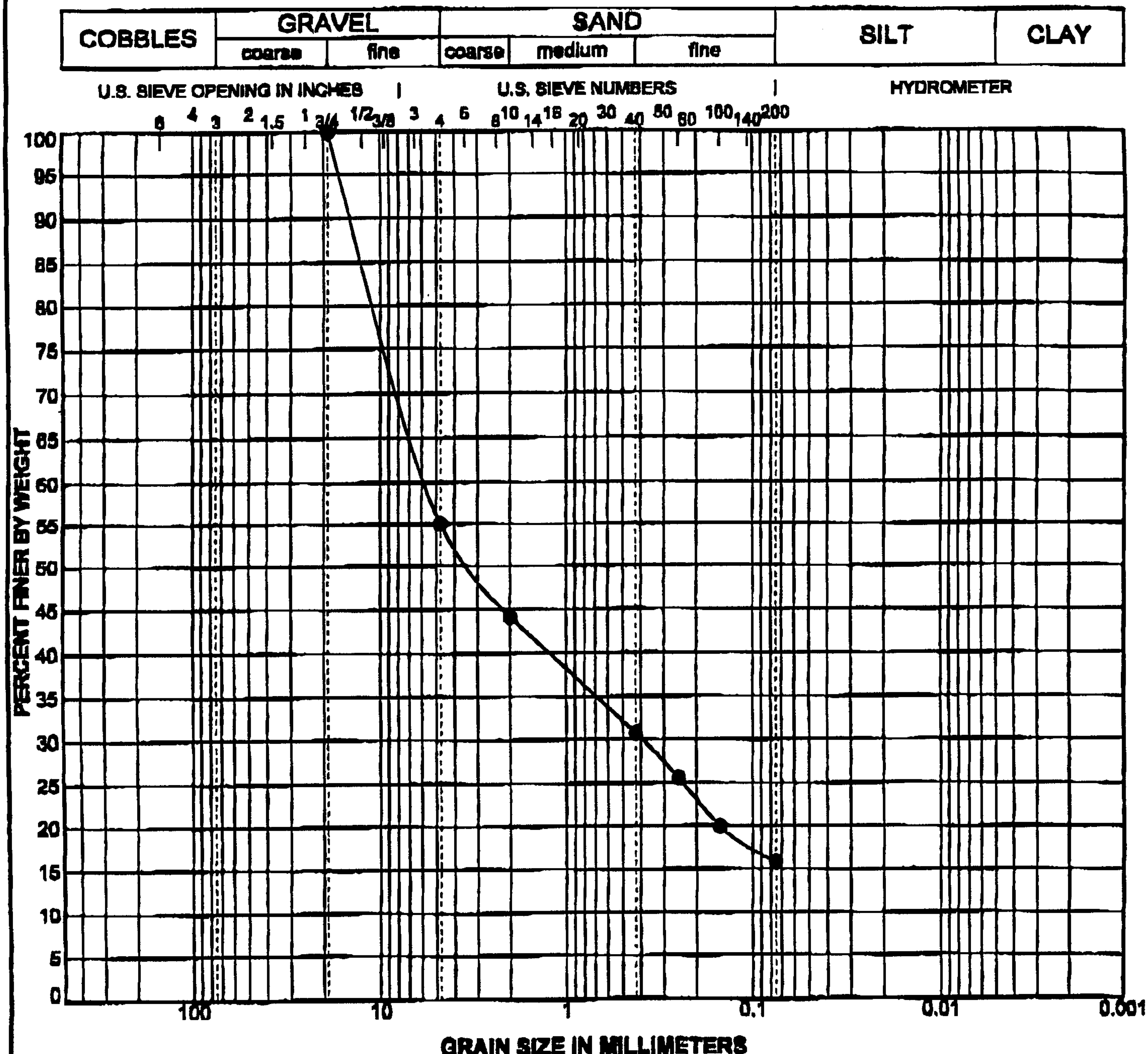
**OPTIMUM CBR**
25

**Modified Proctor MAXIMUM DENSITY**
116

**OPTIMUM MOISTURE**
13.5%

FA

Law Engineering and Environmental Services - Miami Lakes - Florida




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | DBC-0.5 S-2 | 1.5'-3.0' | SILTY GRAVEL with SAND | GM | 19 | 5.536 | 0.397 | | | |

**Remarks:**

Test Method - ASTM D422

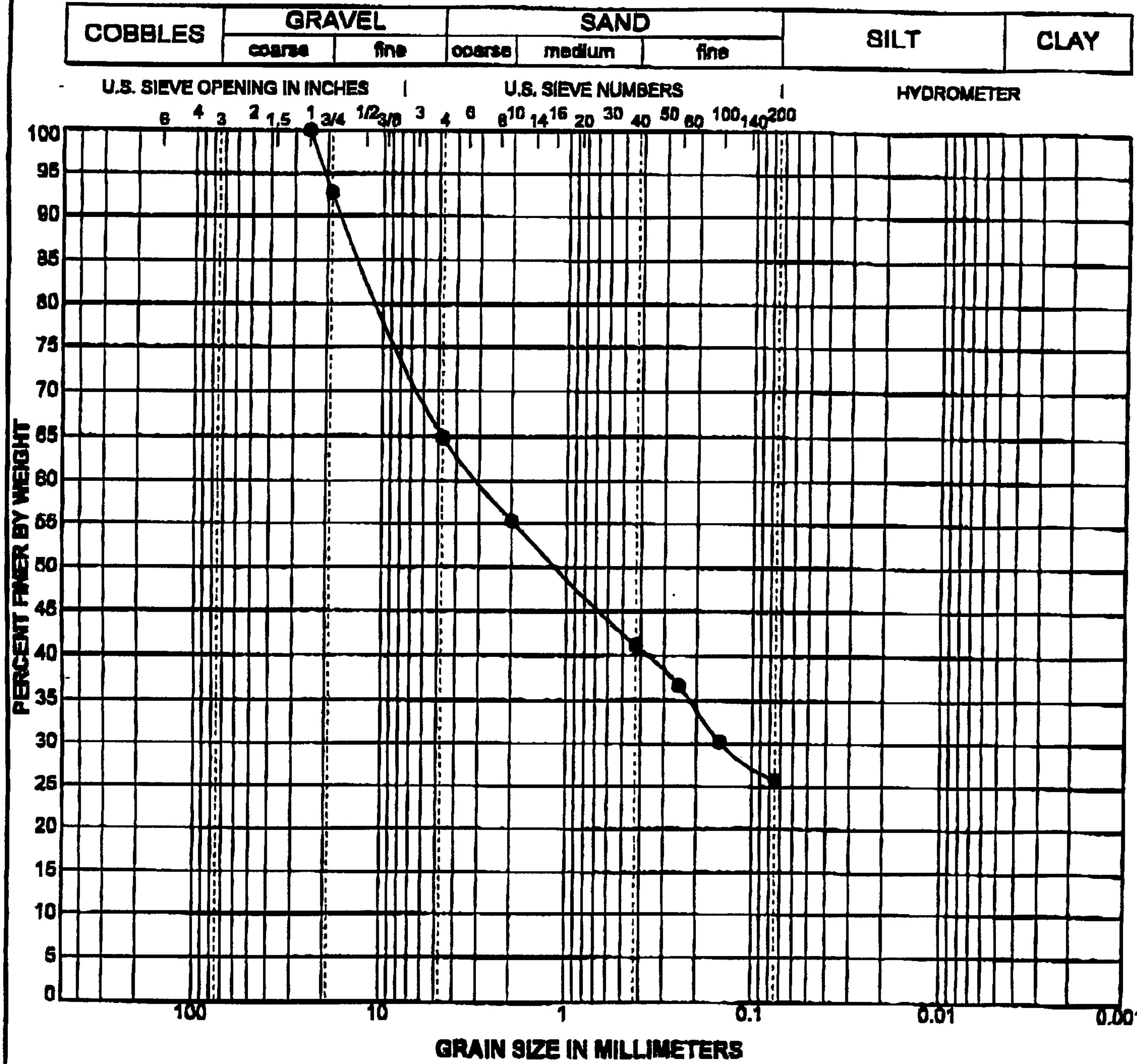
# GRAIN SIZE DISTRIBUTION

Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: FA

LAWGIBB GROUP




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | CB-2.0 S-2 | 1.5'-3.0' | SILTY SAND with GRAVEL | SM | 25 | 3.048 | 0.147 | | | |

**Remarks:**

Test Method - ASTM D422

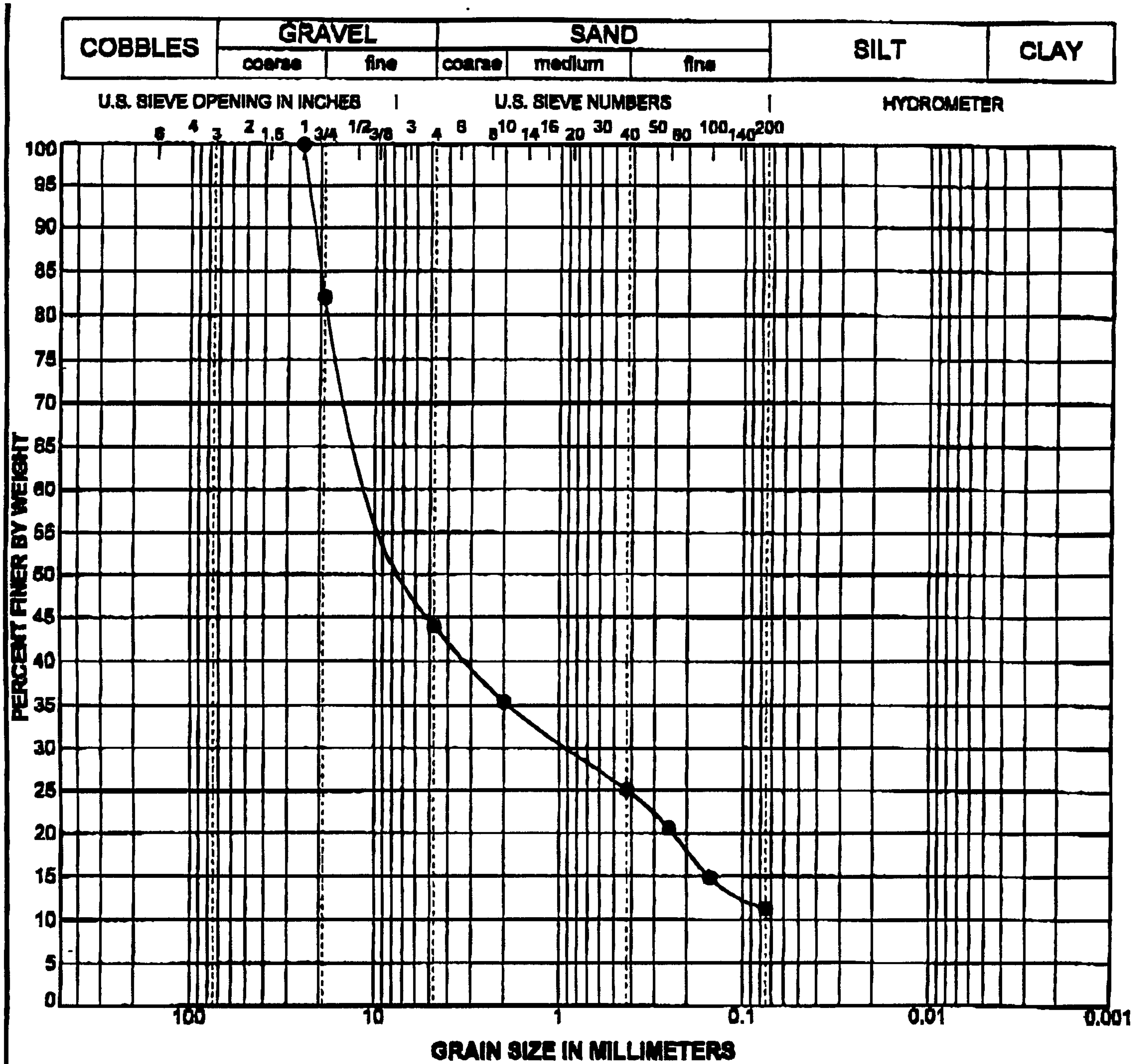
## GRAIN SIZE DISTRIBUTION

Project: Tamiami Tail

Project No: 40700-0-2289

Checked By: FA

LAWGIBB GROUP




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | CB-2.5 S-2 | 1.5'-3.0' | WELL-GRADED GRAVEL with SILT and SAND | GW-GM | 25 | 8.535 | 0.898 | | 1.61 | 145.47 |

**Remarks:**

Test Method - ASTM D422

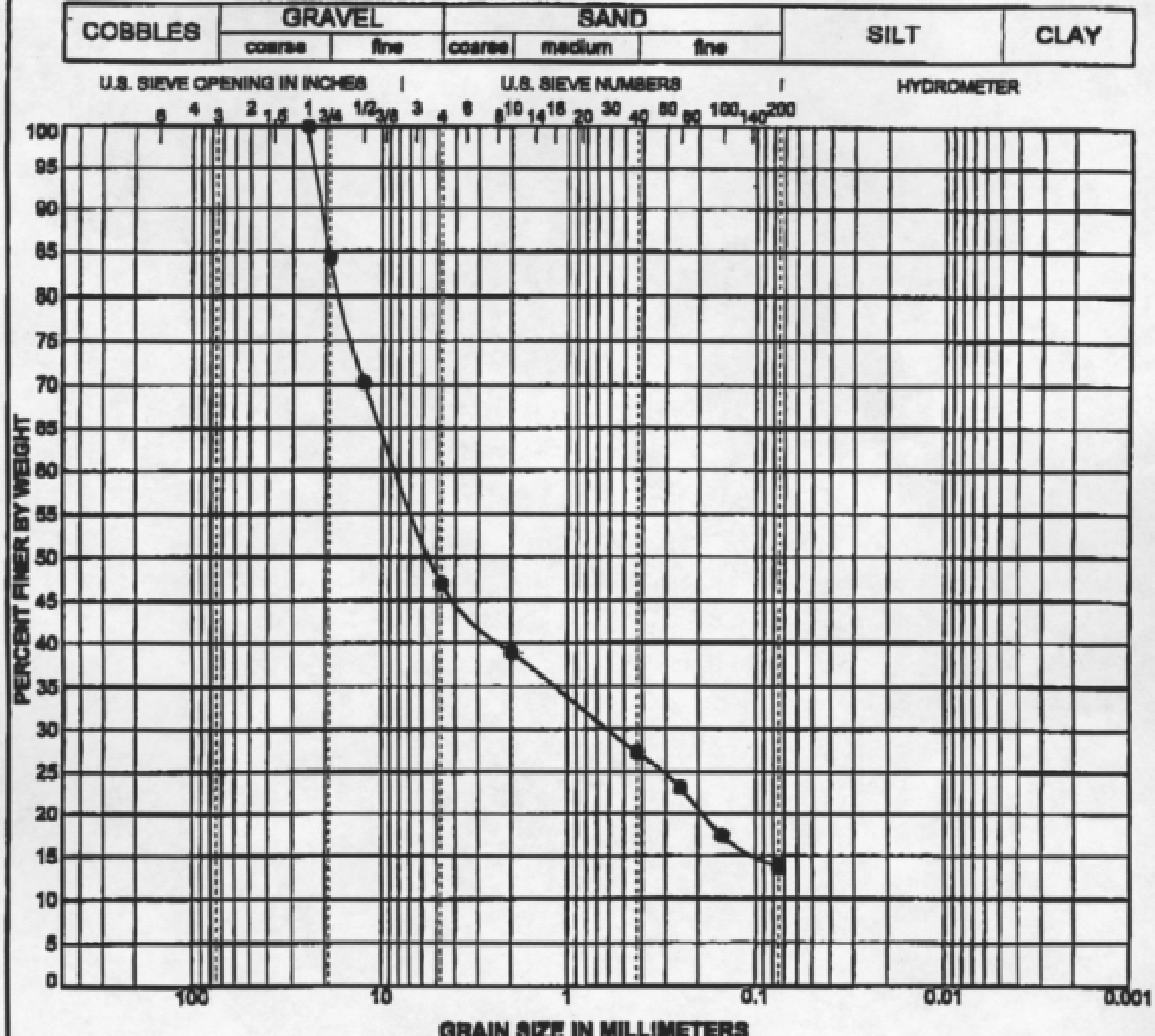
## GRAIN SIZE DISTRIBUTION

Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: FA

LAWGIBB GROUP




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | CB-4.0 S-2 | 1.5'-3.0' | SILTY GRAVEL with SAND | GM | 25 | 8.17 | 0.614 | | | |

**Remarks:**

Test Method - ASTM D422

# GRAIN SIZE DISTRIBUTION

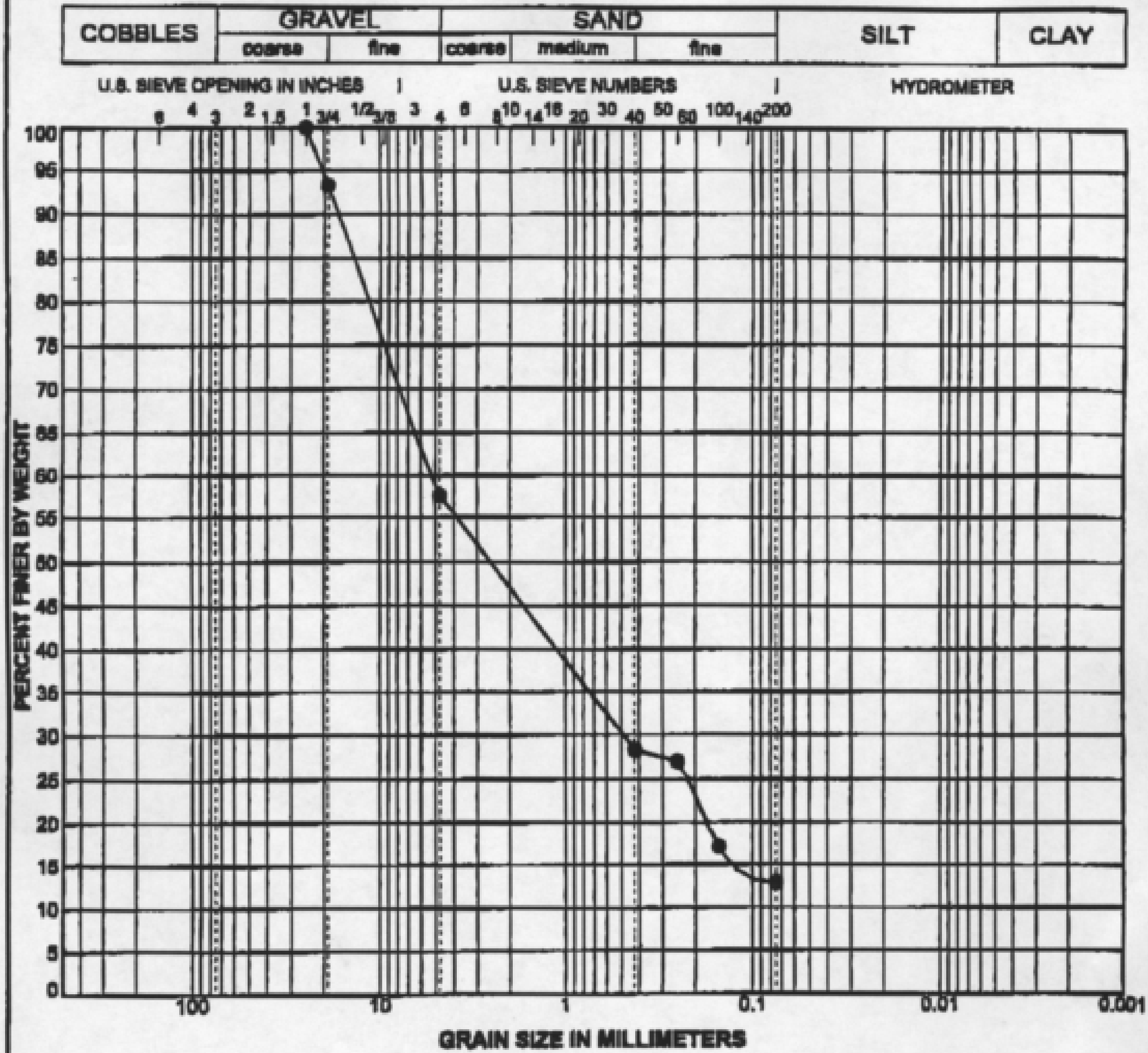
Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: FA

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GIBB.GDT 12/11/00




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | CB-6.0 S-2 | 1.5'-3.0' | SILTY SAND with GRAVEL | SM | 25 | 5.229 | 0.49 | | | |

Remarks:

Test Method - ASTM D422

## GRAIN SIZE DISTRIBUTION

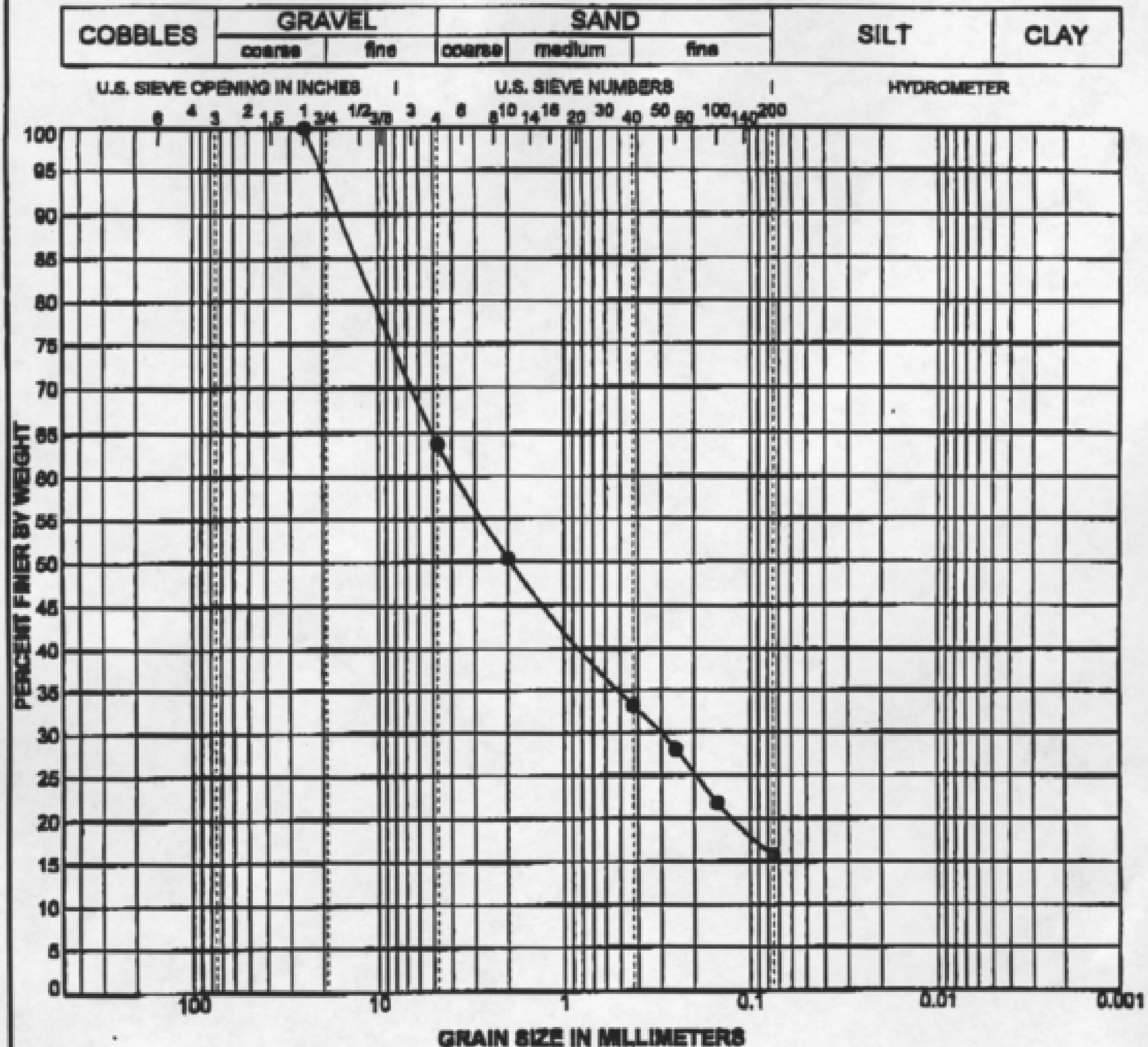
Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: [signature]

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GIBB.GDT 12/11/00




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | DCB-6.5 S-1 | 0.0'-1'-5" | SILTY SAND with GRAVEL | SM | 25 | 3.734 | 0.306 | | | |

**Remarks:**

Test Method - ASTM D422

# GRAIN SIZE DISTRIBUTION

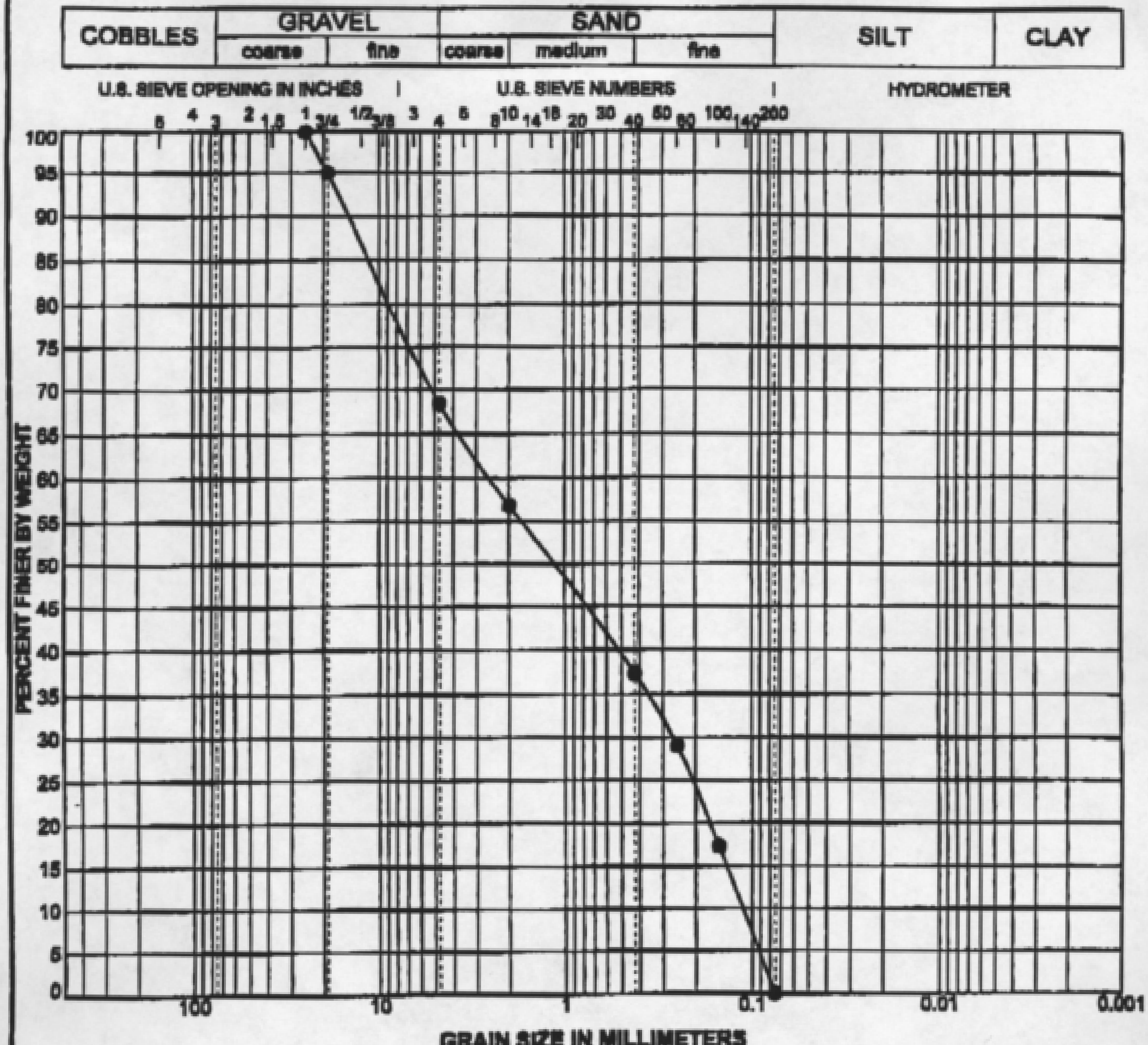
Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: RA

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GIBB.GDT 12/13/99




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | DCB-8.0 S-3 | 3.0'-4.5' | POORLY GRADED SAND with GRAVEL | SP | 25 | 2.53 | 0.267 | 0.112 | 0.25 | 22.62 |

**Remarks:**

Test Method - ASTM D422

## GRAIN SIZE DISTRIBUTION

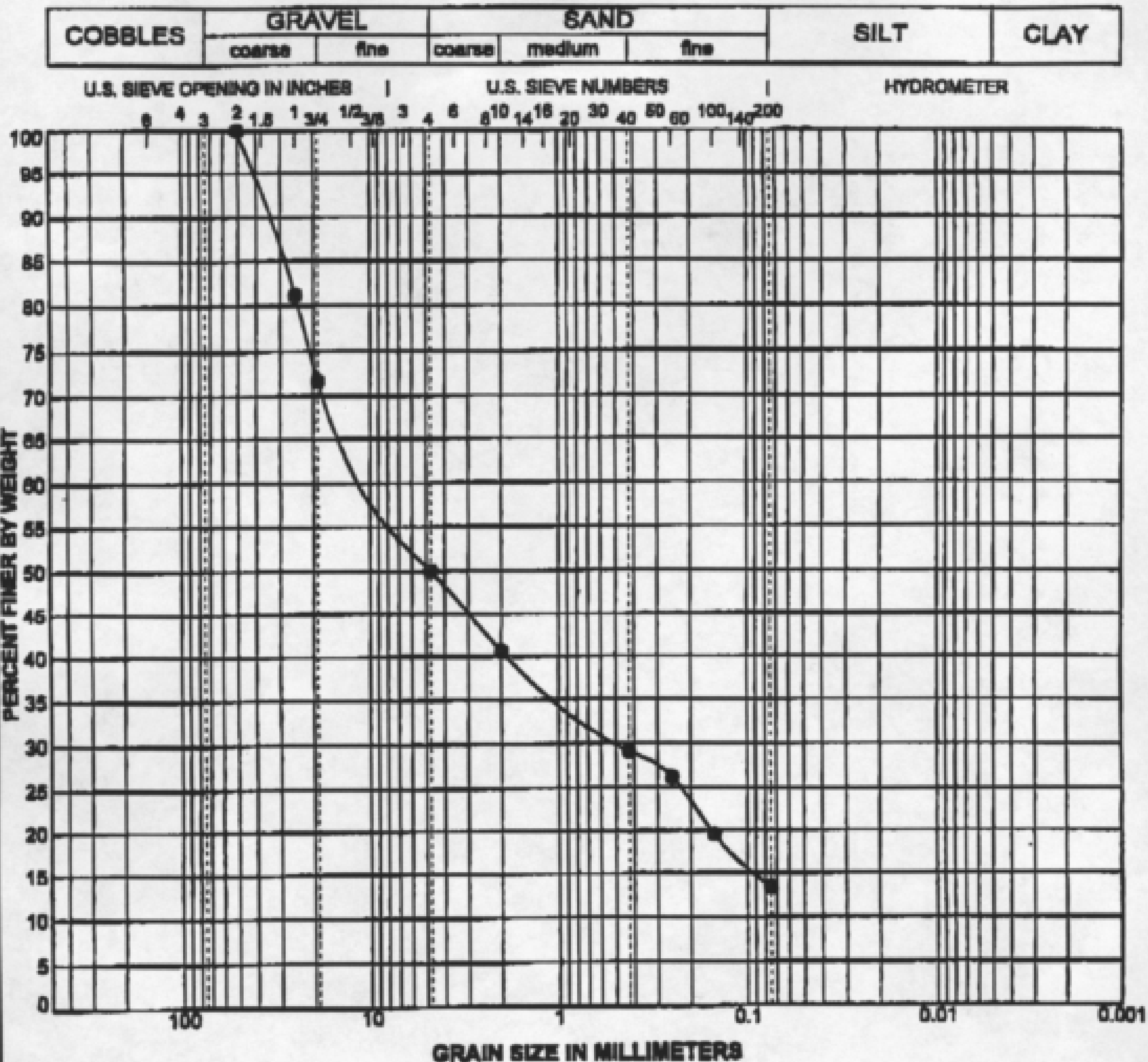
Project: Tamiami Trail

Project No: 40700-0-2269

Checked By: FA

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GIBB.GDT 12/11/00




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | DBC-8.5 S-2 | 1.5'-3.0' | SILTY GRAVEL with SAND | GM | 50.8 | 9.009 | 0.477 | | | |

**Remarks:**

Test Method - ASTM D422

# GRAIN SIZE DISTRIBUTION

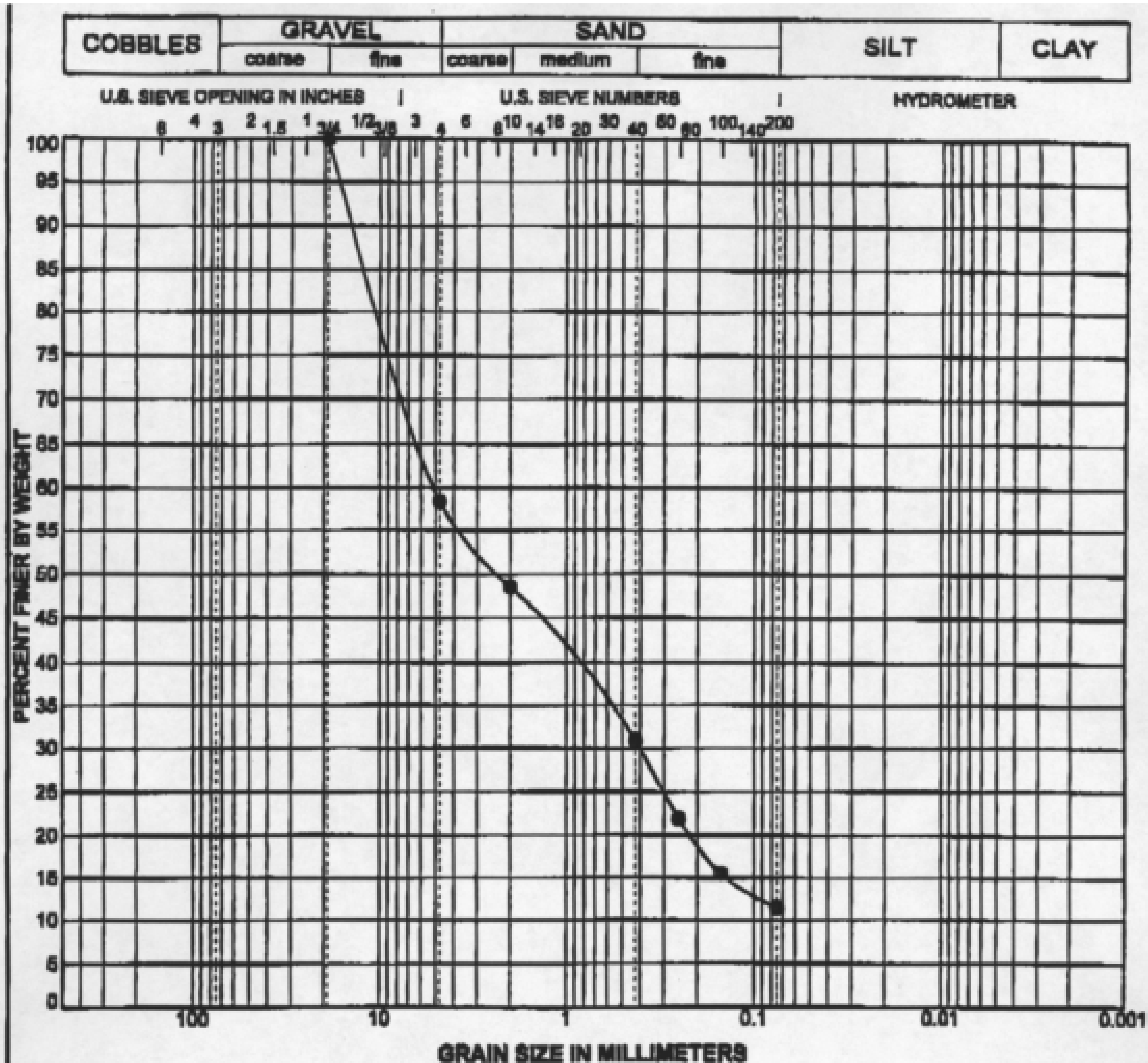
Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: FA

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GSM.GDT 12/1/00




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | DCB-10 S-7 | 0'-1.5' | POORLY GRADED SAND with SILT and GRAVEL | SP-SM | 19 | 5.006 | 0.405 | | 0.56 | 84.96 |

**Remarks:**

Test Method - ASTM D422

## GRAIN SIZE DISTRIBUTION

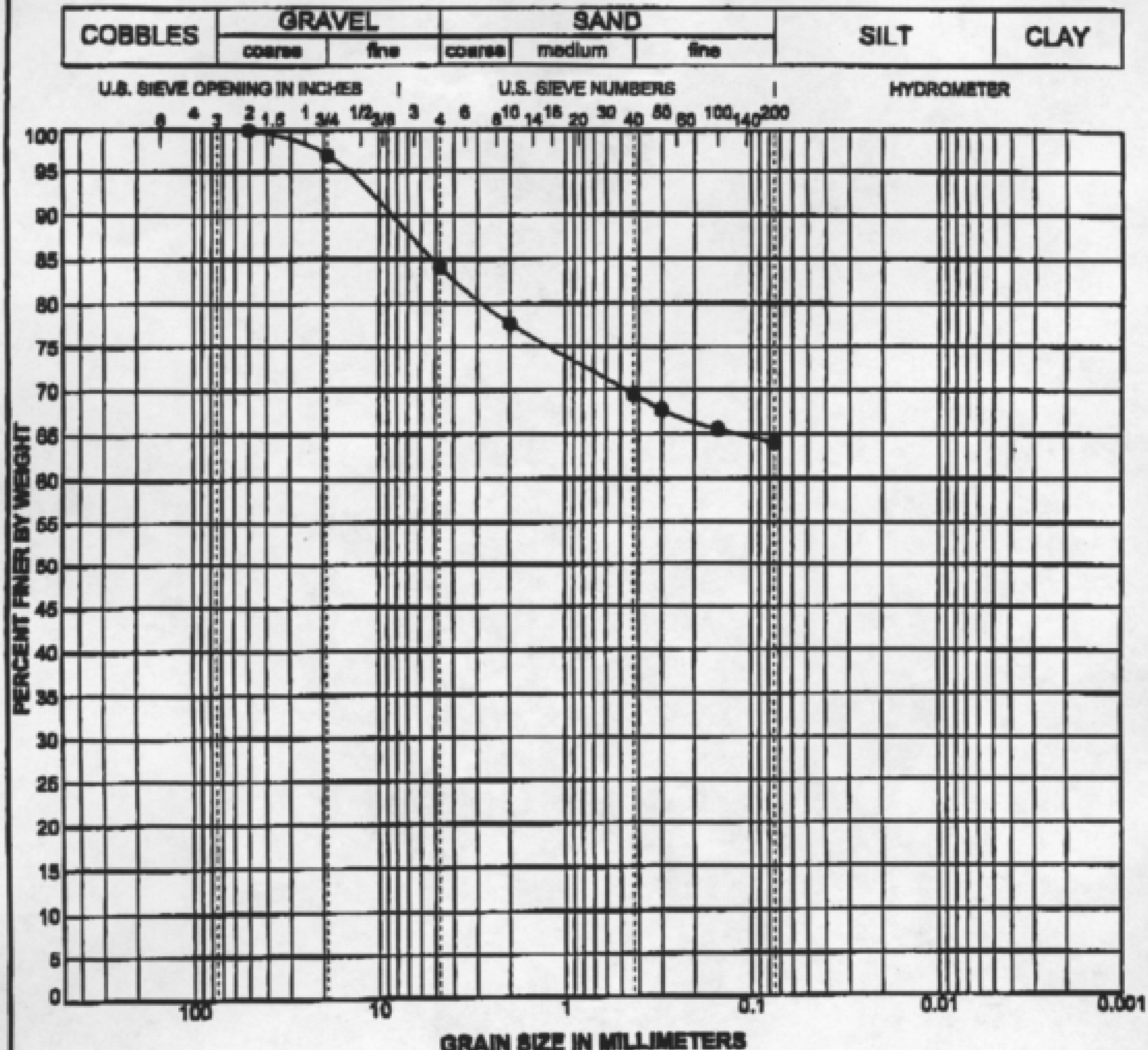
Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: ______

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GIBB.GDT 12/1/00




| Symbol | Location | Depth, feet | Soil Classification | USCS | $D_{100}$, mm | $D_{60}$, mm | $D_{30}$, mm | $D_{10}$, mm | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | DBC-10.6 S-5 | 6.0'-7.5' | SANDY SILT with GRAVEL | ML | 50.8 | | | | | |

**Remarks:**

Test Method - ASTM D422

## GRAIN SIZE DISTRIBUTION

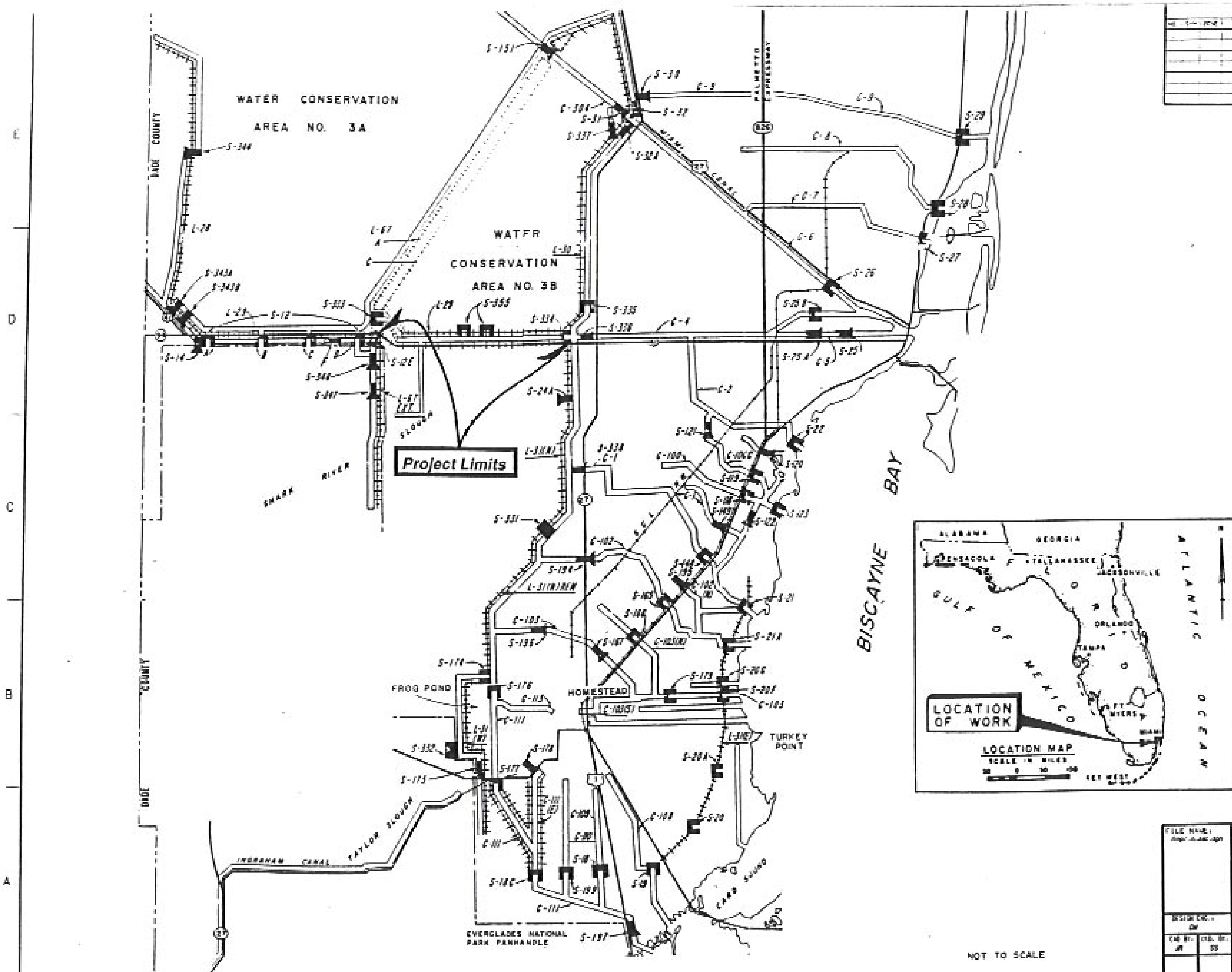
Project: Tamiami Tail

Project No: 40700-0-2269

Checked By: FA

LAWGIBB GROUP

LAW_GRAIN_SIZE TAMIAMI.GPJ LAW_GIBB.GDT 12/1/00




REVISIONS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

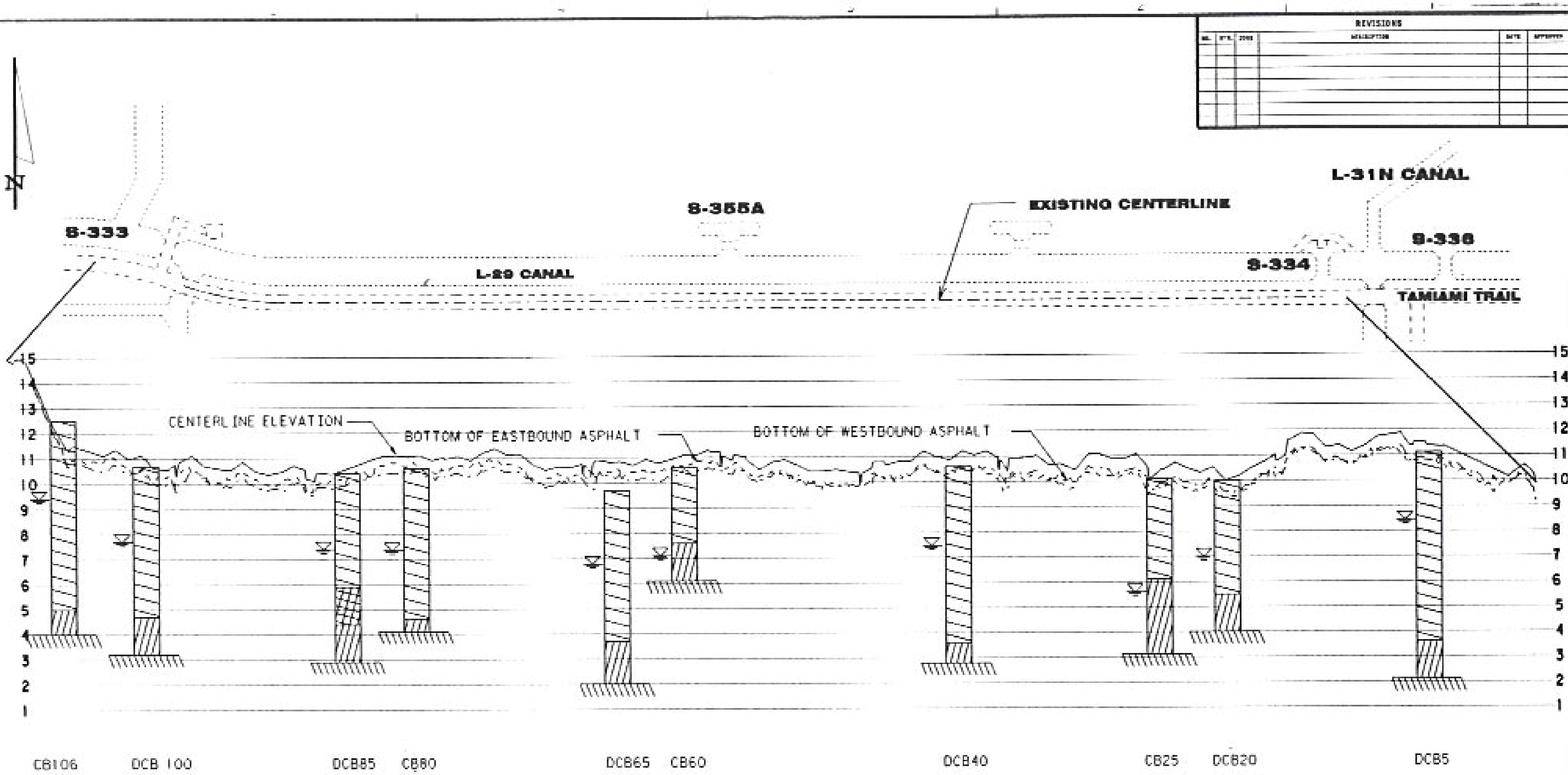
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE -IMP

DRAWING NO. PLATE A0-0

SCALE: AS SHOWN

D.O.FILE NO. 0005




| DESCRIPTION | NORTH | EAST | STATION | OFFSET | ELEVATION |
|---|---|---|---|---|---|
| CB 106 | 518,987.20 | 763,883.90 | 737+10.534 | -1.187 | 12.5 |
| DCB 100 | 518,942.90 | 767,146.40 | 771+03.660 | 10.064 | 10.7 |
| DCB 85 | 518,977.30 | 775,094.80 | 850+52.146 | -4.456 | 10.4 |
| CB 80 | 518,964.00 | 777,834.20 | 877+91.512 | 14.632 | 10.6 |
| DCB 65 | 519,016.10 | 785,802.50 | 957+59.921 | -16.197 | 9.7 |
| CB 60 | 518,997.60 | 788,503.30 | 984+60.634 | 12.319 | 10.6 |
| DCB 40 | 519,034.40 | 799,367.90 | 1093+25.296 | 16.802 | 10.6 |
| CB 25 | 519,100.20 | 807,337.80 | 1172+95.363 | -15.249 | 10.1 |
| DCB 20 | 519,086.20 | 810,051.50 | 1200+08.988 | 11.434 | 10 |
| DCB 5 | 519,141.50 | 818,062.00 | 1280+19.659 | -6.384 | 11.1 |
| T 5 | 519,391.20 | 818,353.40 | 1283+12.223 | -254.719 | 15.7 |
| R 25 | 519,295.80 | 807,541.10 | 1172+99.597 | -210.831 | 9.3 |
| T 45 | 519,503.80 | 796,613.00 | 1065+71.353 | -262.623 | 17.7 |
| R 65 | 519,211.50 | 785,789.80 | 957+47.940 | -211.642 | 9.6 |
| T 85 | 519,232.40 | 775,086.70 | 850+44.579 | -259.572 | 16.4 |
| R 105 | 519,238.50 | 763,923.90 | 737+01.376 | -261.524 | 9.5 |

NOTES:
1. LOCATIONS SHOWN BASED ON PBSJ SURVEY.
2. FIELD TESTING CONDUCTED BY LAWGIBB GROUP, 7-25-00 TO 8-14-00.
3. DCB= DRILLING, CORING AND BORING
4. CB= CORING AND BORING ONLY.
5. PAVEMENT THICKNESSES FROM INFRASTRUCTURE MANAGEMENT SYSTEMS (IMS) GPR SURVEY, JULY 2000.

LEGEND

- WATER ELEVATION
- GRANULAR MATERIAL
- SAND
- PEAT
- BEDROCK

NOT TO SCALE

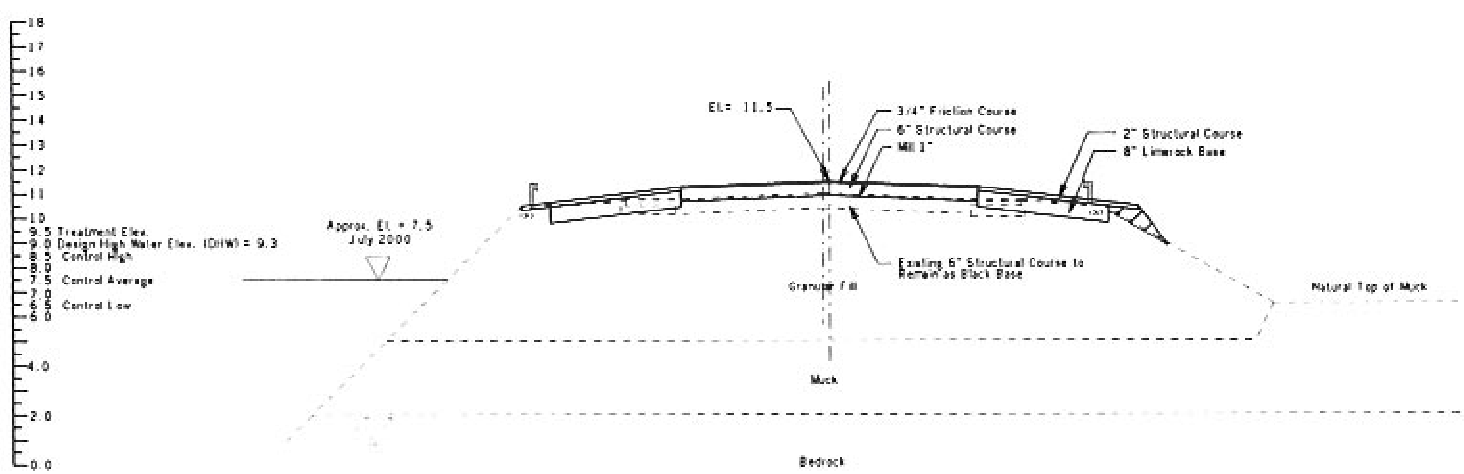
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# GEOTECHNICAL DATA

PLATE B-1

D.O.FILE NO. 0005



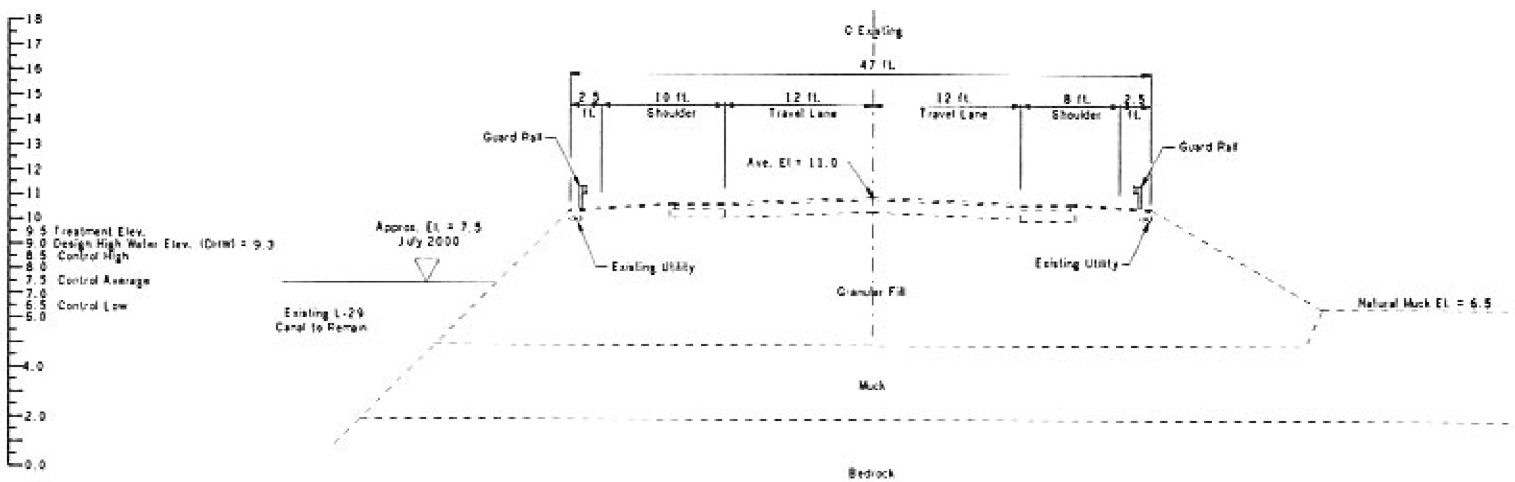

# TYPICAL SECTION
# EXISTING FACILITY- IMPROVED

LOOKING EAST

1" = 10' HORIZONTAL
1" = 5' VERTICAL

| | |
|---|---|
| FILE NAME: | DEPARTMENT OF THE ARMY<br>JACKSONVILLE DISTRICT, CORPS OF ENGINEERS<br>JACKSONVILLE, FLORIDA |
| | CENTRAL AND SOUTHERN FLORIDA PROJECT<br>FOR FLOOD CONTROL AND OTHER PURPOSES<br>TAMIAMI TRAIL ALTERNATIVES<br>EXISTING FACILITY<br>IMPROVED |
| DESIGN ENG.: AV | |
| DRAWN: MF / CHECKED: JA | INV. NO. / DATED: / SCALE: AS SHOWN / DRAWING NO. PLATE AI-0 |

D.O.FILE NO. 0005




# TYPICAL SECTION
# EXISTING ALIGNMENT AND PROFILE
# WITH FOUR NEW BRIDGES

LOOKING EAST

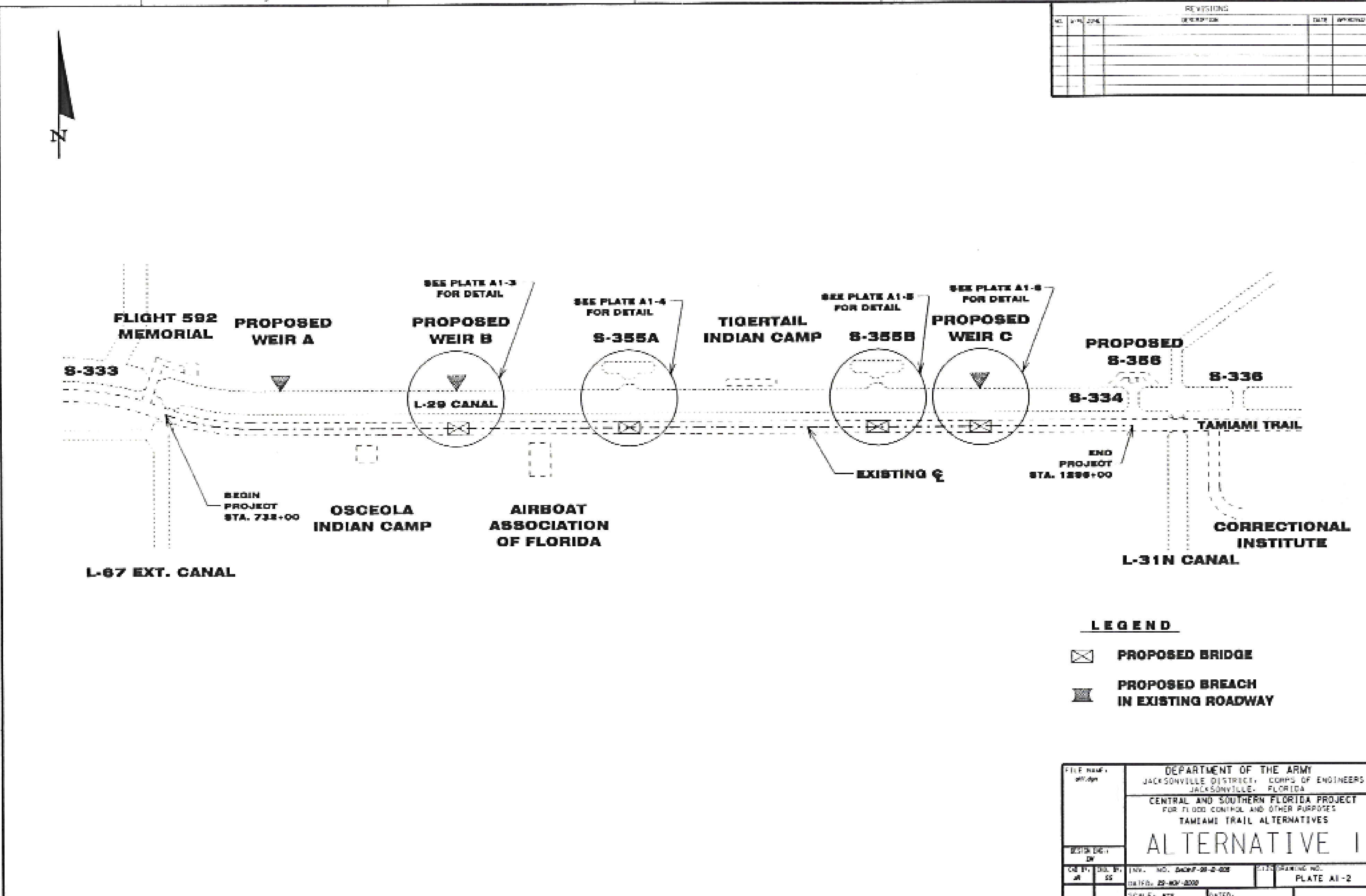
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 1

PLATE A1-1

D.O.FILE NO. 0005




DEPARTMENT OF THE ARMY
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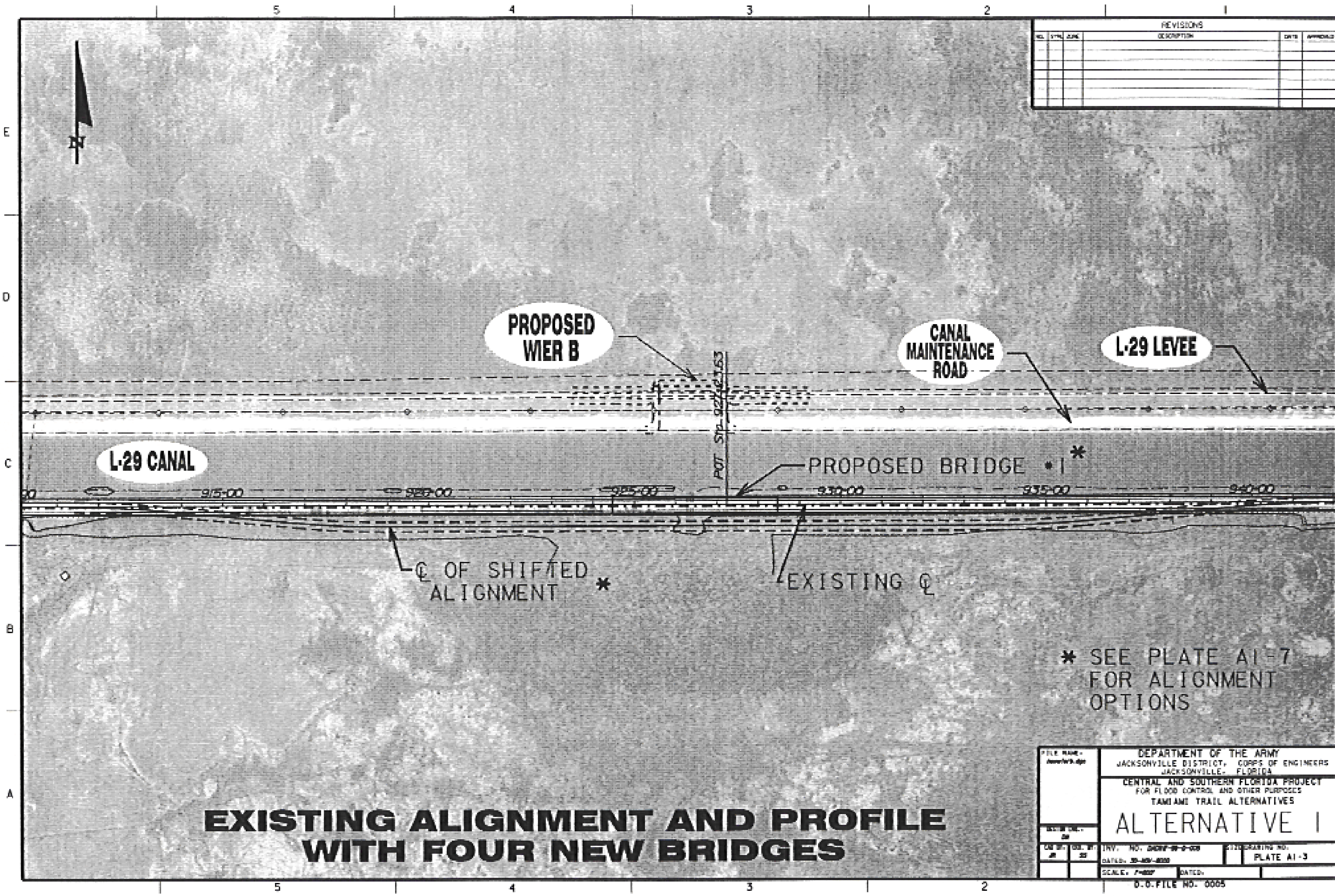
JACKSONVILLE, FLORIDA

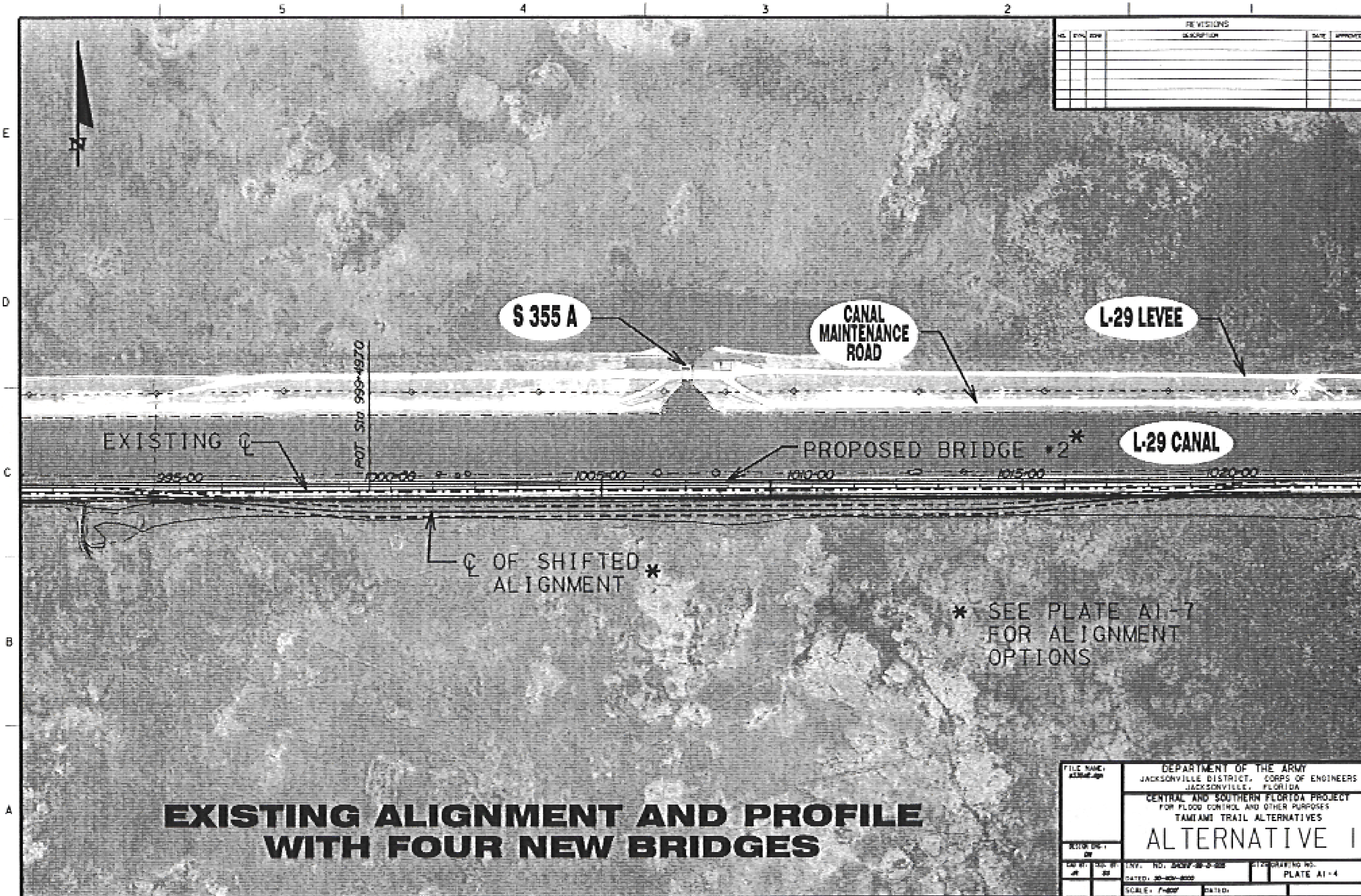
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 1

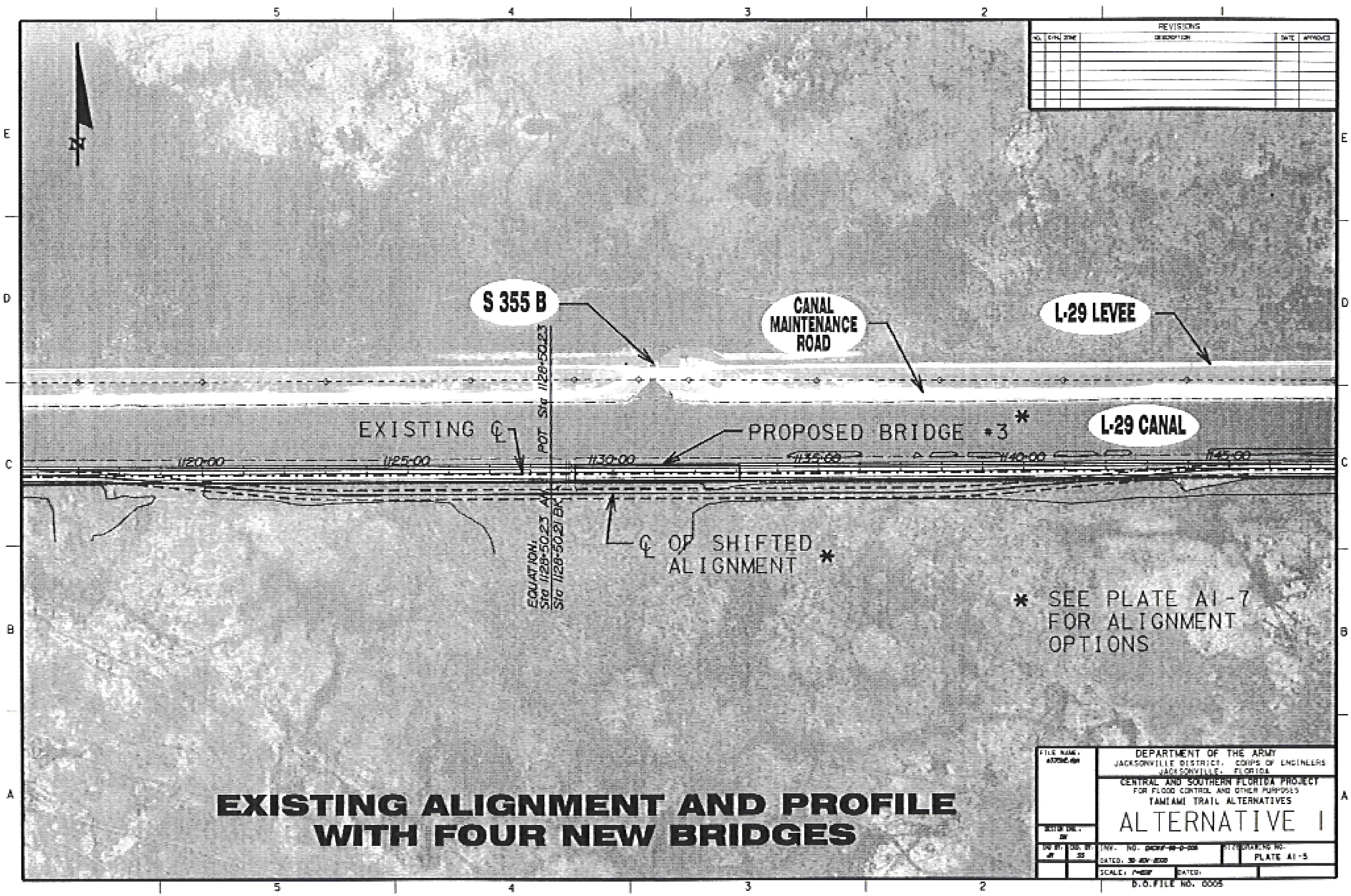
PLATE A1-2

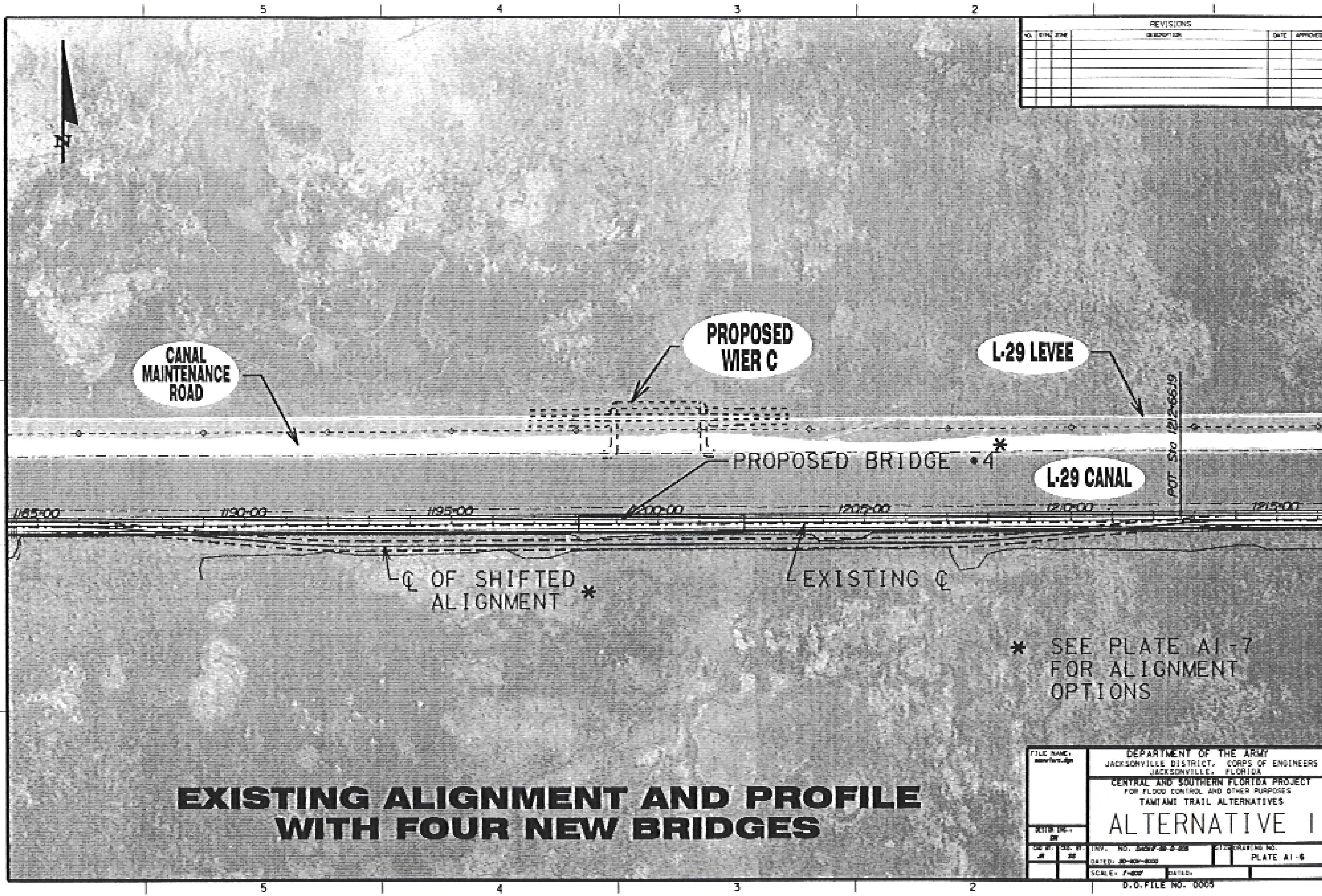
D.O.FILE NO. 0005

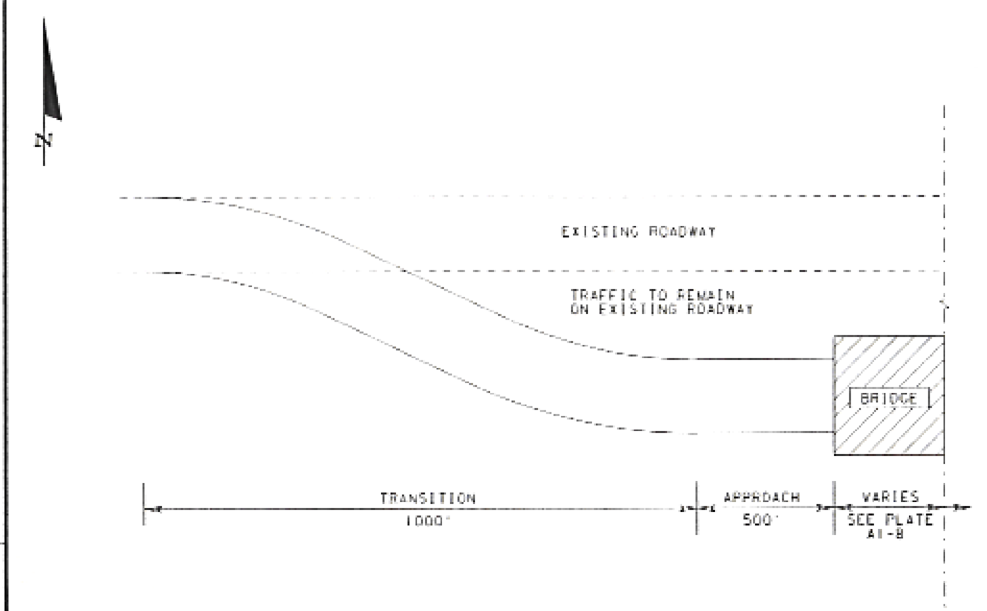

PROPOSED WIER B
CANAL MAINTENANCE ROAD
L-29 LEVEE
L-29 CANAL
PROPOSED BRIDGE #1 *
POT Sta. 927+21.53
915+00
920+00
925+00
930+00
935+00
940+00
℄ OF SHIFTED ALIGNMENT *
EXISTING ℄
* SEE PLATE AI-7 FOR ALIGNMENT OPTIONS
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 1
PLATE AI-3
D.O.FILE NO. 0005
EXISTING ALIGNMENT AND PROFILE
WITH FOUR NEW BRIDGES



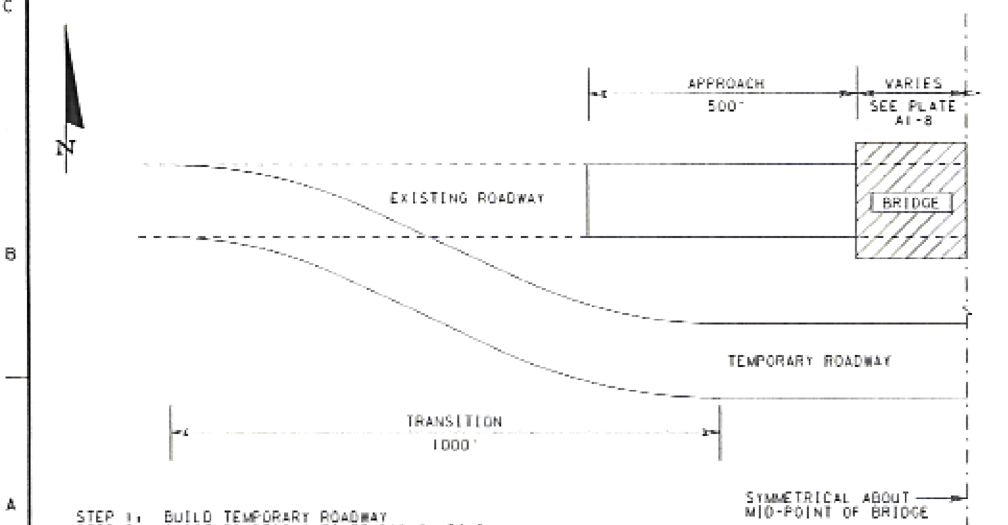

# EXISTING ALIGNMENT AND PROFILE WITH FOUR NEW BRIDGES


S 355 B
CANAL MAINTENANCE ROAD
L-29 LEVEE
L-29 CANAL
EXISTING ℄
PROPOSED BRIDGE #3 *
POT. Sta 1128+50.23
EQUATION: Sta 1128+50.23 AH Sta 1128+50.21 BK
1120+00
1125+00
1130+00
1135+00
1140+00
1145+00
℄ OF SHIFTED ALIGNMENT *
* SEE PLATE AI-7 FOR ALIGNMENT OPTIONS
EXISTING ALIGNMENT AND PROFILE WITH FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE I
PLATE AI-5
D.O.FILE NO. 0005


N
CANAL MAINTENANCE ROAD
PROPOSED WIER C
L-29 LEVEE
L-29 CANAL
PROPOSED BRIDGE •4 *
POT Sta 1212+66.19
1185+00
1190+00
1195+00
1200+00
1205+00
1210+00
1215+00
℄ OF SHIFTED ALIGNMENT *
EXISTING ℄
* SEE PLATE AI-7 FOR ALIGNMENT OPTIONS
EXISTING ALIGNMENT AND PROFILE WITH FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 1
PLATE AI-6
D.O.FILE NO. 0005

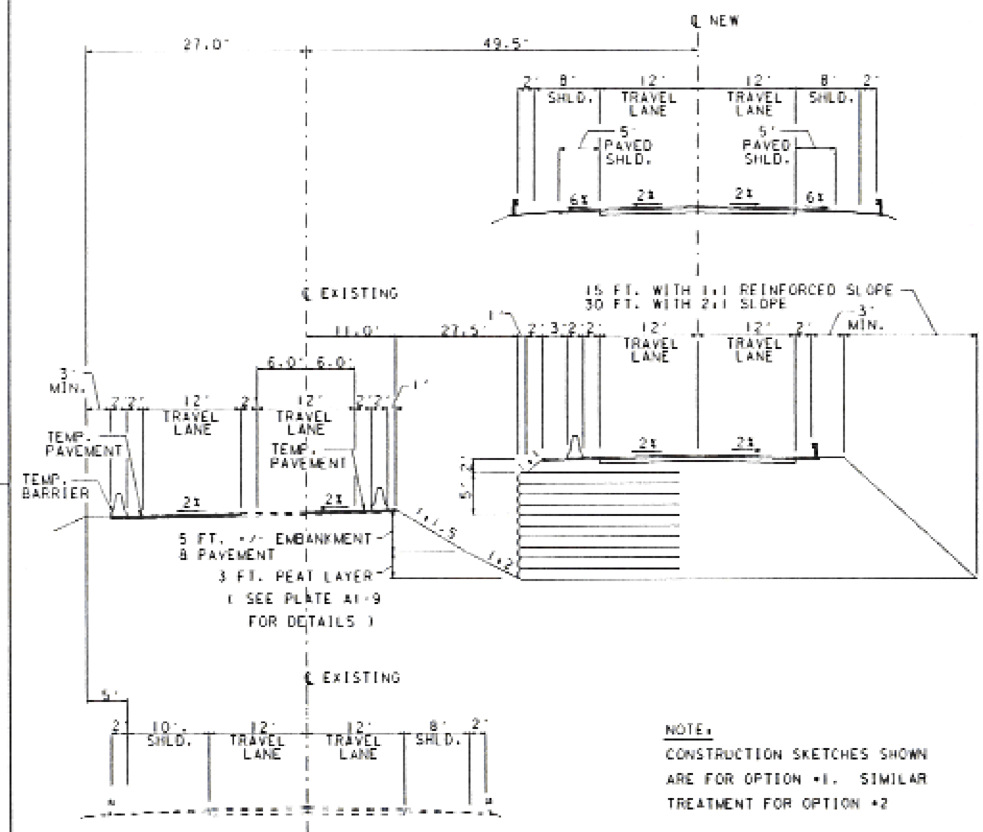



OPTION #1 - SHIFTED ALIGNMENT




STEP 1: BUILD TEMPORARY ROADWAY
STEP 2: SHIFT TRAFFIC ONTO TEMPORARY ROADWAY
STEP 3: CONSTRUCT BRIDGE AND APPROACH

OPTION #2 - TEMPORARY DETOUR




NOTE:
CONSTRUCTION SKETCHES SHOWN ARE FOR OPTION #1. SIMILAR TREATMENT FOR OPTION #2

DETOUR CONSTRUCTION PHASING

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | | ZONE | DESCRIPTION | DATE | APPROVED |

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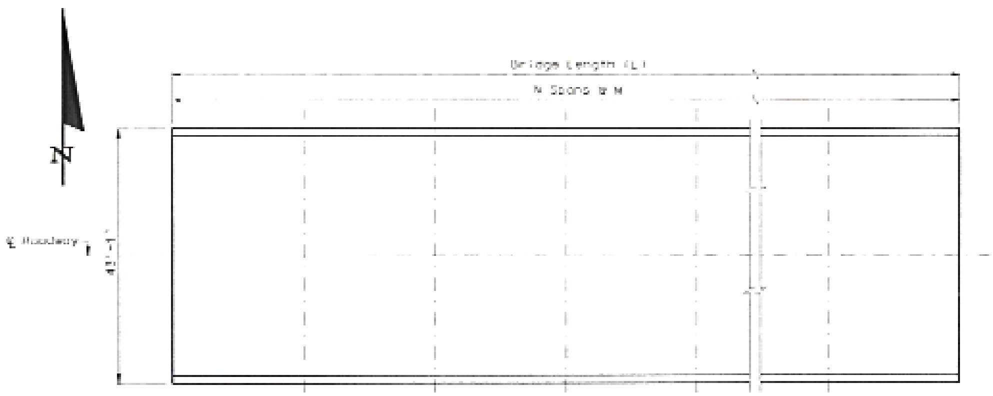
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 1

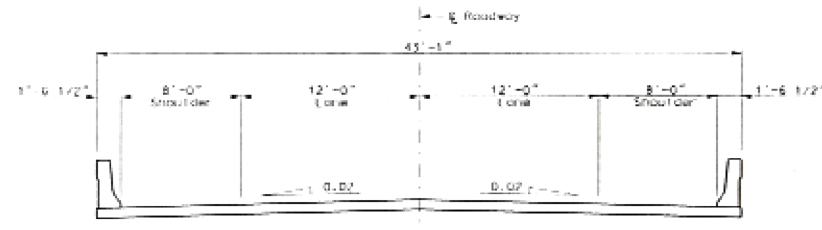
DRAWING NO. PLATE AI-3

D.O.FILE NO. 0005



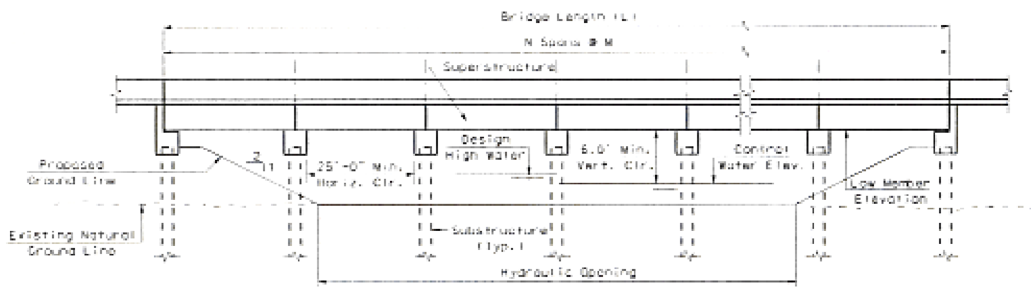

## BRIDGE PLAN

(All Bridges)




## BRIDGE TYPICAL SECTION

(All Bridges)




## BRIDGE ELEVATION

(All Bridges)

| Bridge Number | Bridge Type | Bridge Length (L) | Hydraulic Opening | Number of Spans (N) | Span Lengths (M) | Superstructure Type | Substructure Type | Design High Water | Control Water Elev. | Low Member Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 475.0' | 425' | 11 | 43.18' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |
| 2 | B | 345.5' | 300' | 8 | 43.19' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |
| 3 | B | 345.5' | 300' | 8 | 43.19' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |
| 4 | A | 475.0' | 425' | 11 | 43.18' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |

## BRIDGE DATA

REVISIONS

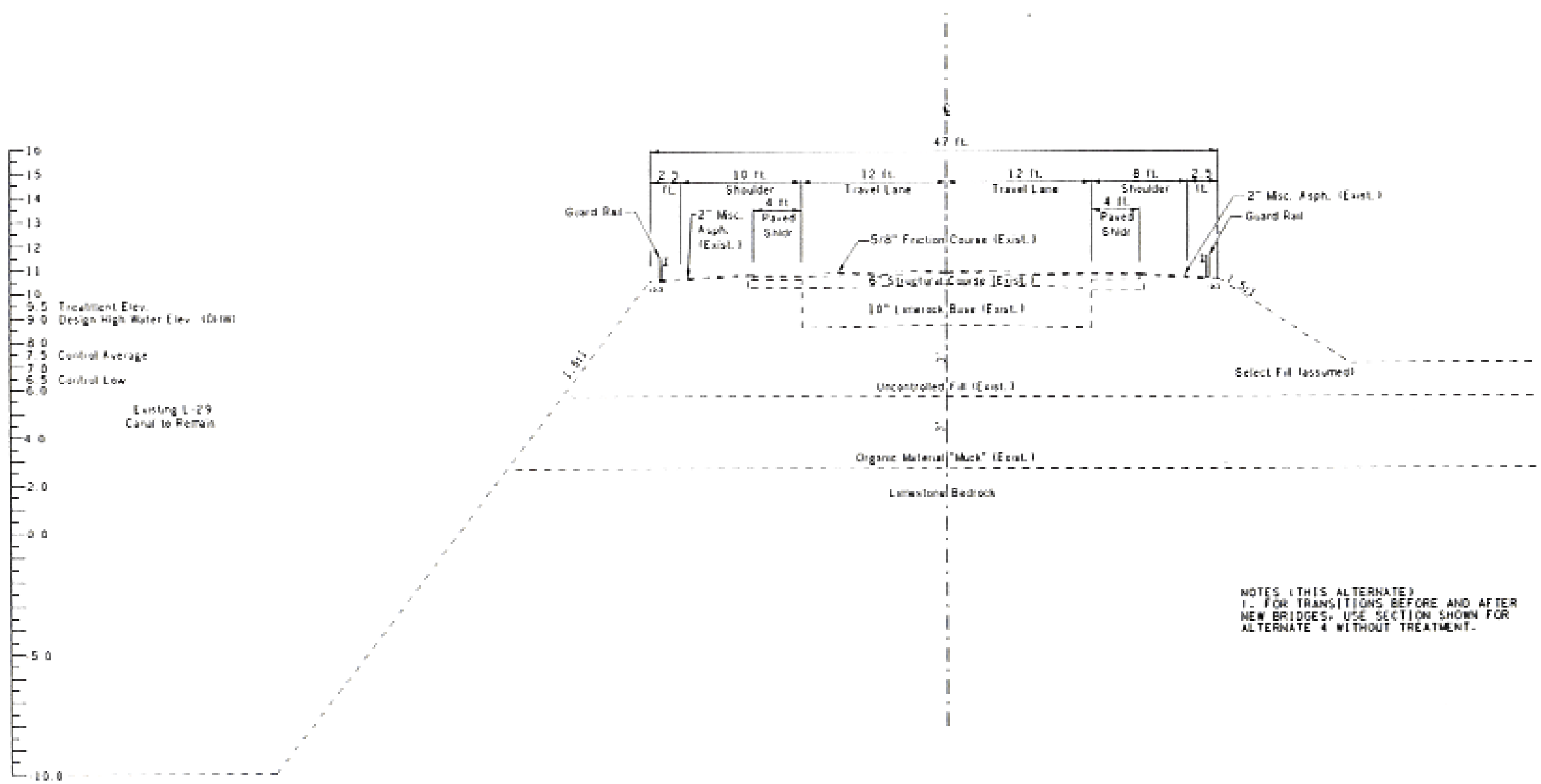
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 1

DRAWING NO. A1-B

D.O.FILE NO. 0005




NOTES (THIS ALTERNATE)
1. FOR TRANSITIONS BEFORE AND AFTER NEW BRIDGES, USE SECTION SHOWN FOR ALTERNATE 4 WITHOUT TREATMENT.

# TYPICAL SECTION
# ALTERNATIVE 1
# EXISTING ALIGNMENT AND PROFILE
# WITH FOUR NEW BRIDGES

| REVISIONS | | | | |
|---|---|---|---|---|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |

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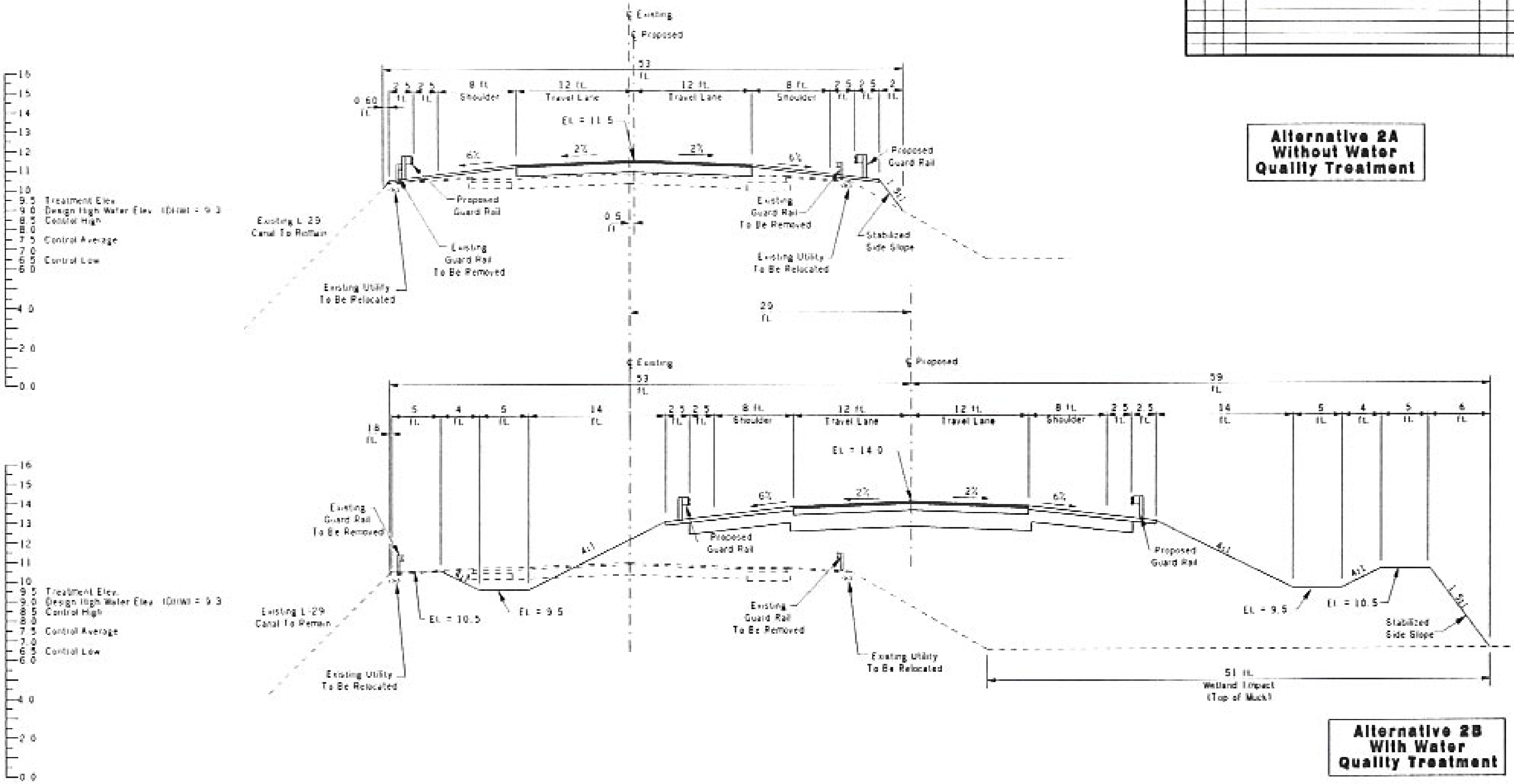
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 1

PLATE A1-9
SCALE: AS SHOWN

D.O.FILE NO. 0005



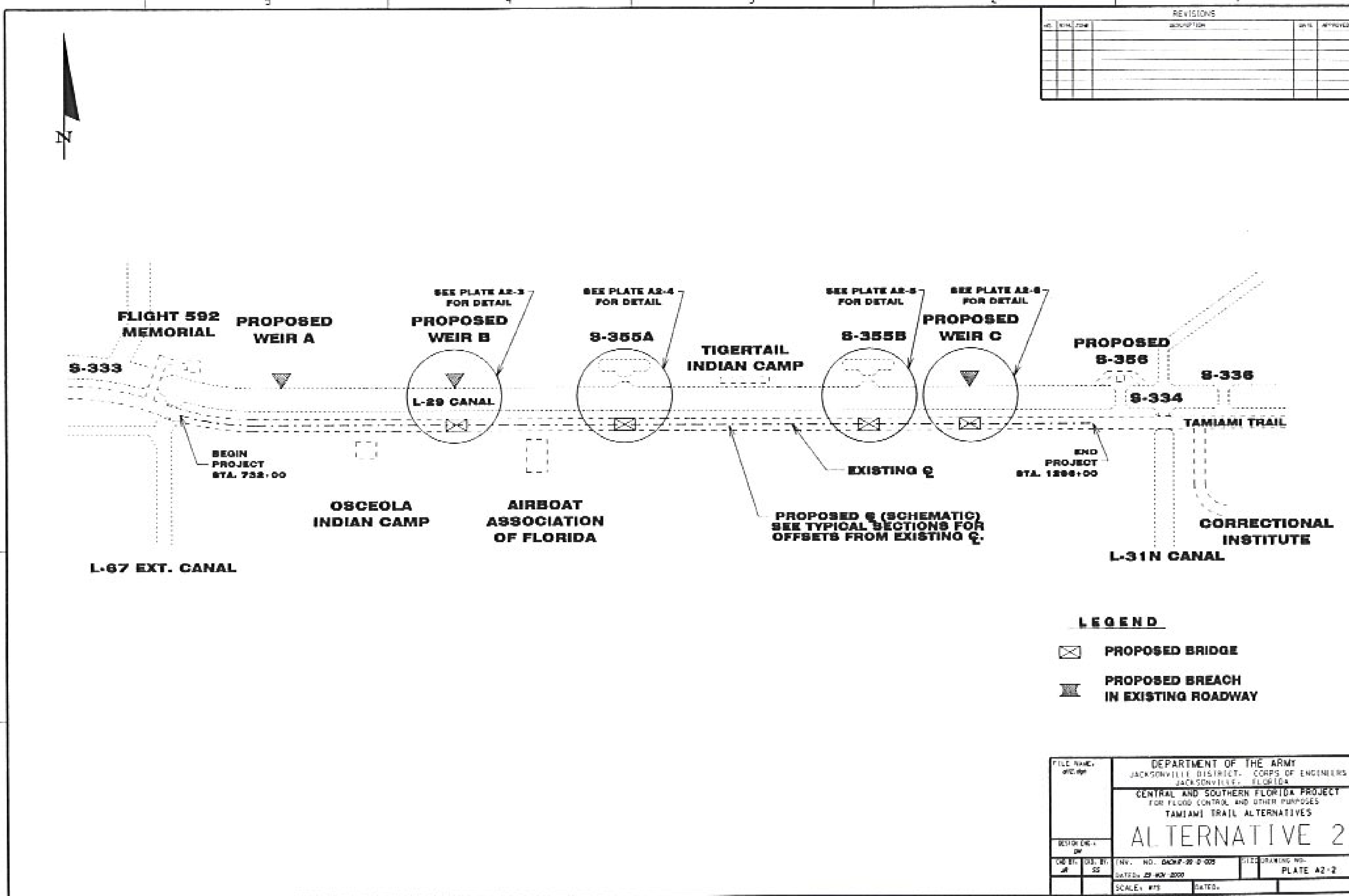

LOOKING EAST

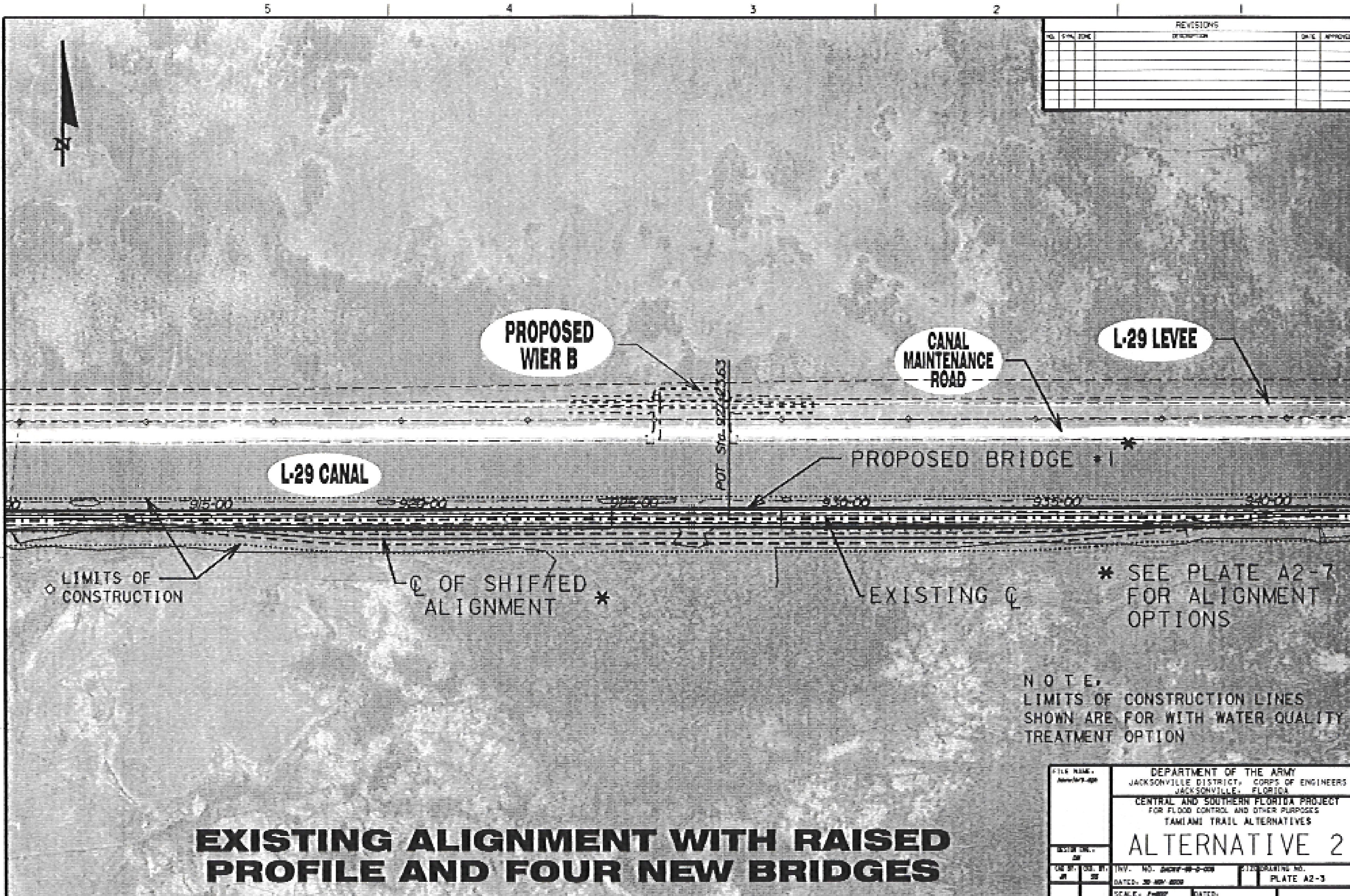
SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

# TYPICAL SECTION
# EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

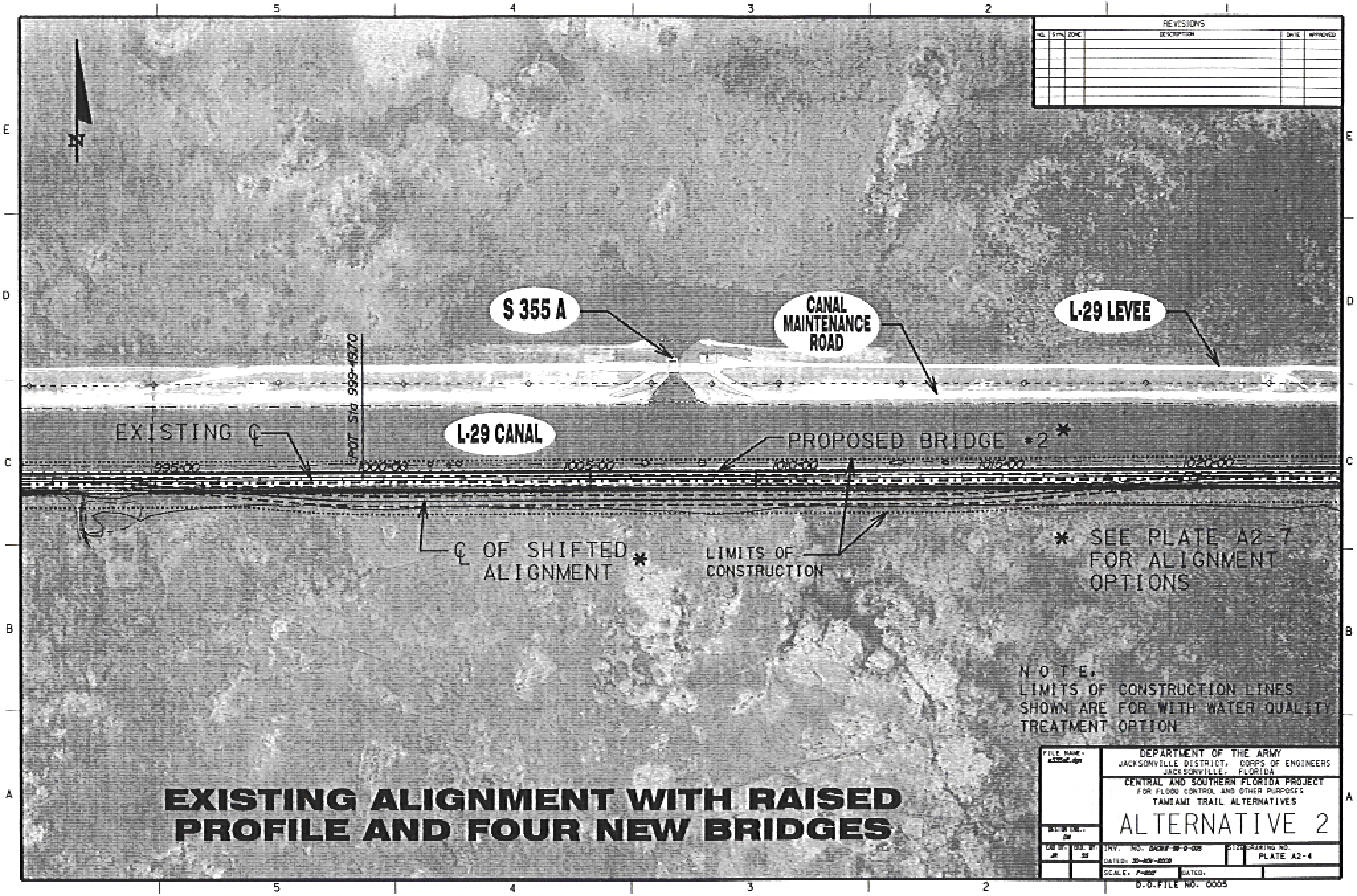
| | |
|---|---|
| FILE NAME: typsec2.dgn | DEPARTMENT OF THE ARMY<br>JACKSONVILLE DISTRICT, CORPS OF ENGINEERS<br>JACKSONVILLE, FLORIDA |
| | CENTRAL AND SOUTHERN FLORIDA PROJECT<br>FOR FLOOD CONTROL AND OTHER PURPOSES<br>TAMIAMI TRAIL ALTERNATIVES |
| | ALTERNATIVE 2 |
| | DRAWING NO. PLATE A2-1 |

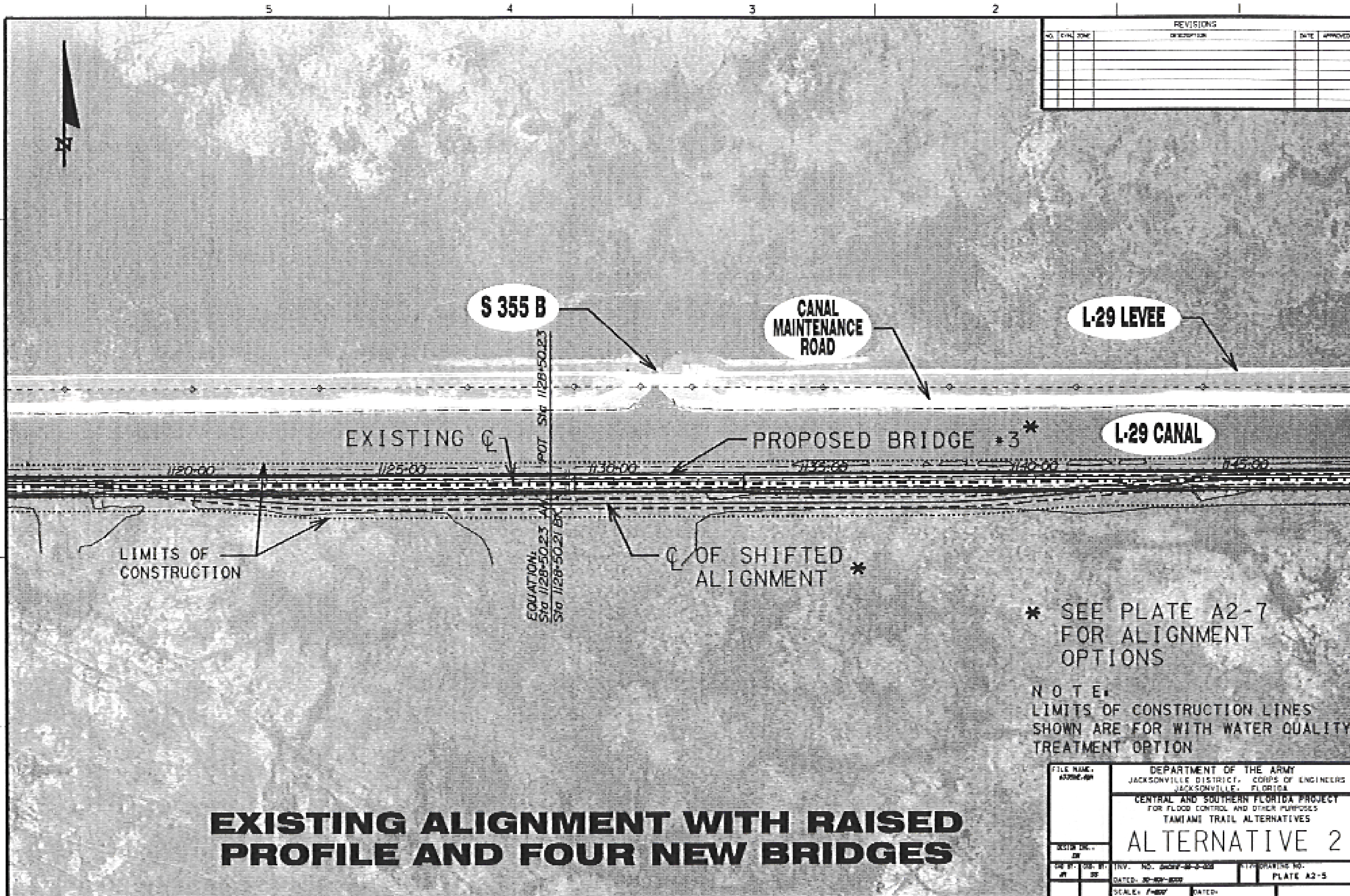
D.O.FILE NO. 0005

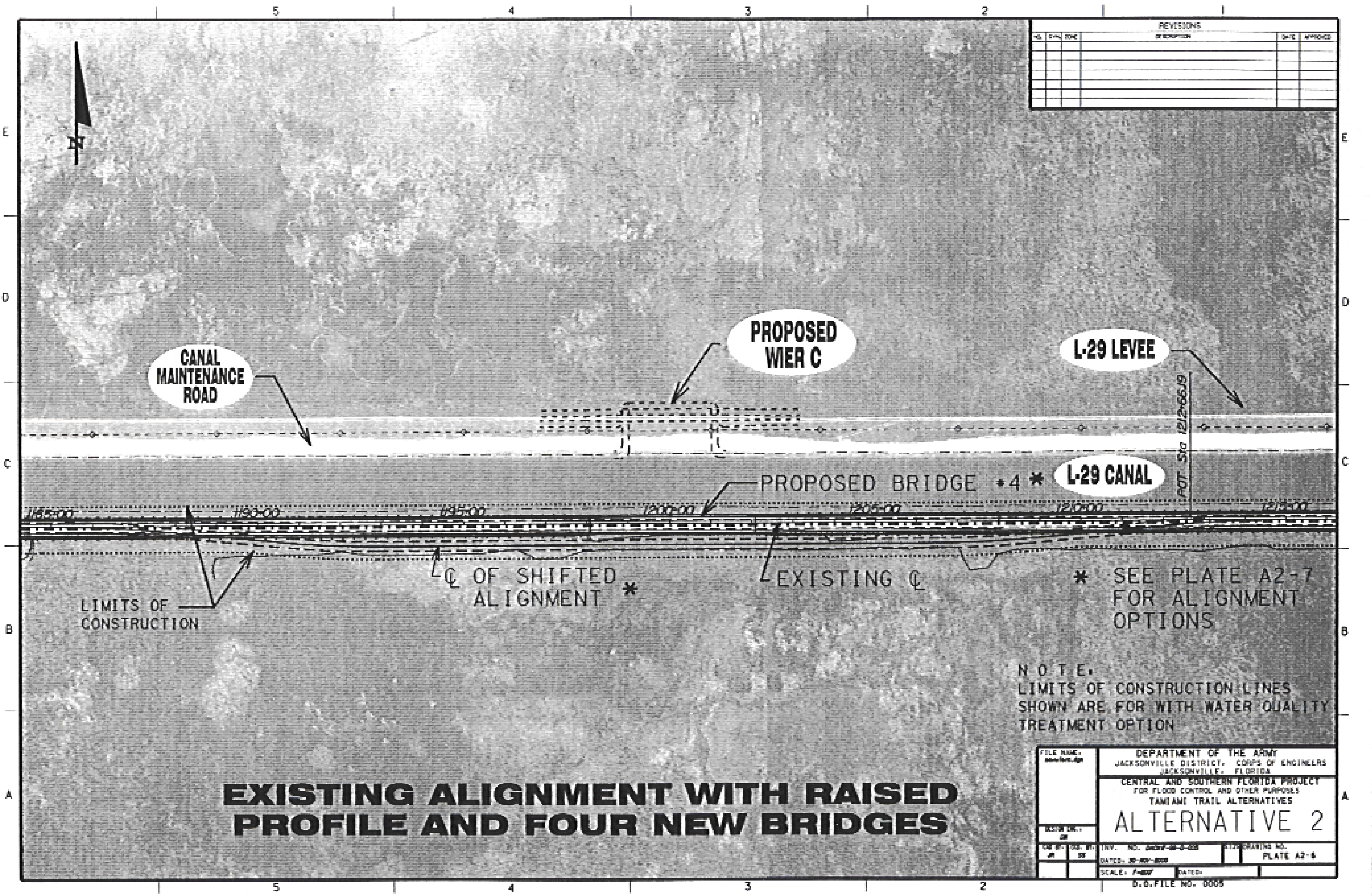

N
FLIGHT 592 MEMORIAL
S-333
PROPOSED WEIR A
PROPOSED WEIR B
SEE PLATE A2-3 FOR DETAIL
L-29 CANAL
SEE PLATE A2-4 FOR DETAIL
S-355A
TIGERTAIL INDIAN CAMP
SEE PLATE A2-5 FOR DETAIL
S-355B
SEE PLATE A2-6 FOR DETAIL
PROPOSED WEIR C
PROPOSED S-356
S-336
S-334
TAMIAMI TRAIL
BEGIN PROJECT STA. 732+00
OSCEOLA INDIAN CAMP
AIRBOAT ASSOCIATION OF FLORIDA
EXISTING ℄
PROPOSED ℄ (SCHEMATIC) SEE TYPICAL SECTIONS FOR OFFSETS FROM EXISTING ℄.
END PROJECT STA. 1296+00
CORRECTIONAL INSTITUTE
L-31N CANAL
L-67 EXT. CANAL
LEGEND
PROPOSED BRIDGE
PROPOSED BREACH IN EXISTING ROADWAY
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 2
PLATE A2-2
D.O.FILE NO. 0005



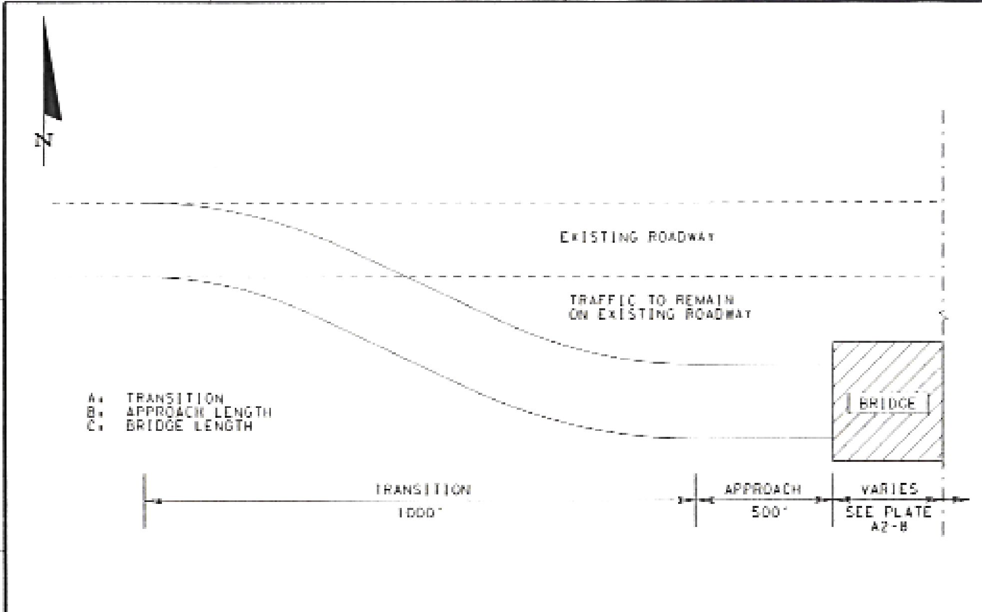
PROPOSED WIER B
CANAL MAINTENANCE ROAD
L-29 LEVEE
PROPOSED BRIDGE #1
L-29 CANAL
POT Sta. 927+23.63
915+00
920+00
925+00
930+00
935+00
940+00
LIMITS OF CONSTRUCTION
℄ OF SHIFTED ALIGNMENT *
EXISTING ℄
* SEE PLATE A2-7 FOR ALIGNMENT OPTIONS
NOTE: LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 2
PLATE A2-3
D.O. FILE NO. 6005


S 355 A
CANAL MAINTENANCE ROAD
L-29 LEVEE
L-29 CANAL
EXISTING ℄
PROPOSED BRIDGE *2 *
POT Sta 999+49.70
℄ OF SHIFTED ALIGNMENT *
LIMITS OF CONSTRUCTION
* SEE PLATE A2-7 FOR ALIGNMENT OPTIONS
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 2
PLATE A2-4
D.O. FILE NO. 0005

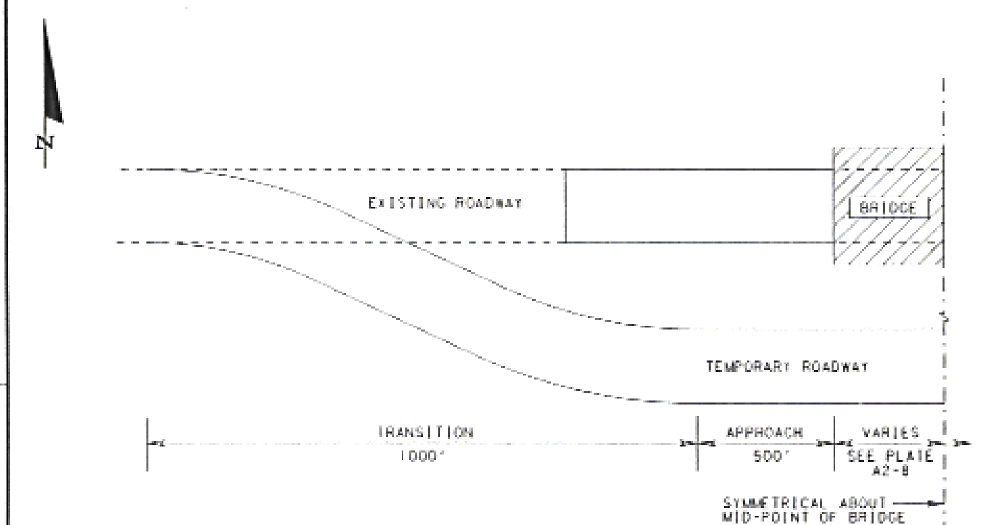

S 355 B
CANAL MAINTENANCE ROAD
L-29 LEVEE
L-29 CANAL
EXISTING ℄
PROPOSED BRIDGE #3 *
1120+00
1125+00
1130+00
1135+00
1140+00
1145+00
POT Sta 1128+50.23
EQUATION:
Sta 1128+50.23 AH
Sta 1128+50.21 BK
LIMITS OF CONSTRUCTION
℄ OF SHIFTED ALIGNMENT *
* SEE PLATE A2-7 FOR ALIGNMENT OPTIONS
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 2
PLATE A2-5
D.O.FILE NO. 0005



REVISIONS
CANAL MAINTENANCE ROAD
PROPOSED WIER C
L-29 LEVEE
L-29 CANAL
POT Sta 1212+66.19
PROPOSED BRIDGE #4 *
LIMITS OF CONSTRUCTION
℄ OF SHIFTED ALIGNMENT *
EXISTING ℄
* SEE PLATE A2-7 FOR ALIGNMENT OPTIONS
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 2
PLATE A2-6
D.O.FILE NO. 0005

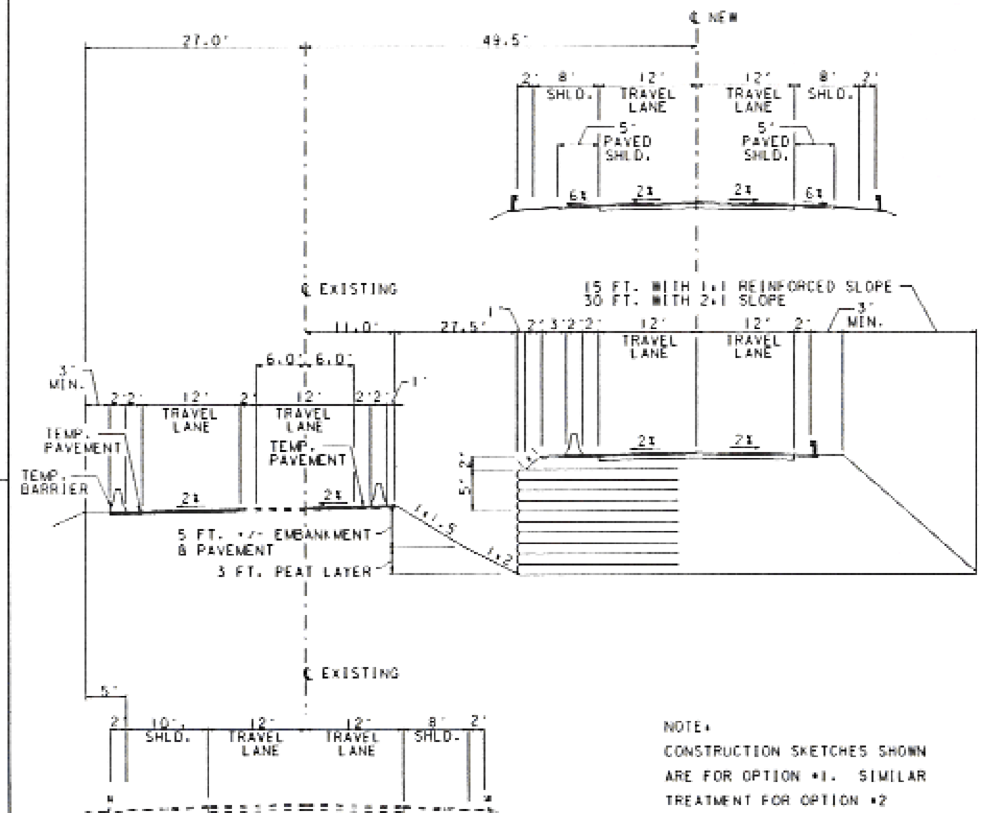



OPTION #1 - SHIFTED ALIGNMENT




STEP 1: BUILD TEMPORARY ROADWAY
STEP 2: SHIFT TRAFFIC ONTO TEMPORARY ROADWAY
STEP 3: CONSTRUCT BRIDGE AND APPROACH

OPTION #2 - TEMPORARY DETOUR




NOTE:
CONSTRUCTION SKETCHES SHOWN ARE FOR OPTION #1. SIMILAR TREATMENT FOR OPTION #2

DETOUR CONSTRUCTION PHASING

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SYMBOL | ZONE | DESCRIPTION | DATE | APPROVED |

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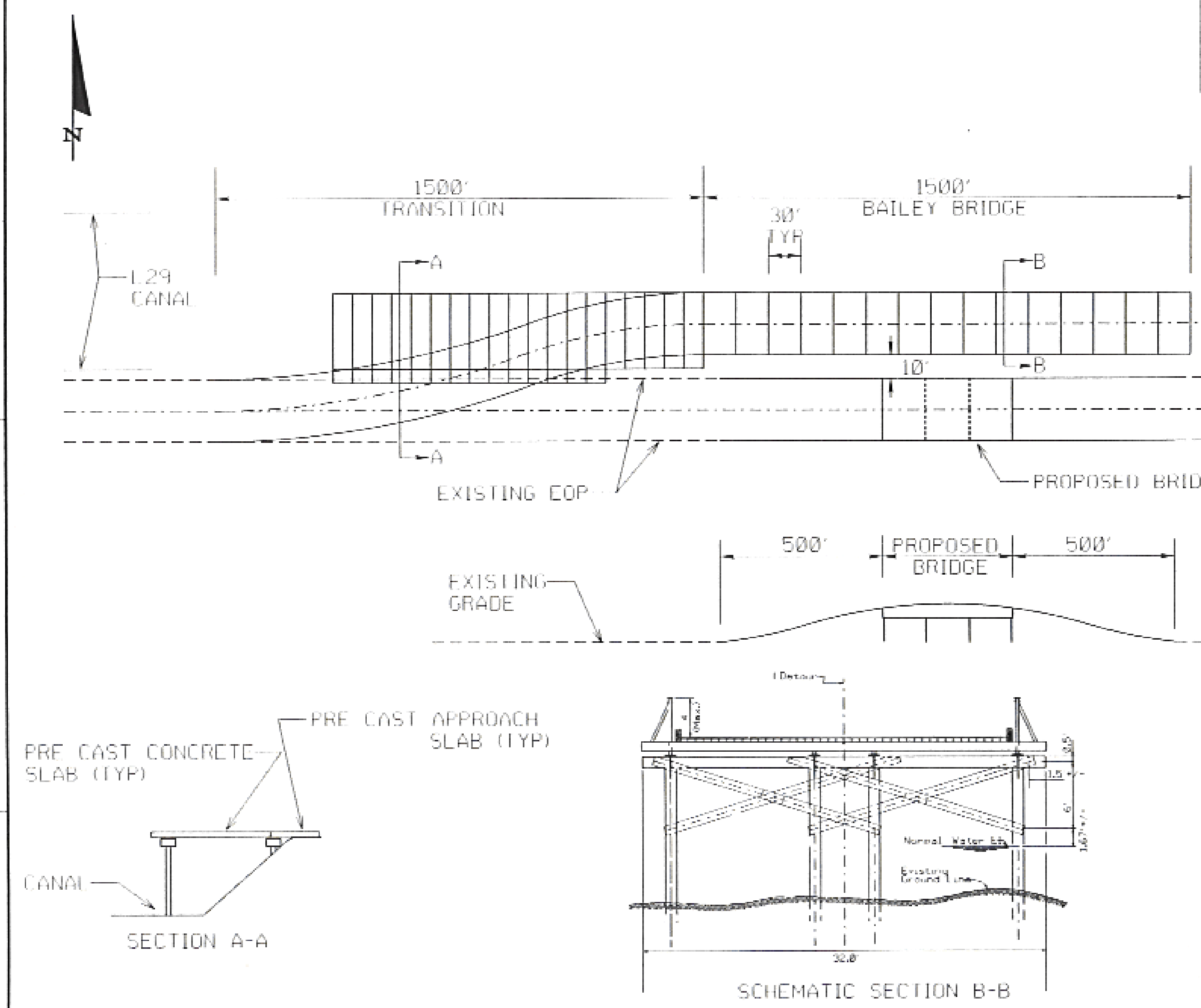
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 2

FILE NAME: conschema6.dgn
DESIGNED BY: GW
CKD BY: JR
DRN BY: SS
INV. NO. DACW17-99-D-0005
DATED: 29-NOV-2000
SCALE: NTS
DRAWING NO. PLATE A2-7
D.O.FILE NO. 0005




REVISIONS

| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|
| | | | | | |

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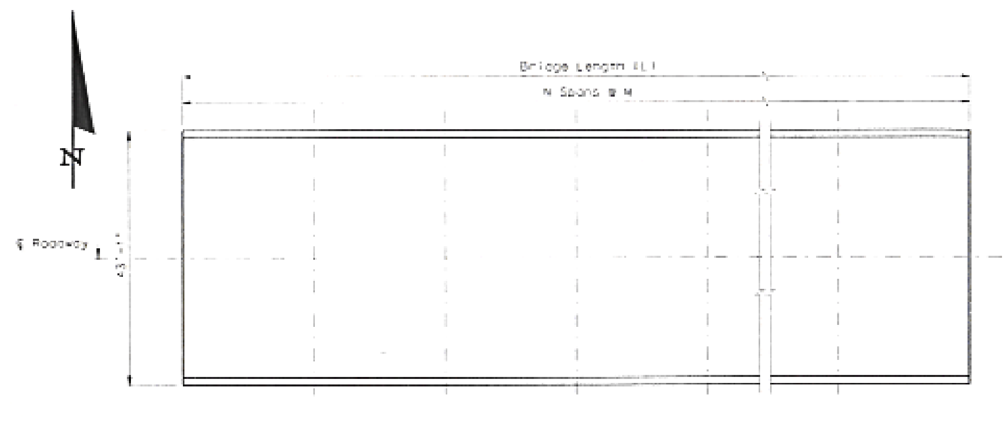
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

TEMPORARY ALIGNMENT
NORTH OF EXISTING ROADWAY

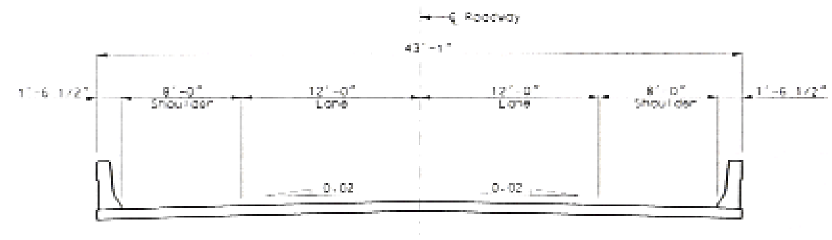
PLATE A2-7A

SCALE: NTS

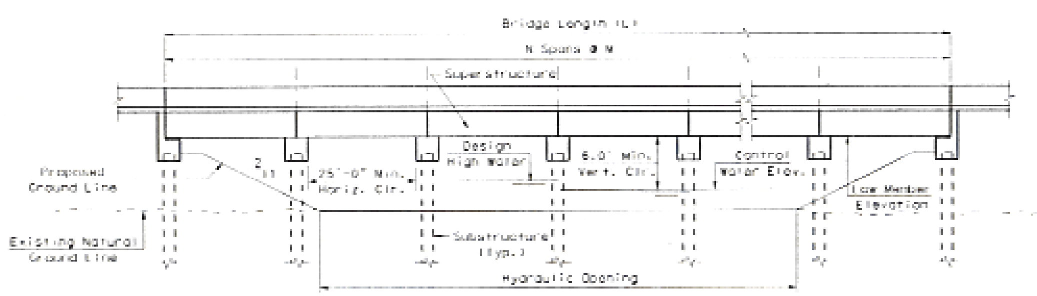
D.O.FILE NO. 0005




## BRIDGE PLAN
(All Bridges)




## BRIDGE TYPICAL SECTION
(All Bridges)




## BRIDGE ELEVATION
(All Bridges)

| Bridge Number | Bridge Type | Bridge Length (L) | Hydraulic Opening | Number of Spans (N) | Span Lengths (M) | Superstructure Type | Substructure Type | Design High Water | Control Water Elev. | Low Member Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 475.0' | 425' | 11 | 43.18' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |
| 2 | B | 345.5' | 300' | 8 | 43.19' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |
| 3 | B | 345.5' | 300' | 8 | 43.19' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |
| 4 | A | 475.0' | 425' | 11 | 43.18' | AASHTO Type II | 18 in. Prestressed Pile | 9.3' | 7.5' | 13.5' |

## BRIDGE DATA

REVISIONS

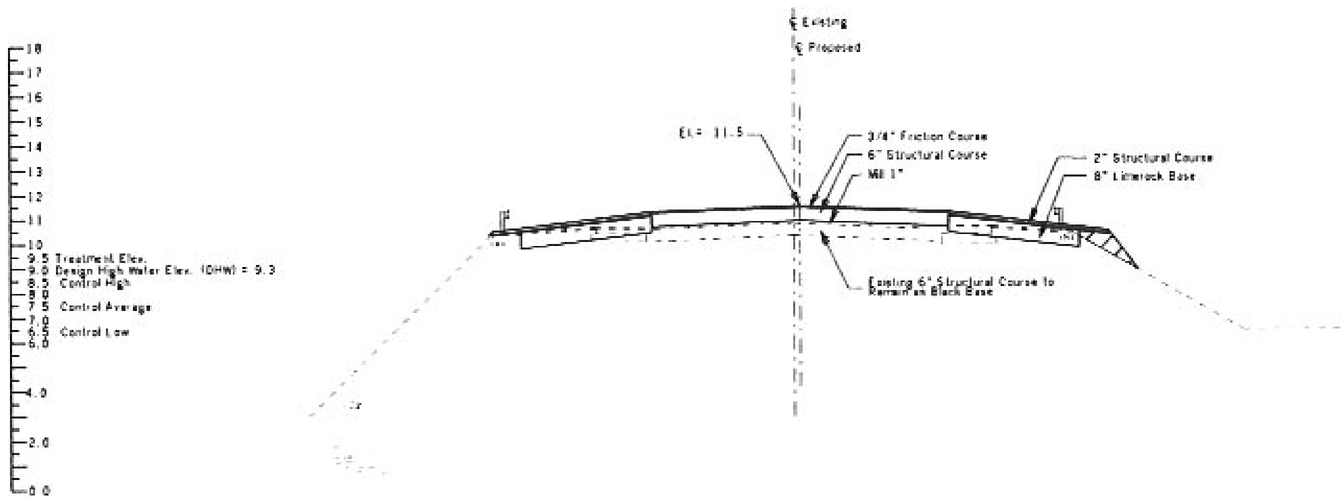
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 2

DRAWING NO. A2-8

D.O.FILE NO. 0005




**LEGEND**

= Select Fill (A-1, A-3)

# TYPICAL SECTION
# EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

**Alternative 2 Without Water Quality Treatment**

LOOKING EAST

1" = 10' HORIZONTAL
1" = 5' VERTICAL

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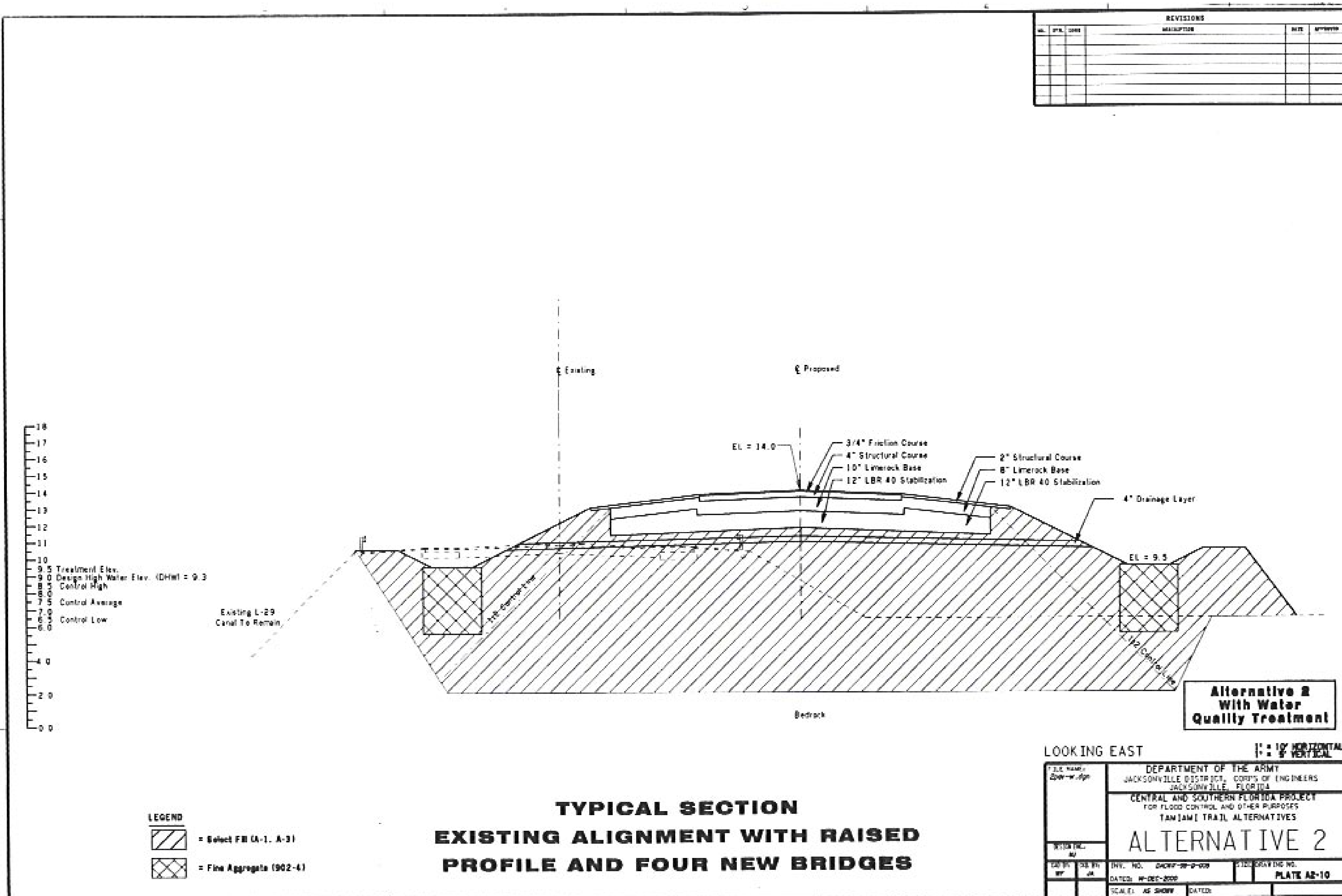
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 2

PLATE A2-9

SCALE: AS SHOWN

D.O.FILE NO. 0005




# TYPICAL SECTION
## EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

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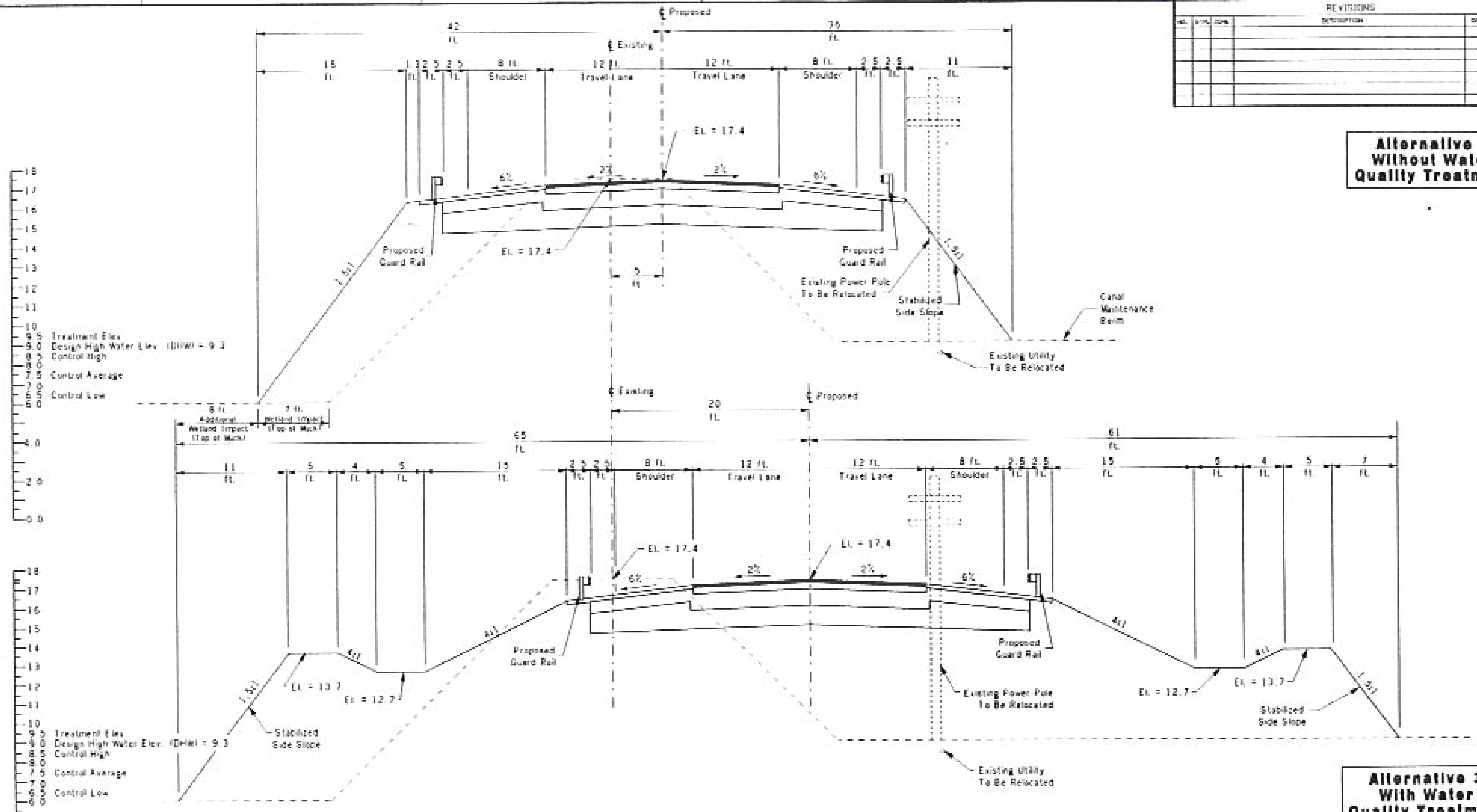
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 2

PLATE A2-10

D.O.FILE NO. 0005




LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

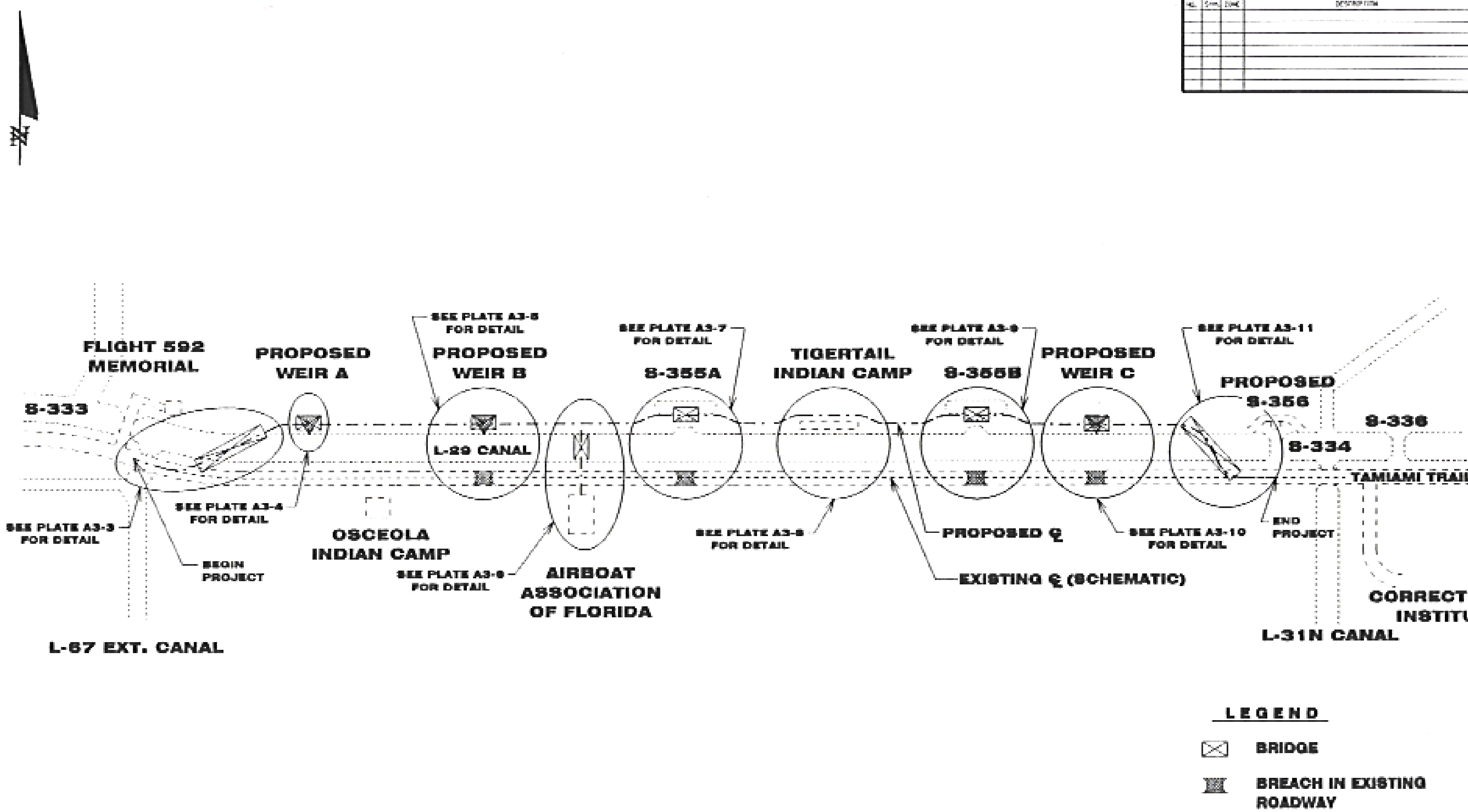
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 3

FILE NAME: typsec3.dgn
INV. NO. DACW17-99-D-005
DATED: 30-NOV-2000
DRAWING NO. PLATE A3-1
D.O. FILE NO. 0005

# TYPICAL SECTIONS
# NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES




| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |

# NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES

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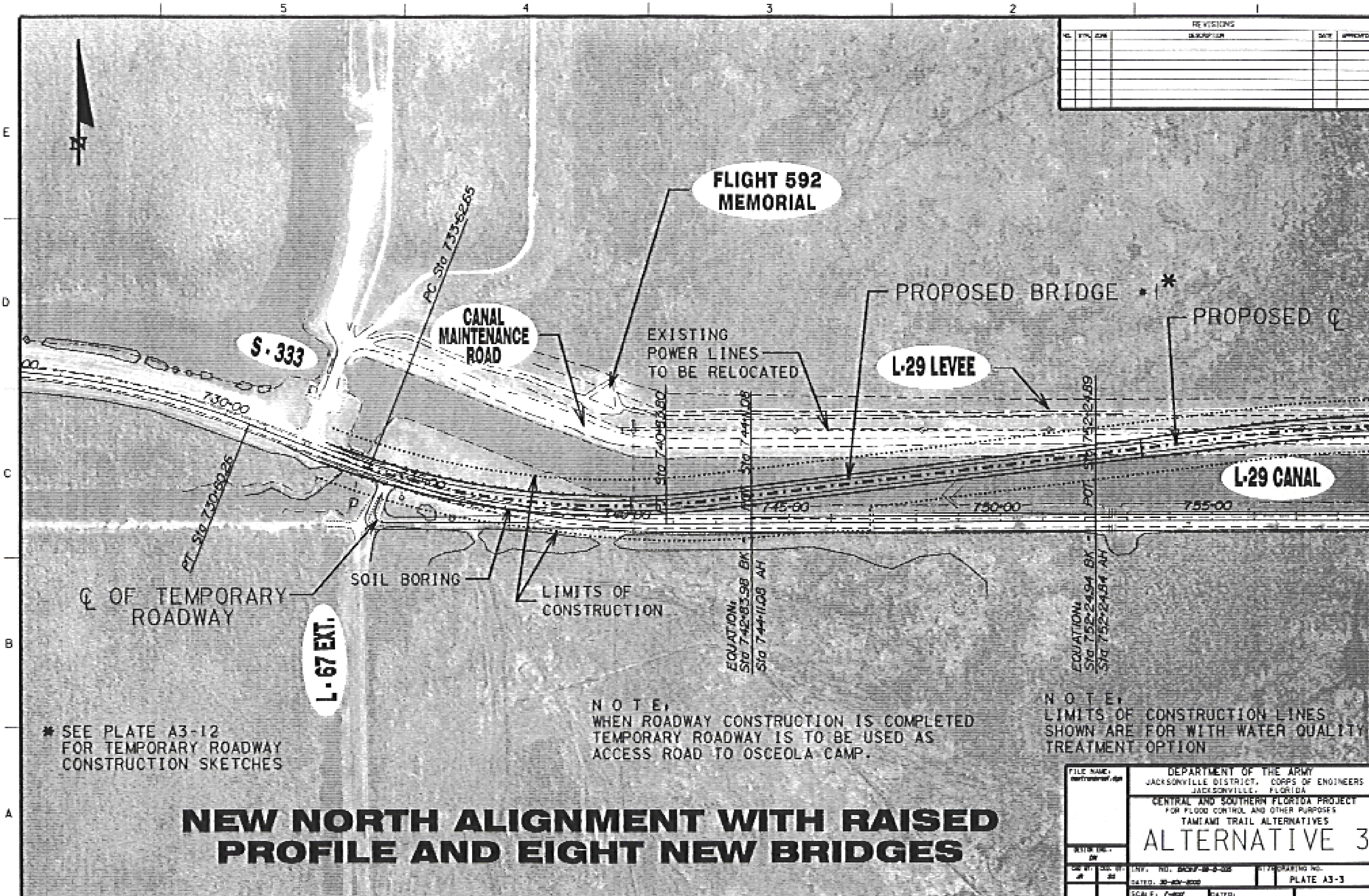
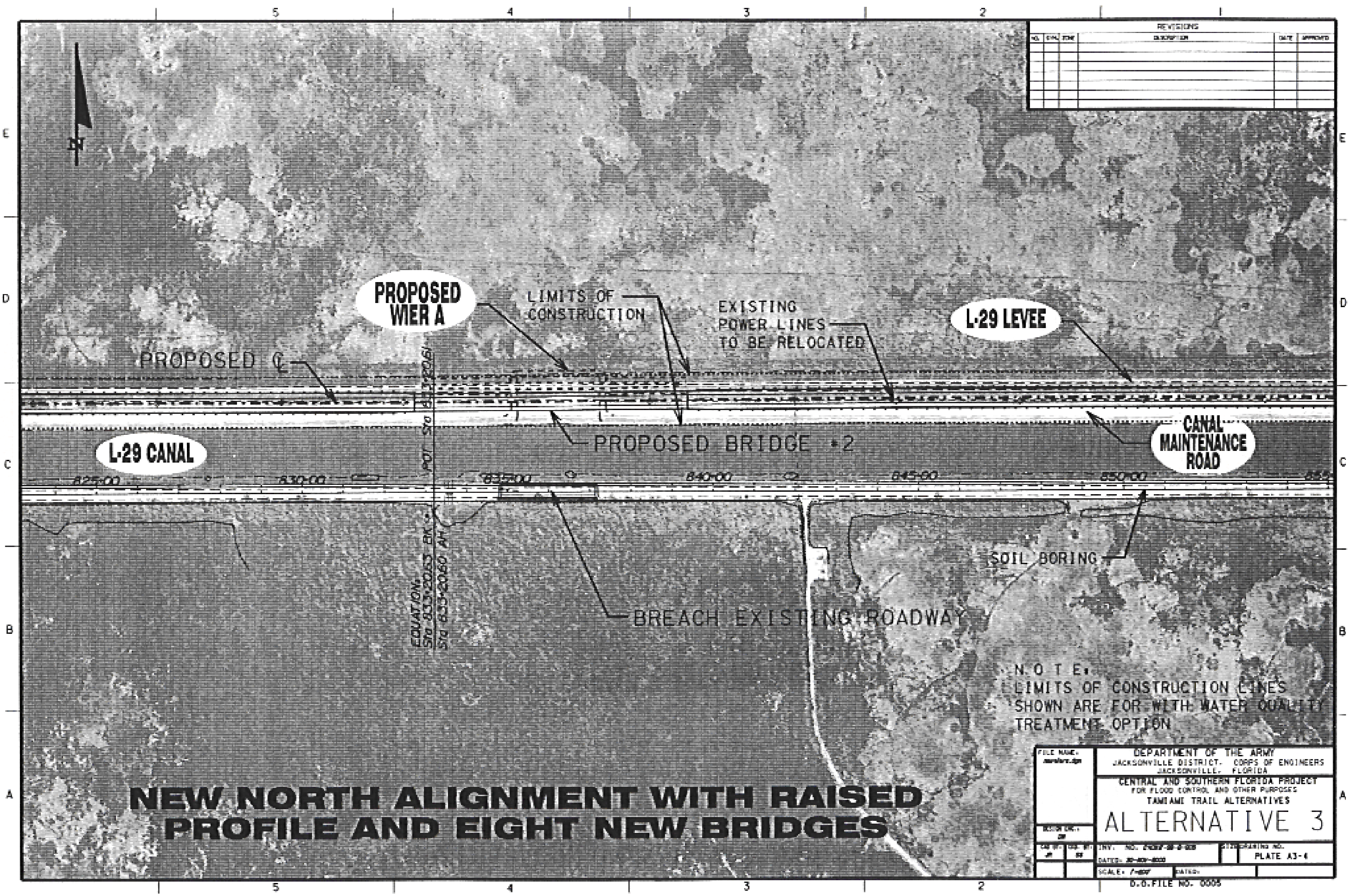
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

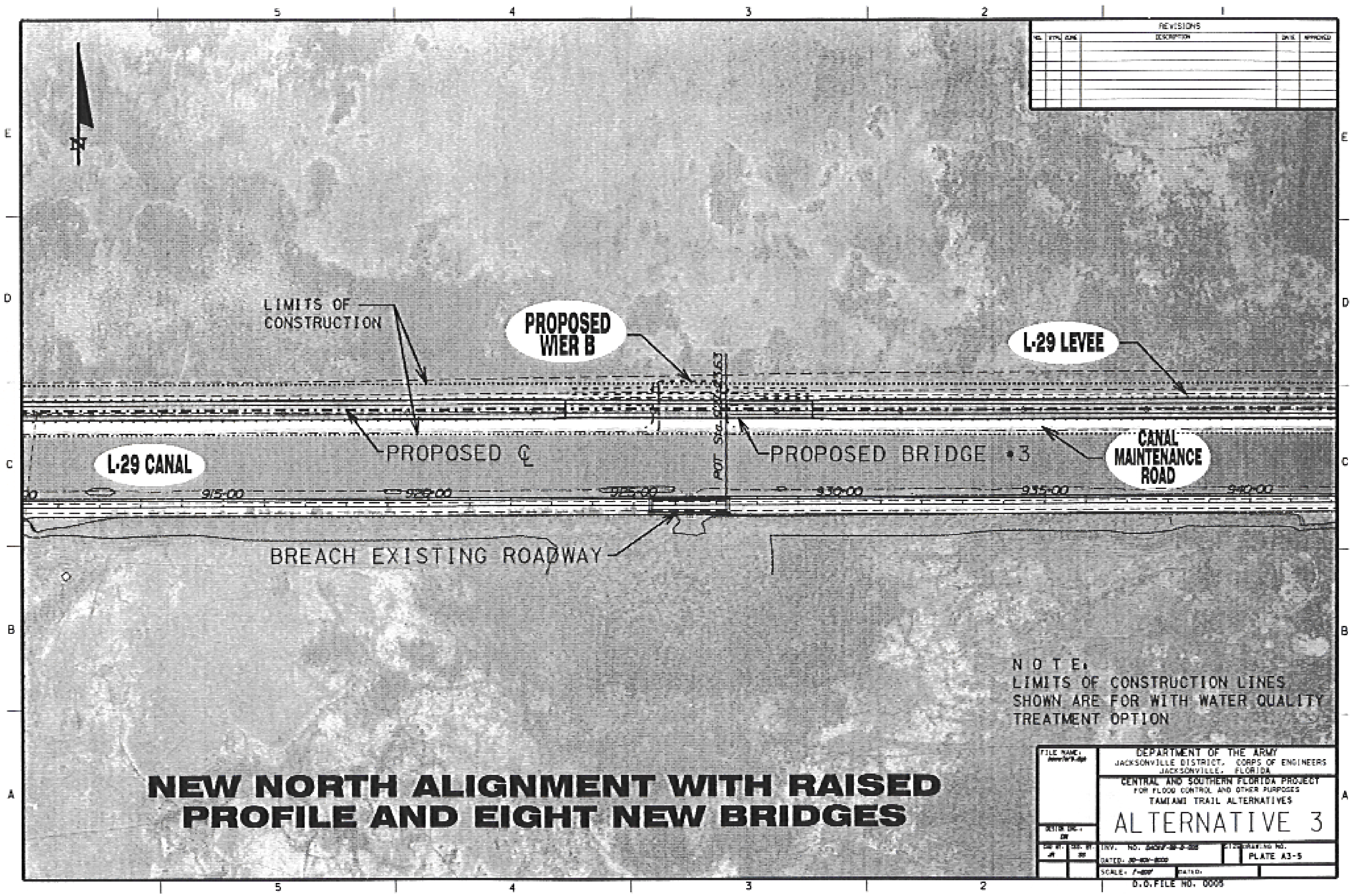
ALTERNATIVE 3

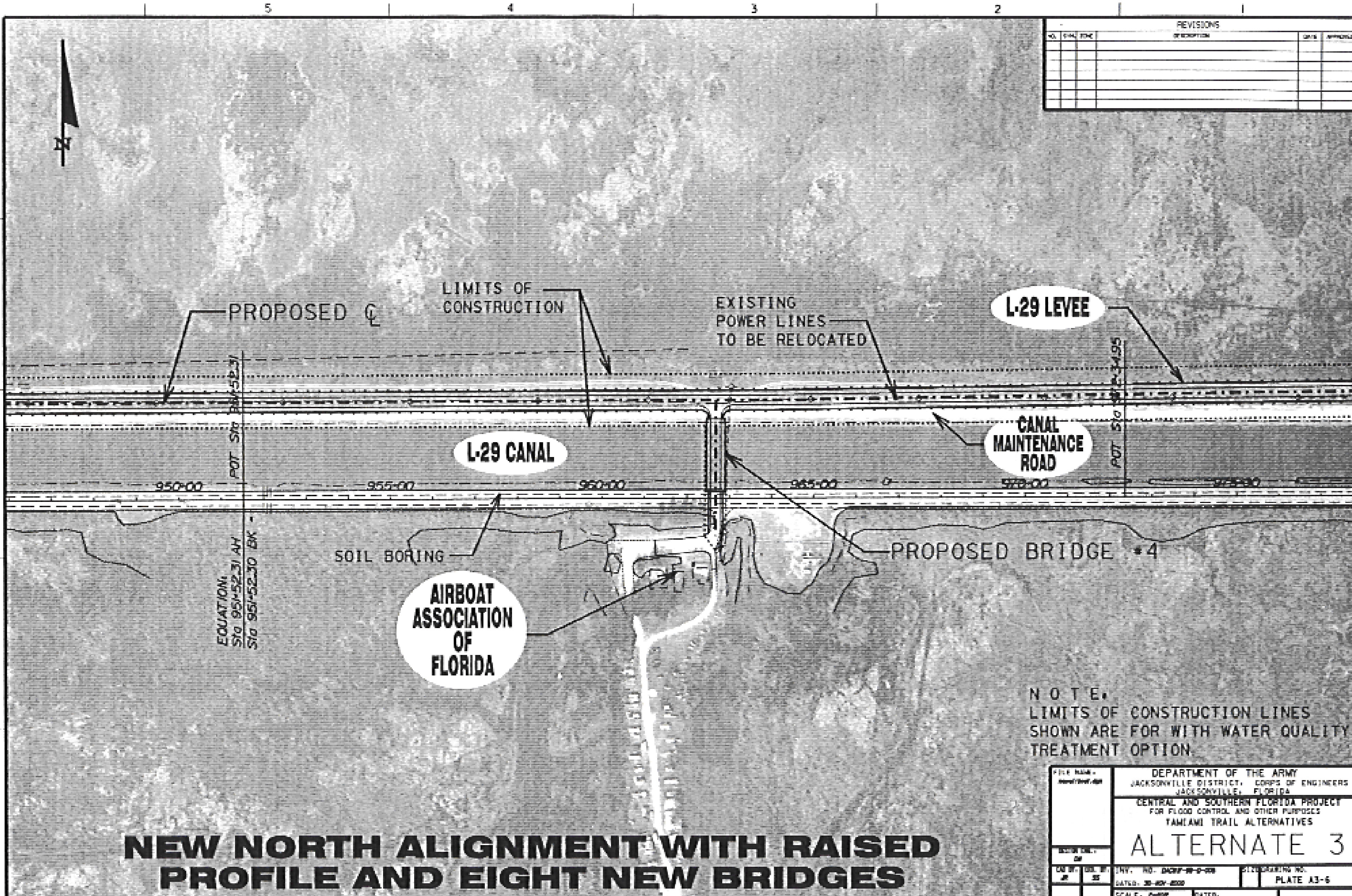
DRAWING NO. PLATE A3-2
SCALE: NTS

D.O.FILE NO. 0005

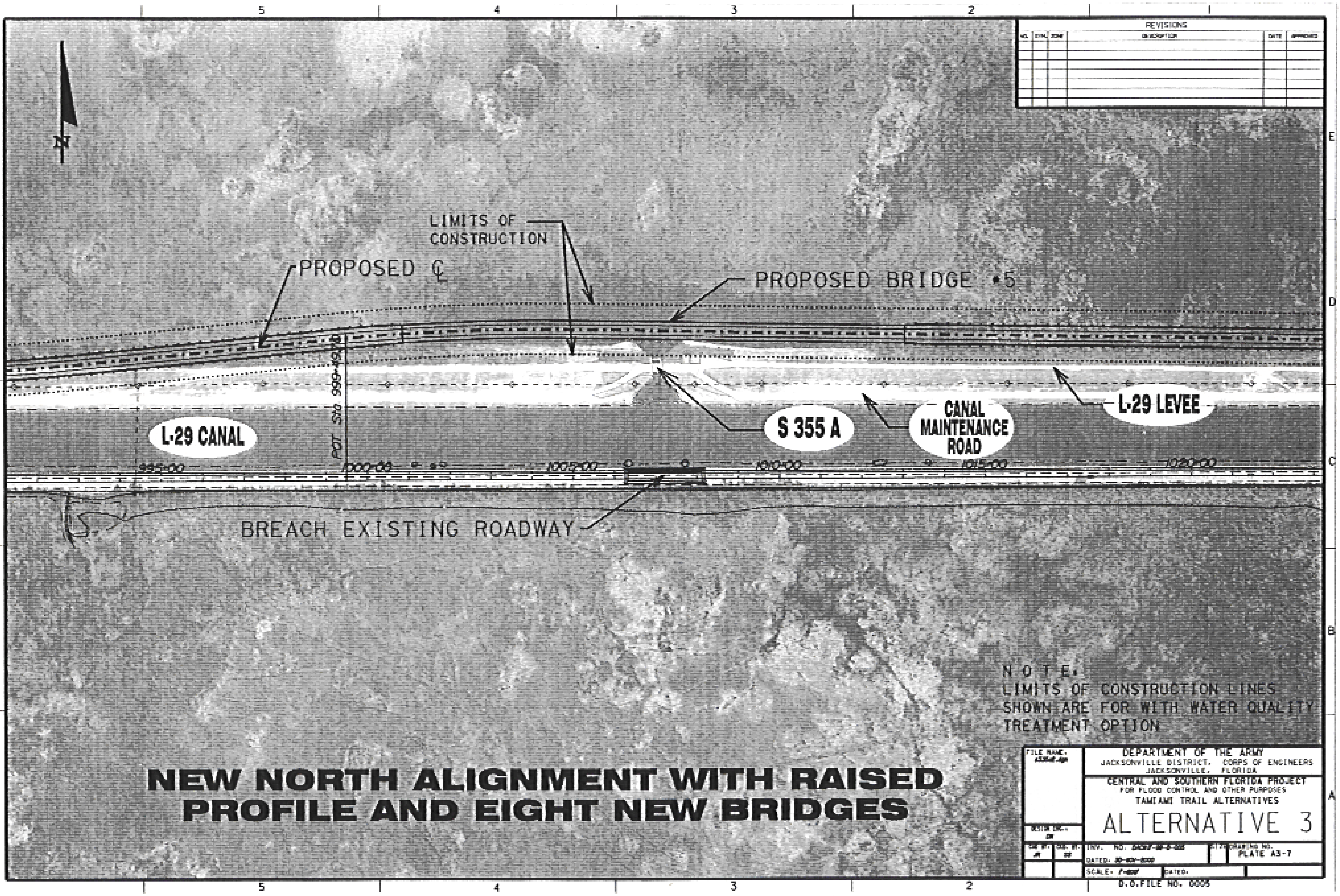

N
FLIGHT 592 MEMORIAL
S-333
CANAL MAINTENANCE ROAD
EXISTING POWER LINES TO BE RELOCATED
PROPOSED BRIDGE *
PROPOSED ℄
L-29 LEVEE
L-29 CANAL
PC Sta 733+62.65
PT Sta 730+60.26
730+00
745+00
750+00
755+00
Sta 740+53.80
POT Sta 744+11.08
POT Sta 752+24.89
EQUATION: Sta 742+83.98 BK Sta 744+11.08 AH
EQUATION: Sta 752+24.94 BK Sta 752+24.84 AH
SOIL BORING
LIMITS OF CONSTRUCTION
℄ OF TEMPORARY ROADWAY
L-67 EXT.
* SEE PLATE A3-12 FOR TEMPORARY ROADWAY CONSTRUCTION SKETCHES
NOTE: WHEN ROADWAY CONSTRUCTION IS COMPLETED TEMPORARY ROADWAY IS TO BE USED AS ACCESS ROAD TO OSCEOLA CAMP.
NOTE: LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-3
D.O.FILE NO. 0005

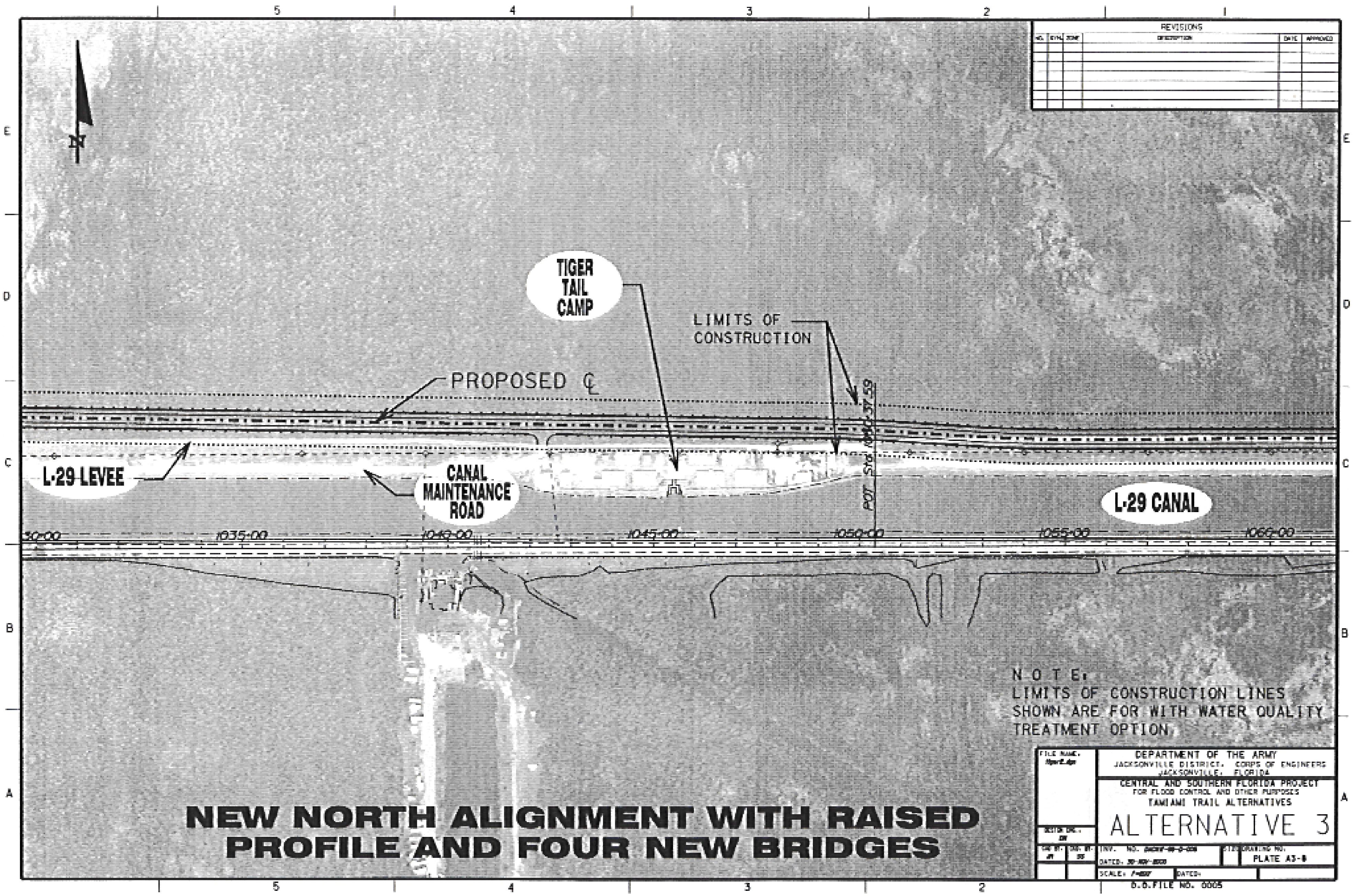

PROPOSED WIER A
LIMITS OF CONSTRUCTION
EXISTING POWER LINES TO BE RELOCATED
L-29 LEVEE
PROPOSED ℄
PROPOSED BRIDGE #2
L-29 CANAL
CANAL MAINTENANCE ROAD
825+00
830+00
835+00
840+00
845+00
850+00
EQUATION:
Sta 833+20.63 BK =
Sta 833+20.60 AH
POT Sta 833+20.61
BREACH EXISTING ROADWAY
SOIL BORING
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-4
D.O.FILE NO. 0005


REVISIONS
LIMITS OF CONSTRUCTION
PROPOSED WIER B
L-29 LEVEE
L-29 CANAL
PROPOSED ℄
PROPOSED BRIDGE #3
CANAL MAINTENANCE ROAD
BREACH EXISTING ROADWAY
915+00
920+00
925+00
930+00
935+00
940+00
N O T E:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-5
D.O.FILE NO. 0005

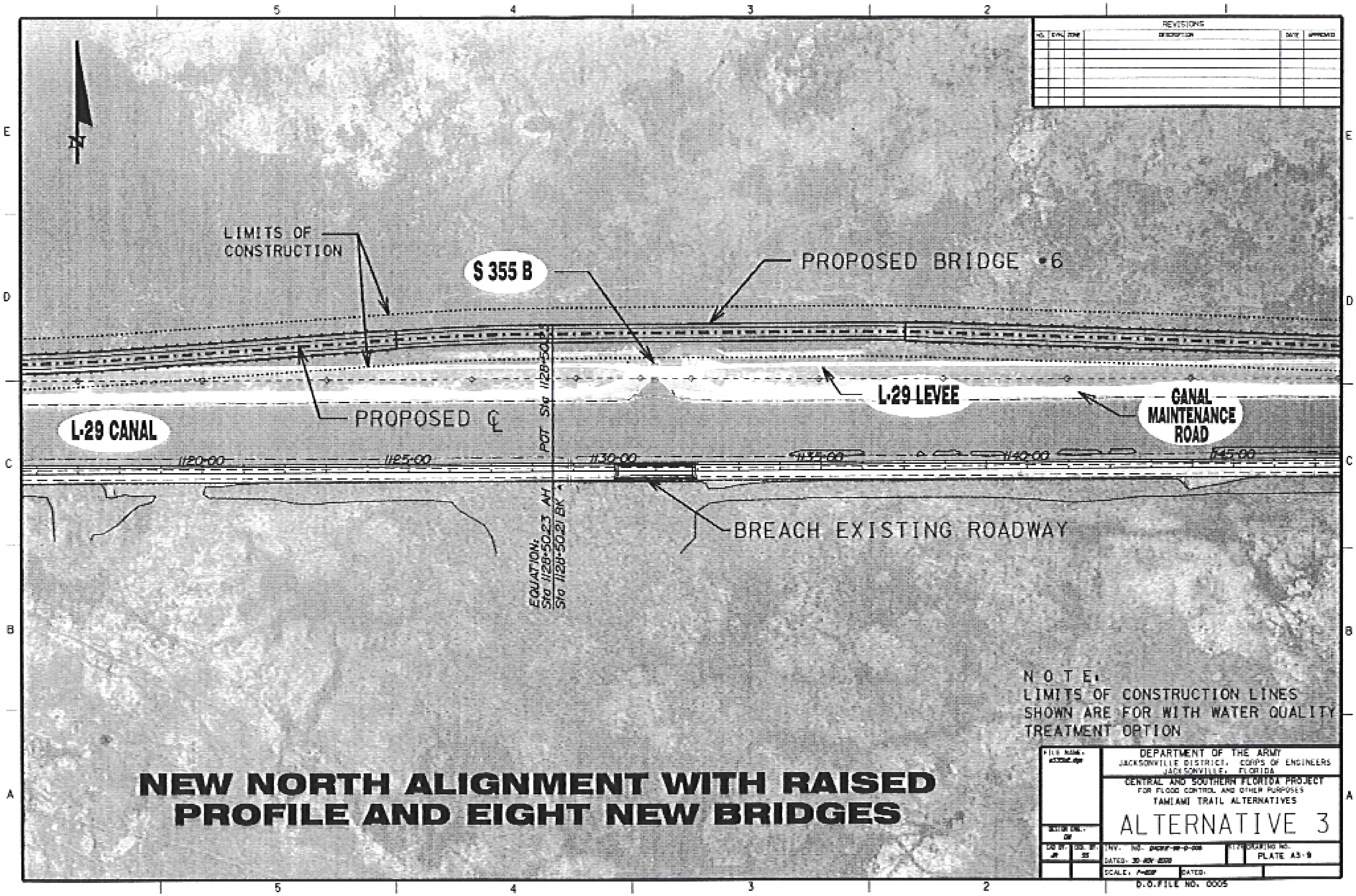


PROPOSED ℄
LIMITS OF CONSTRUCTION
EXISTING POWER LINES TO BE RELOCATED
L-29 LEVEE
CANAL MAINTENANCE ROAD
L-29 CANAL
950+00
955+00
960+00
965+00
SOIL BORING
PROPOSED BRIDGE #4
AIRBOAT ASSOCIATION OF FLORIDA
EQUATION:
Sta 951+52.31 AH
Sta 951+52.30 BK
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION.
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATE 3
PLATE A3-6
D.O.FILE NO. 0005

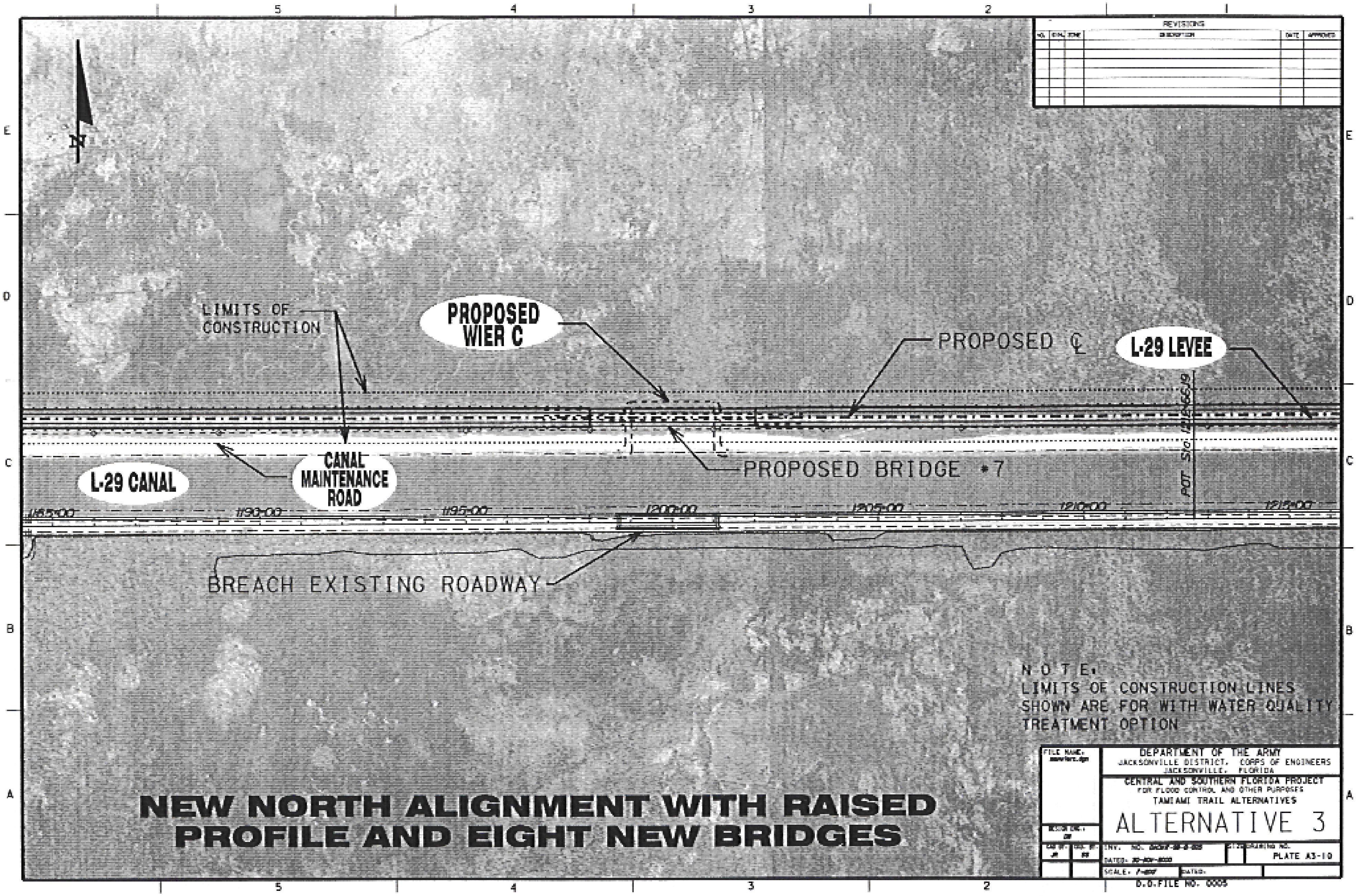

LIMITS OF CONSTRUCTION
PROPOSED ℄
PROPOSED BRIDGE •5
L-29 CANAL
POT Sta 999+49.16
S 355 A
CANAL MAINTENANCE ROAD
L-29 LEVEE
995+00
1000+00
1005+00
1010+00
1015+00
1020+00
BREACH EXISTING ROADWAY
N
REVISIONS
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-7
D.O.FILE NO. 0005

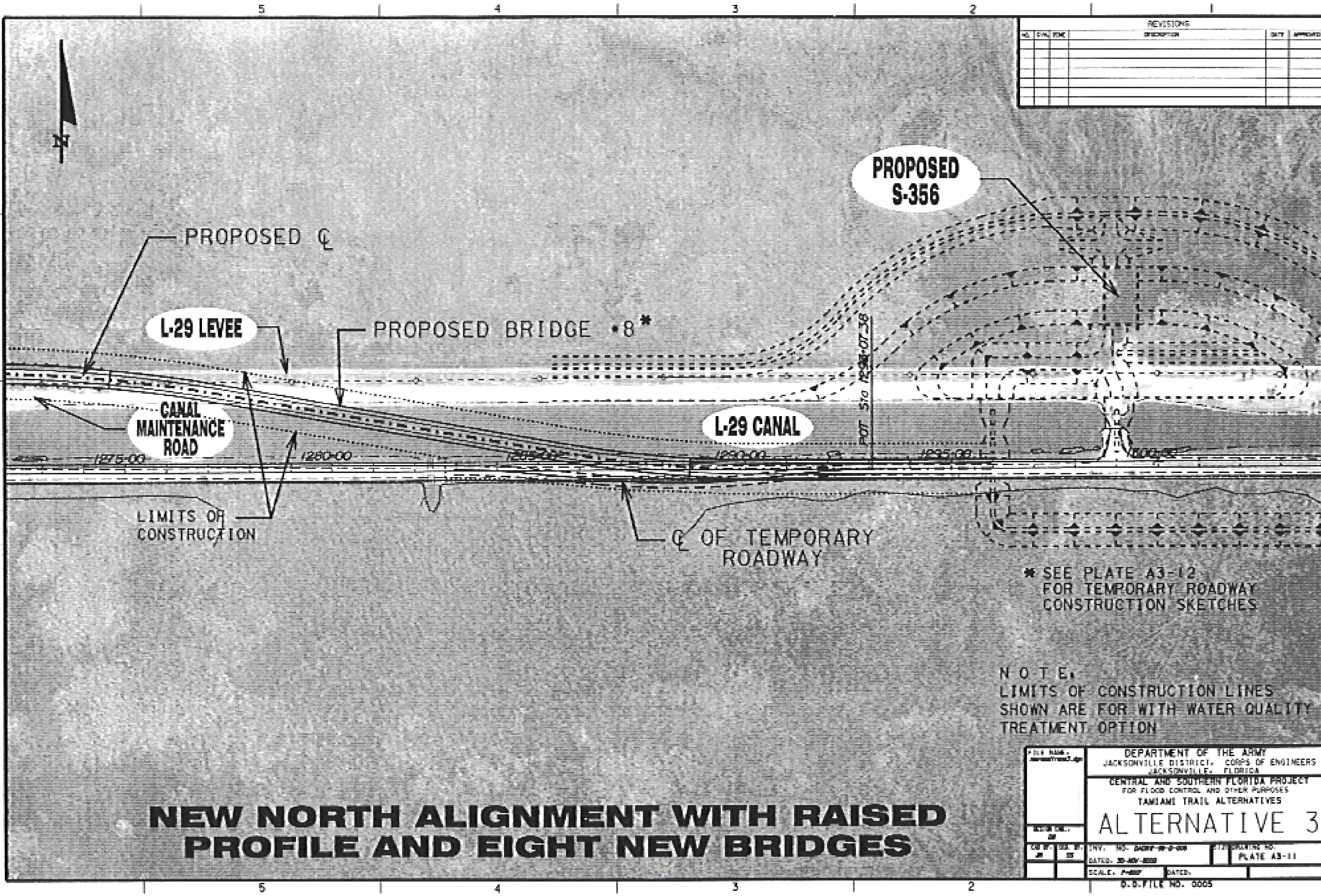


L-29 LEVEE
CANAL MAINTENANCE ROAD
TIGER TAIL CAMP
LIMITS OF CONSTRUCTION
PROPOSED ℄
POT Sta 1050+37.59
L-29 CANAL
1035+00
1040+00
1045+00
1050+00
1055+00
1060+00
N O T E:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION.
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-8
D.O.FILE NO. 0005
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

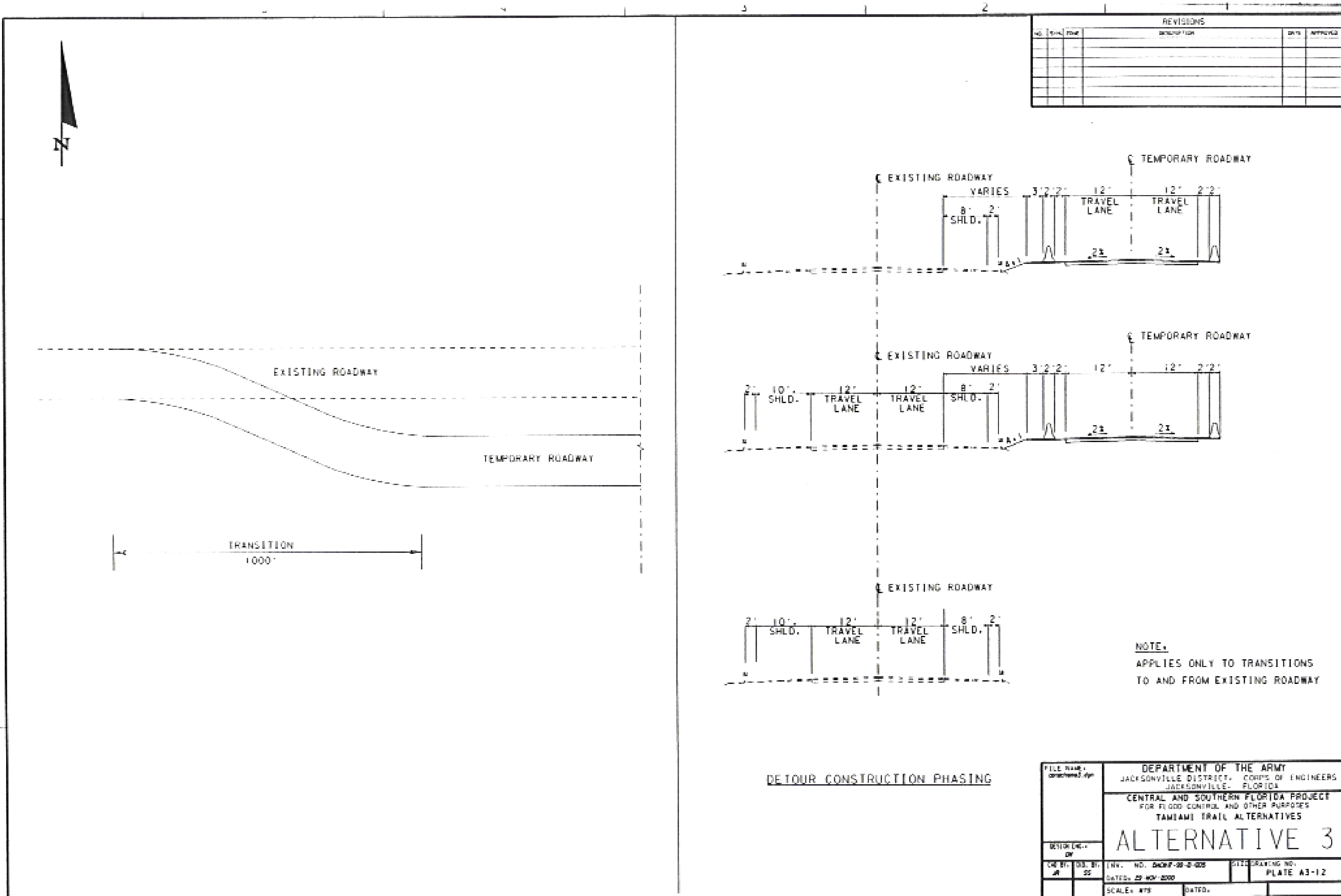


LIMITS OF CONSTRUCTION
S 355 B
PROPOSED BRIDGE •6
L-29 LEVEE
CANAL MAINTENANCE ROAD
PROPOSED ℄
L-29 CANAL
1120+00
1125+00
1130+00
1135+00
1140+00
1145+00
POT Sta 1128+50.2
EQUATION:
Sta 1128+50.23 AH
Sta 1128+50.21 BK
BREACH EXISTING ROADWAY
N O T E:
LIMITS OF CONSTRUCTION LINES
SHOWN ARE FOR WITH WATER QUALITY
TREATMENT OPTION
NEW NORTH ALIGNMENT WITH RAISED
PROFILE AND EIGHT NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-9
D.O.FILE NO. 0005


REVISIONS
N
LIMITS OF CONSTRUCTION
PROPOSED WIER C
PROPOSED ℄
L-29 LEVEE
PROPOSED BRIDGE *7
CANAL MAINTENANCE ROAD
L-29 CANAL
1185+00
1190+00
1195+00
1200+00
1205+00
1210+00
1215+00
BREACH EXISTING ROADWAY
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-10
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES



PROPOSED S-356
PROPOSED ℄
L-29 LEVEE
PROPOSED BRIDGE •8*
CANAL MAINTENANCE ROAD
L-29 CANAL
POT Sta 1292+07.38
1275+00
1280+00
1285+00
1290+00
1295+00
1300+00
LIMITS OF CONSTRUCTION
℄ OF TEMPORARY ROADWAY
* SEE PLATE A3-12 FOR TEMPORARY ROADWAY CONSTRUCTION SKETCHES
NOTE: LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 3
PLATE A3-11
D.O. FILE NO. 0005
NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES




DETOUR CONSTRUCTION PHASING

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JACKSONVILLE, FLORIDA

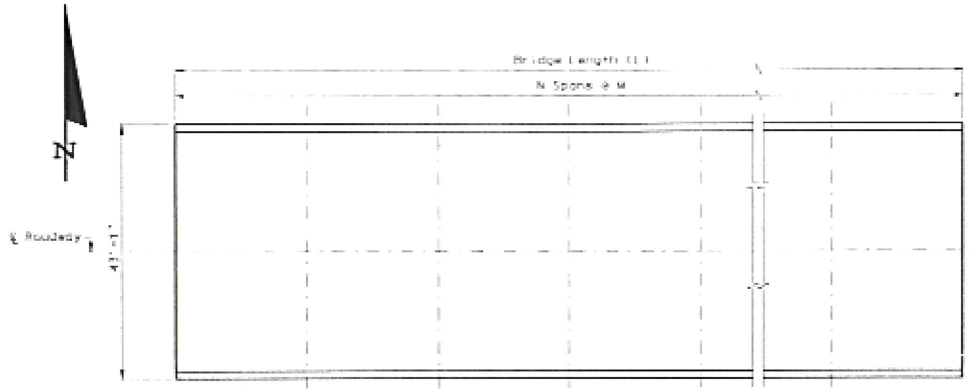
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 3

PLATE A3-12

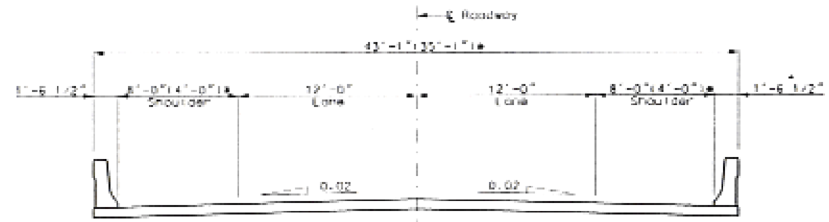
SCALE: NTS

D.O.FILE NO. 0005




## BRIDGE PLAN

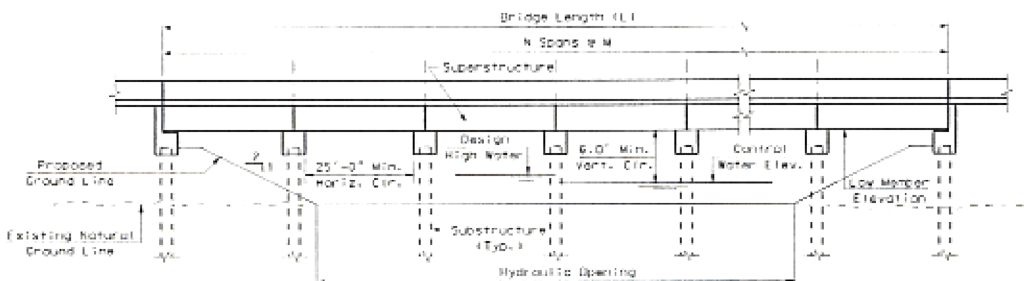
(All Bridges)




## BRIDGE TYPICAL SECTION

(All Bridges)

* Dimensions in parenthesis are for Bridge 4




## BRIDGE ELEVATION

(All Bridges)

| Bridge Number | Bridge Type | Bridge Length (L) | Hydraulic Opening | Number of Spans (N) | Span Lengths (M) | Superstructure Type | Substructure Type | Design High Water | Control Water Elev. | Low Member Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | C | 1214' | N/A | 12 | 101.17' | AASHTO Type V | 36" Drilled Shaft | 10.5' | 8.5' | 14.5' |
| 2 | D | 248.5' | 200' | 6 | 41.42' | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 3 | E | 194.0' | 150' | 3 | 64.67' | AASHTO Type III | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 4 | F | 168.5' | N/A | 4 | 42.13 | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 8.5' | 14.5' |
| 5 | G | 1200' | N/A | 13 | 92.31' | AASHTO Type V | 24 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 6 | G | 1200' | N/A | 13 | 92.31' | AASHTO Type V | 24 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 7 | D | 248.5' | 200' | 6 | 41.42' | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 8 | C | 1214' | N/A | 12 | 101.17' | AASHTO Type V | 36" Drilled Shaft | 10.5' | 8.5' | 14.5' |

## BRIDGE DATA

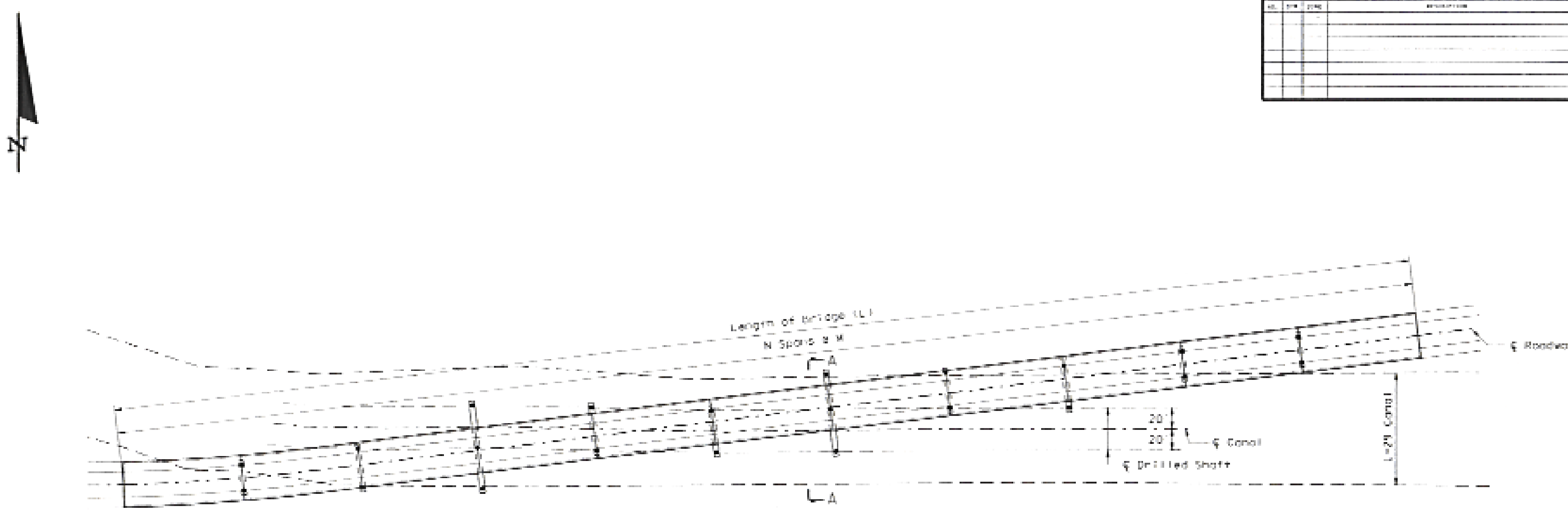
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 3 (BRIDGE 2 THRU 7)

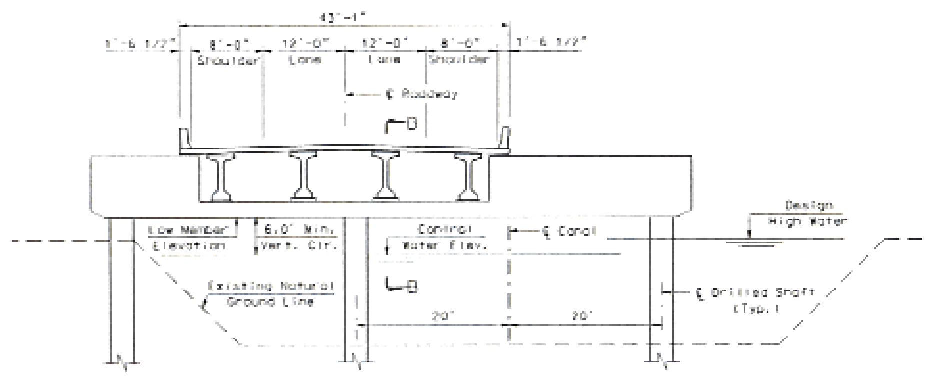
DRAWING NO. A3-13a

D.O.FILE NO. 0005

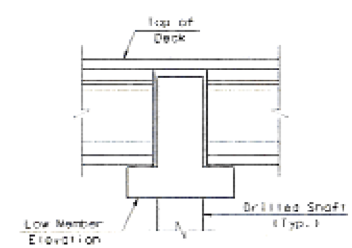



## BRIDGE PLAN

(Bridge 1 shown, Bridge 8 similar)




## SECTION A-A




## SECTION B-B

NOTE:

1. Refer to Drawing No. A3-13a for Bridge Data Table

REVISIONS

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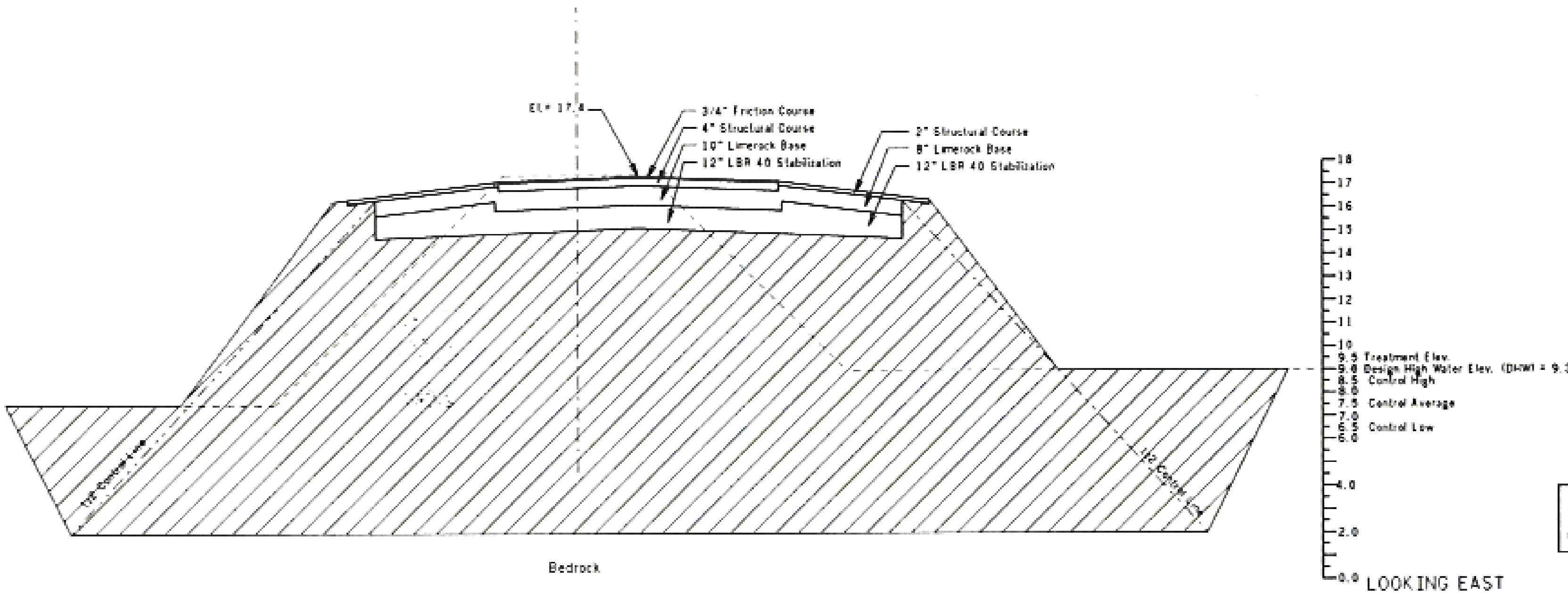
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 3
(Bridges 1 and 8)

DRAWING NO. A3-13b

D.O.FILE NO. 0005




**Alternative 3 Without Water Quality Treatment**

1" = 10' HORIZONTAL
1" = 5' VERTICAL

# TYPICAL SECTIONS
# NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES

LEGEND

▨ = Select Fill (A-1, A-3)

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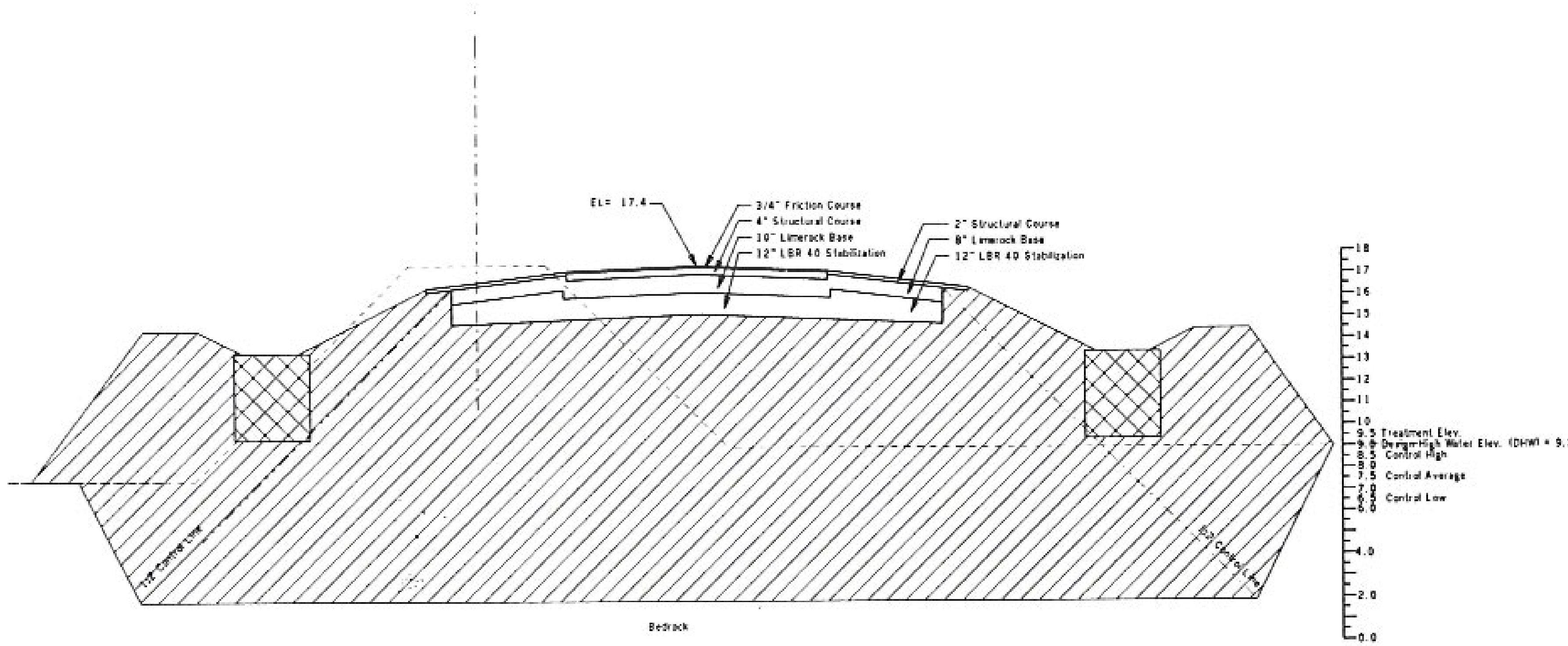
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 3

PLATE A3-14

D.O.FILE NO. 0005




**Alternative 3 With Water Quality Treatment**

LOOKING EAST

# TYPICAL SECTIONS
## NEW NORTH ALIGNMENT WITH RAISED PROFILE AND EIGHT NEW BRIDGES

LEGEND

- = Select Fill (A-1, A-3)
- = Fine Aggregate (902-4)

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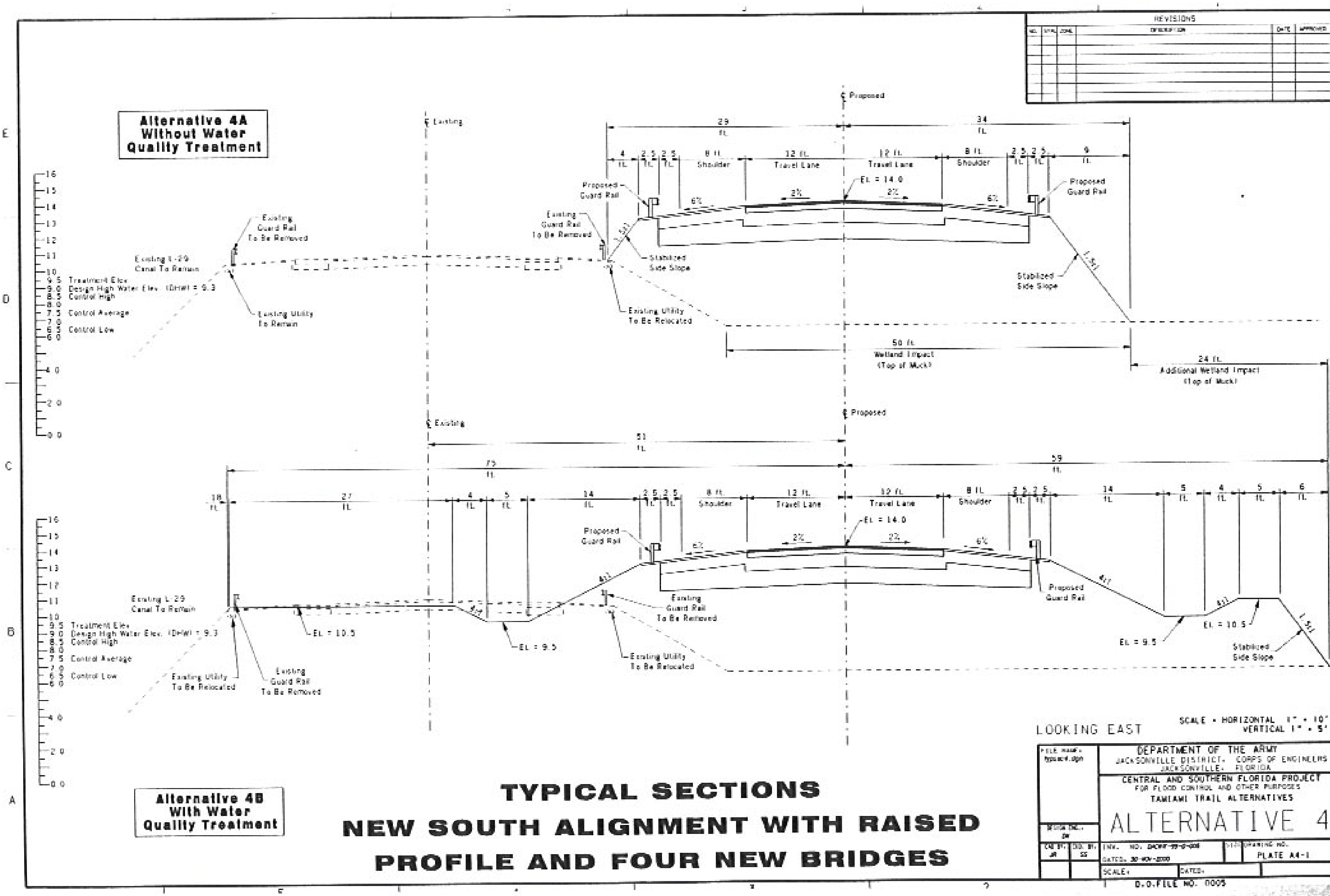
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 3

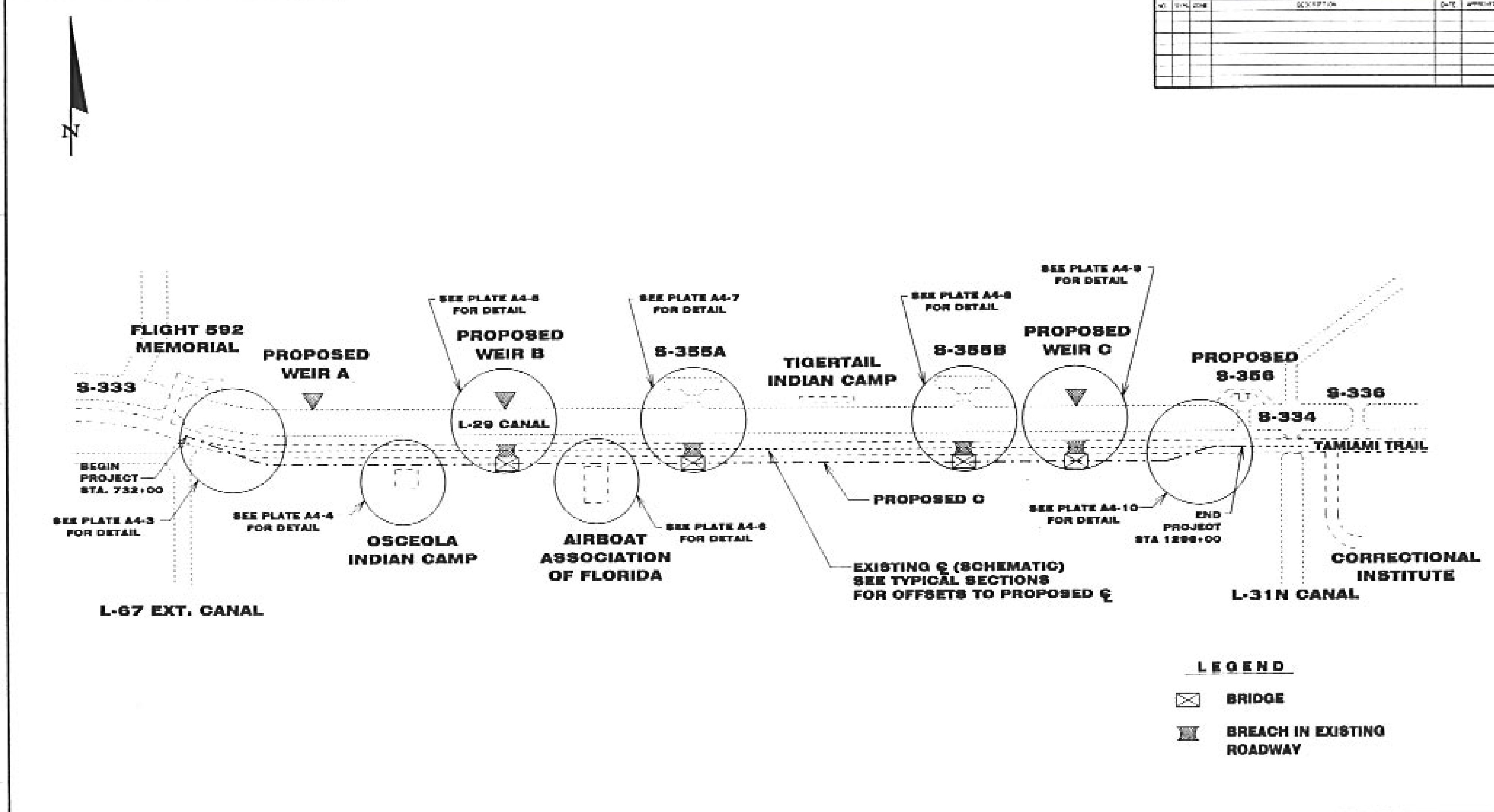
PLATE A3-15

SCALE: AS SHOWN

D.O.FILE NO. 0005




# TYPICAL SECTIONS
# NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

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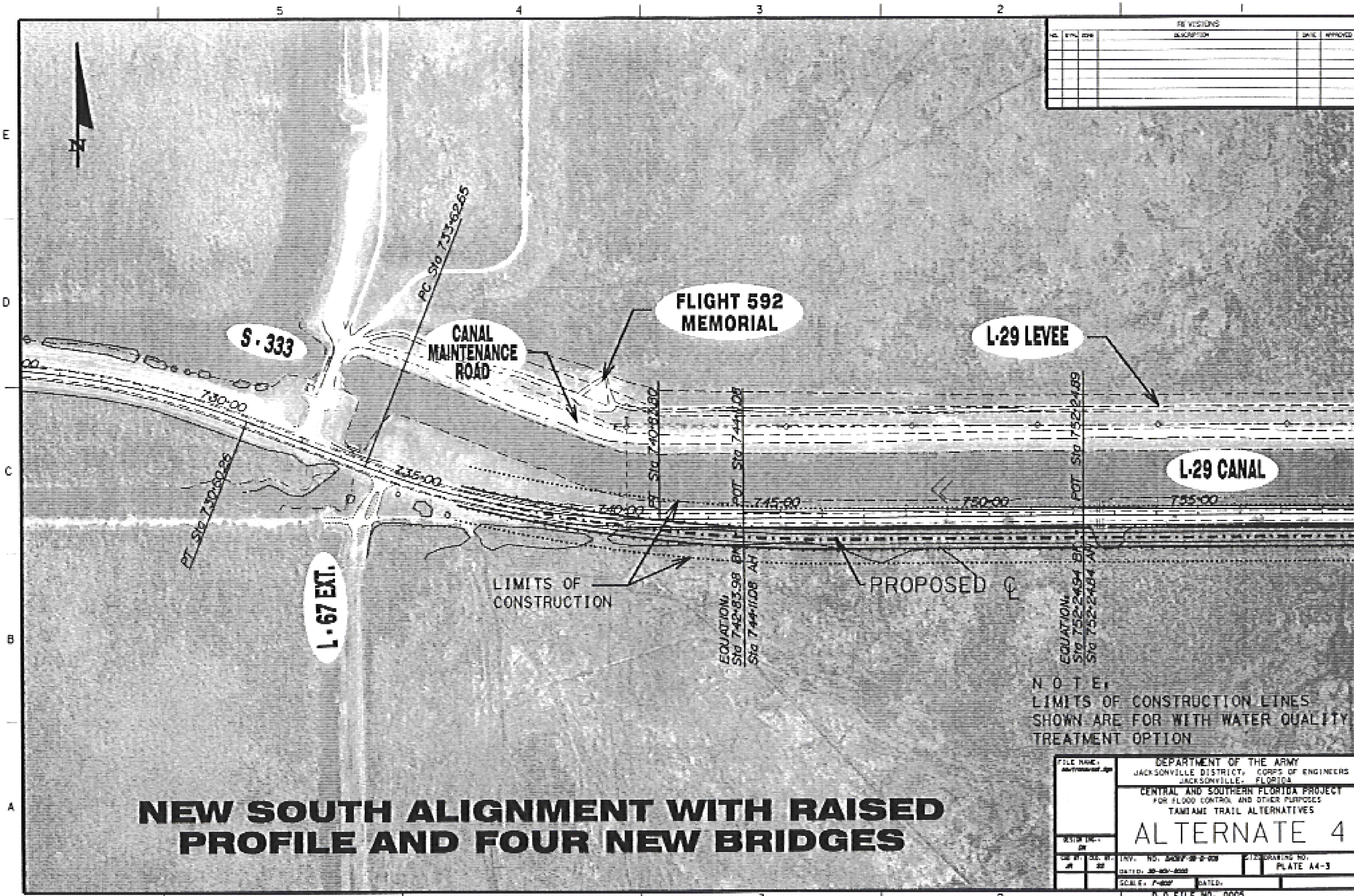
JACKSONVILLE, FLORIDA

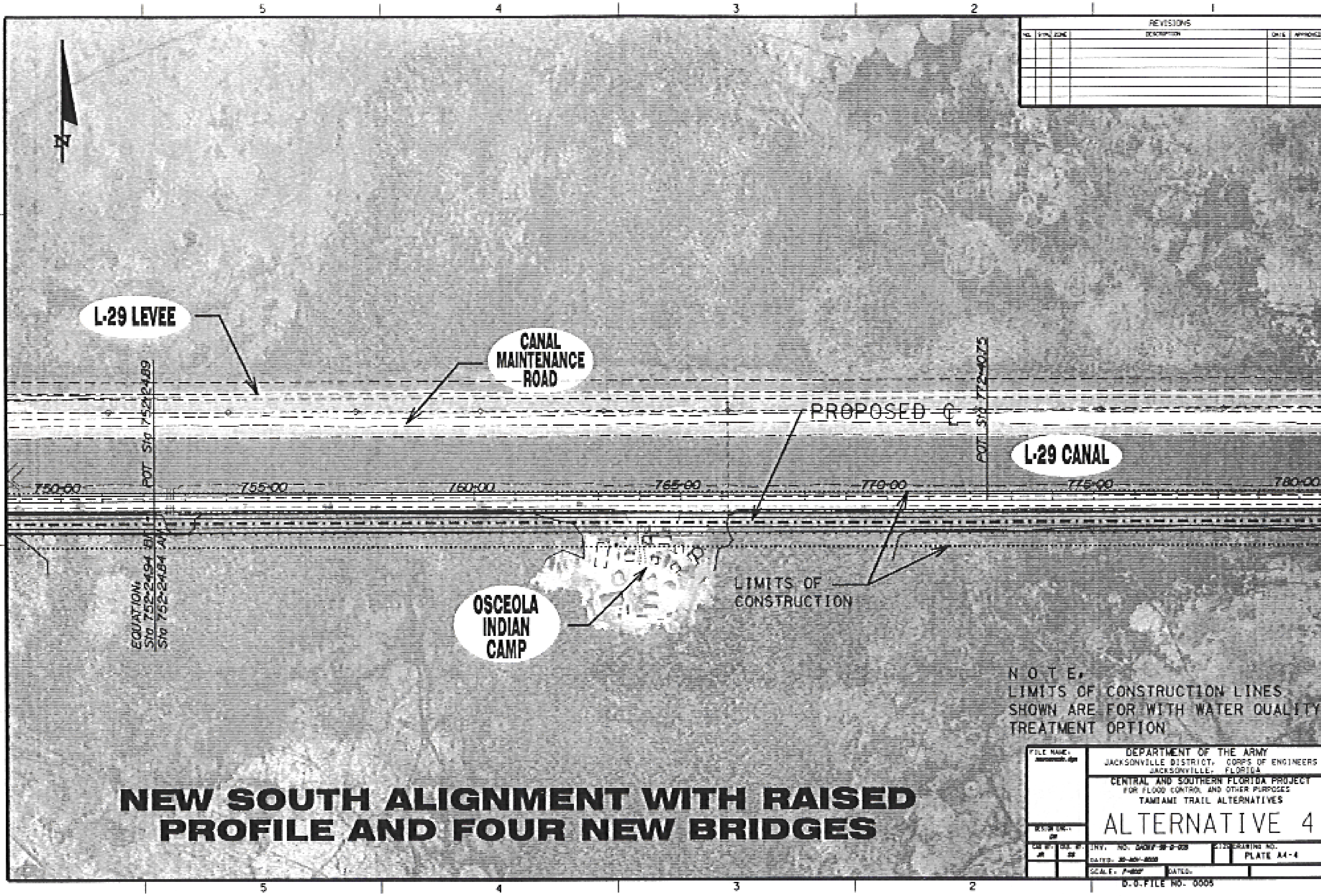
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 4

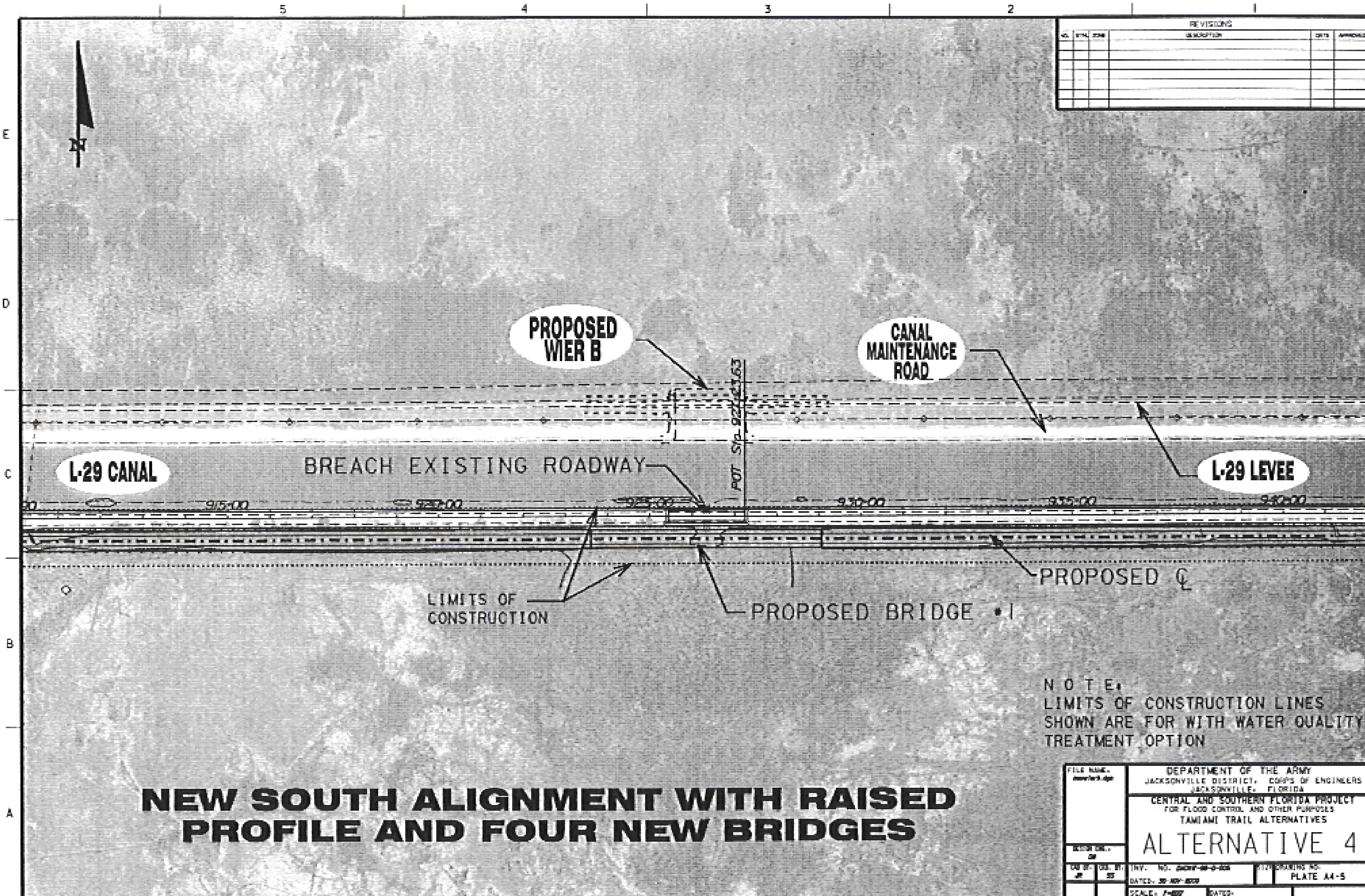
PLATE A4-2
D.O. FILE NO. 0005



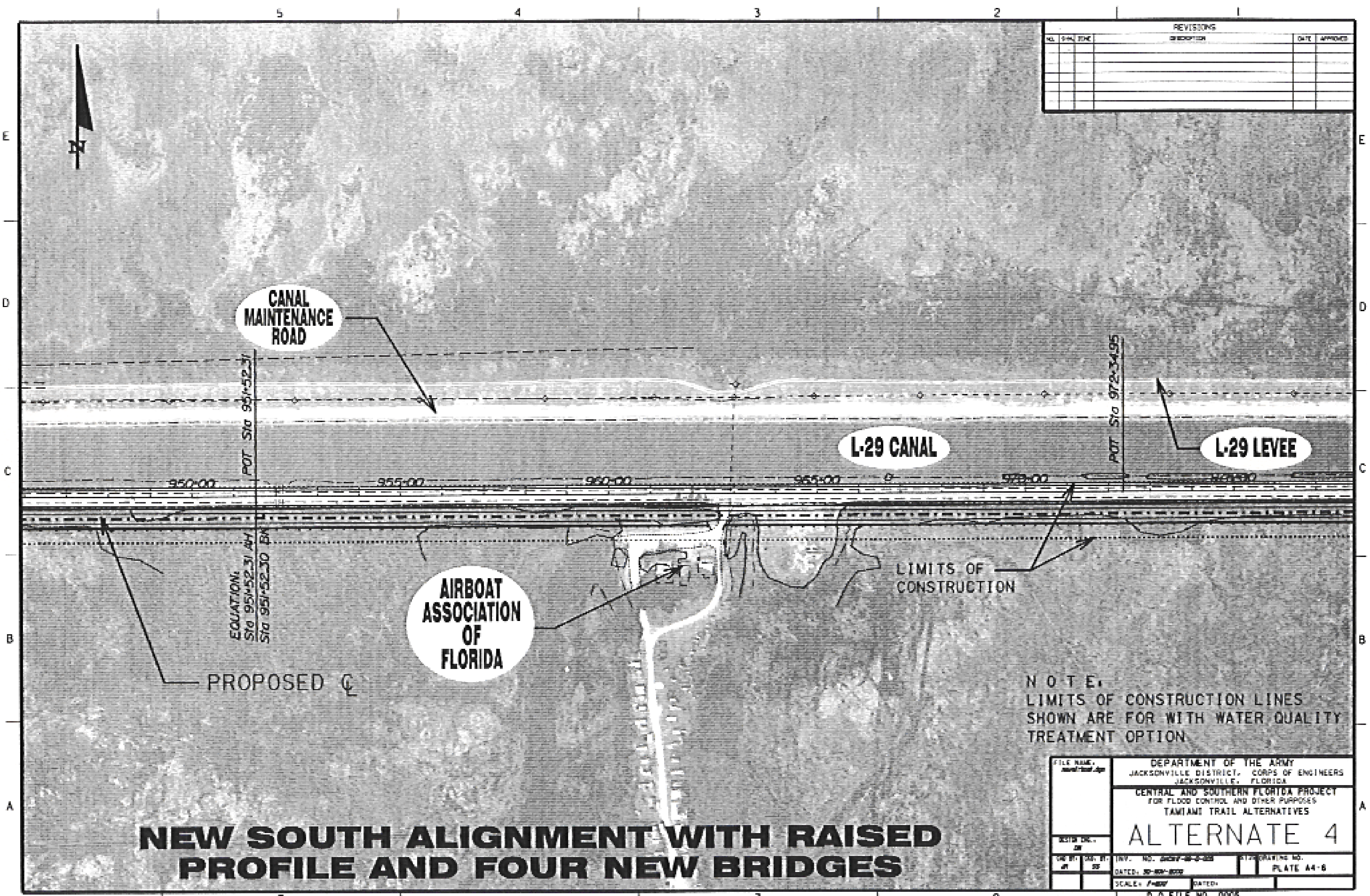
S · 333
CANAL MAINTENANCE ROAD
FLIGHT 592 MEMORIAL
L-29 LEVEE
L-29 CANAL
L · 67 EXT.
PC Sta 733+62.65
PT Sta 730+50.26
PT Sta 740+62.80
POT Sta 744+11.08
POT Sta 752+24.89
730+00
735+00
740+00
745+00
750+00
755+00
LIMITS OF CONSTRUCTION
PROPOSED ℄
EQUATION: Sta 742+83.98 BK Sta 744+11.08 AH
EQUATION: Sta 752+24.94 BK Sta 752+24.84 AH
N O T E:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DESCRIPTION
DATE
APPROVED
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATE 4
PLATE A4-3
D.O.FILE NO. 0005

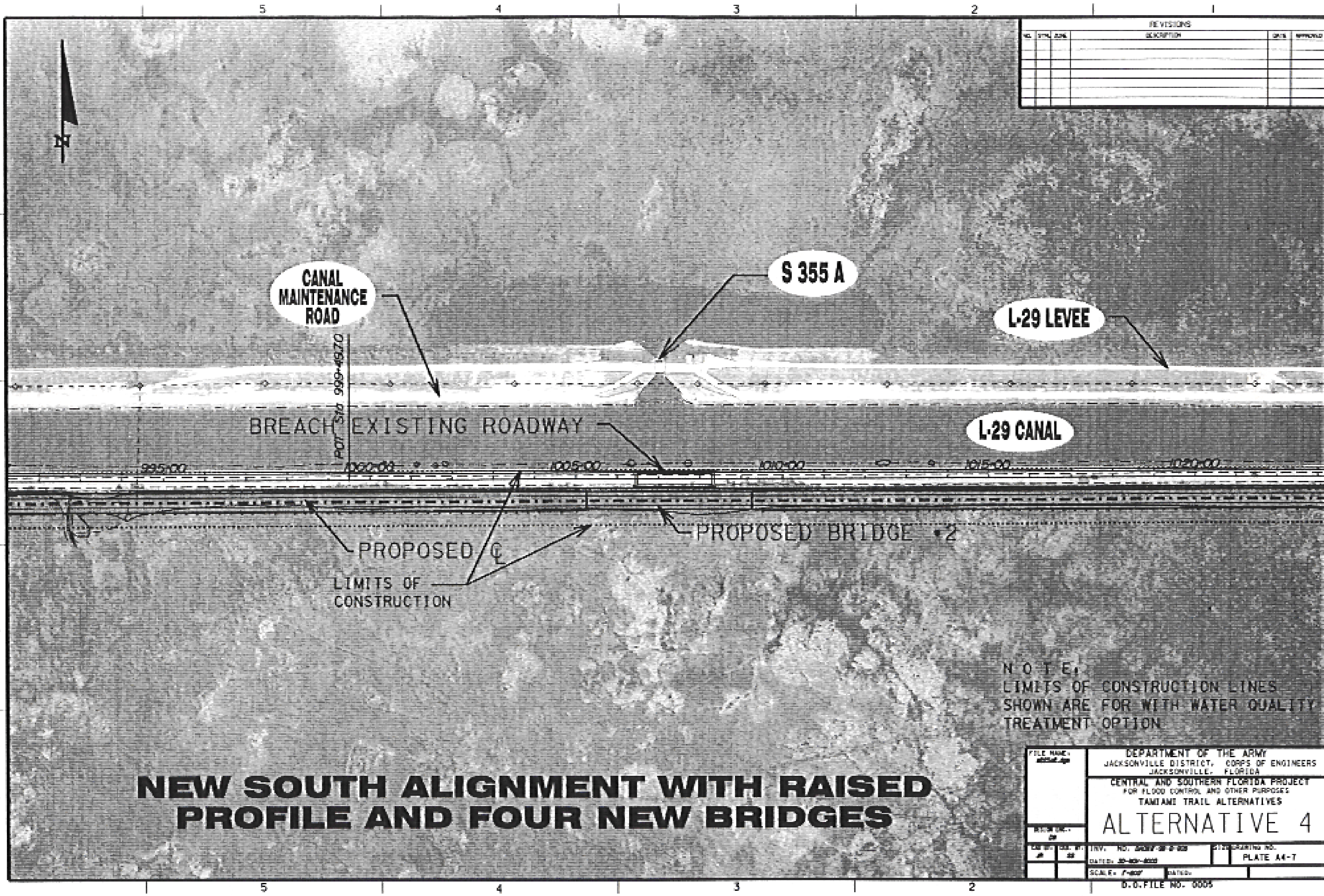


L-29 LEVEE
CANAL MAINTENANCE ROAD
PROPOSED ℄
L-29 CANAL
POT Sta 752+24.89
EQUATION:
Sta 752+24.94 BK
Sta 752+24.84 AH
POT Sta 772+40.75
750+00
755+00
760+00
765+00
770+00
775+00
780+00
OSCEOLA INDIAN CAMP
LIMITS OF CONSTRUCTION
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 4
PLATE A4-4
D.O.FILE NO. 0005

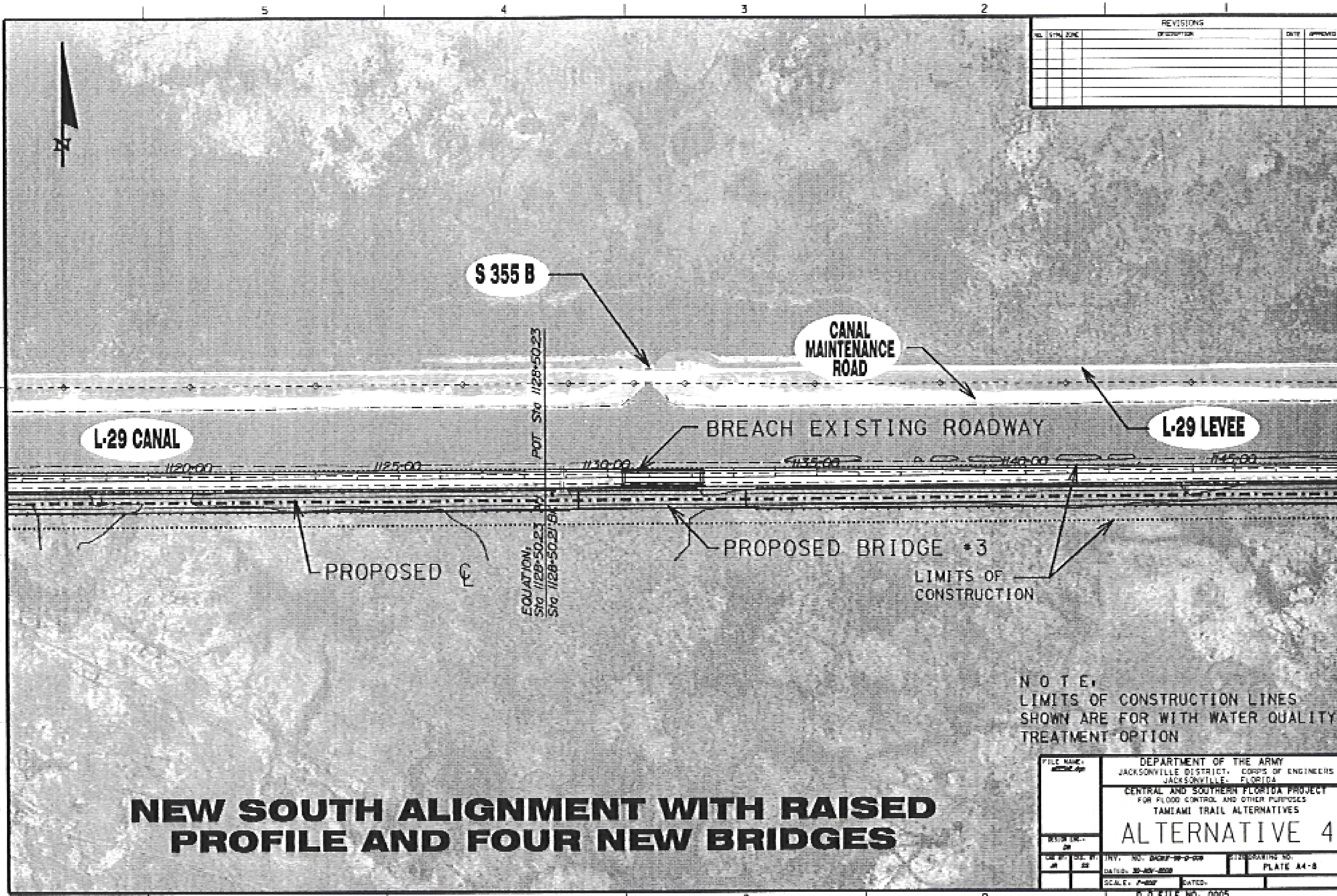


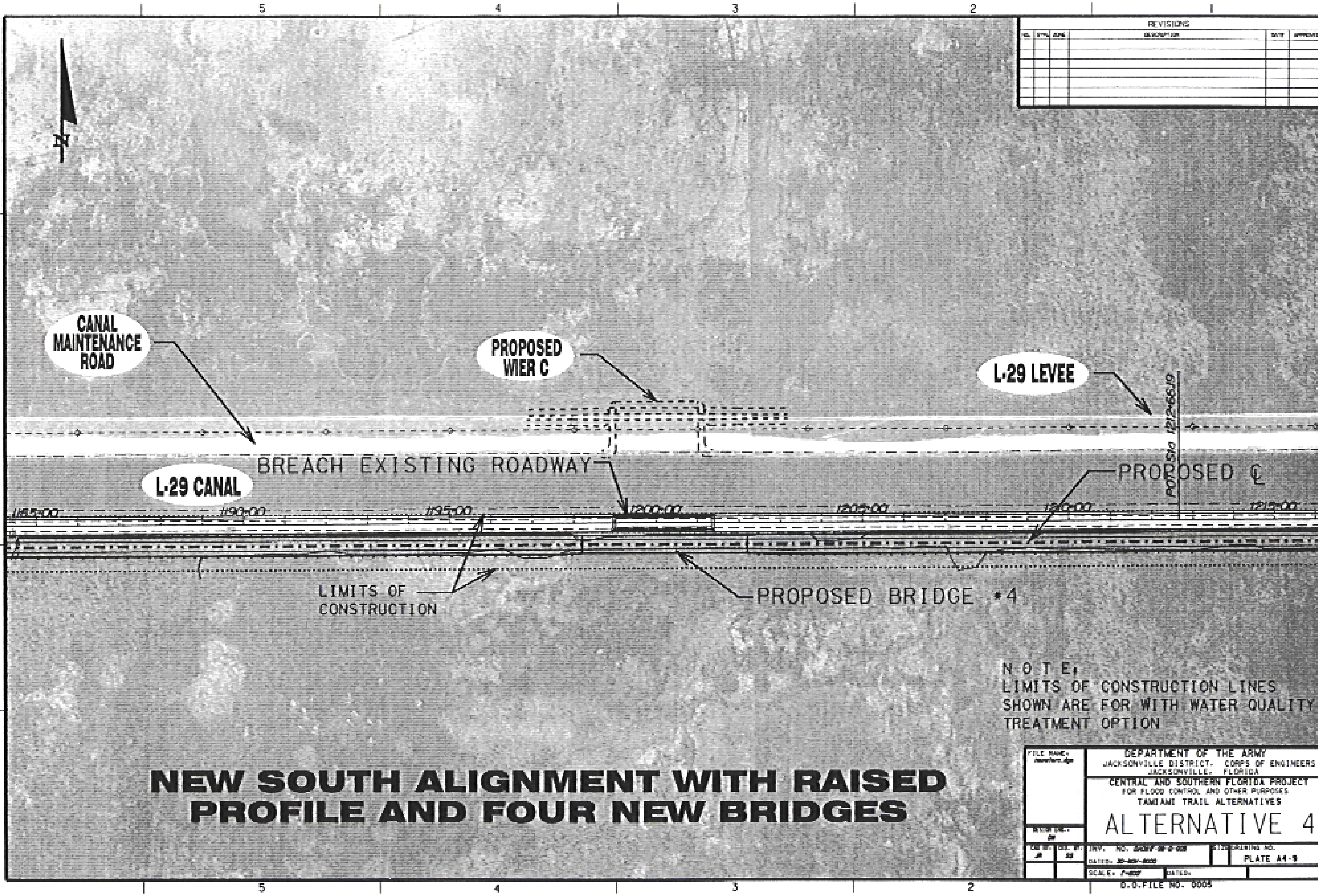
N
PROPOSED WIER B
CANAL MAINTENANCE ROAD
L-29 CANAL
BREACH EXISTING ROADWAY
POT Sta. 927+43.63
915+00
920+00
925+00
930+00
935+00
940+00
L-29 LEVEE
LIMITS OF CONSTRUCTION
PROPOSED BRIDGE #1
PROPOSED ℄
N O T E:
LIMITS OF CONSTRUCTION LINES
SHOWN ARE FOR WITH WATER QUALITY
TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED
PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 4
PLATE A4-5
D.O.FILE NO. 0005

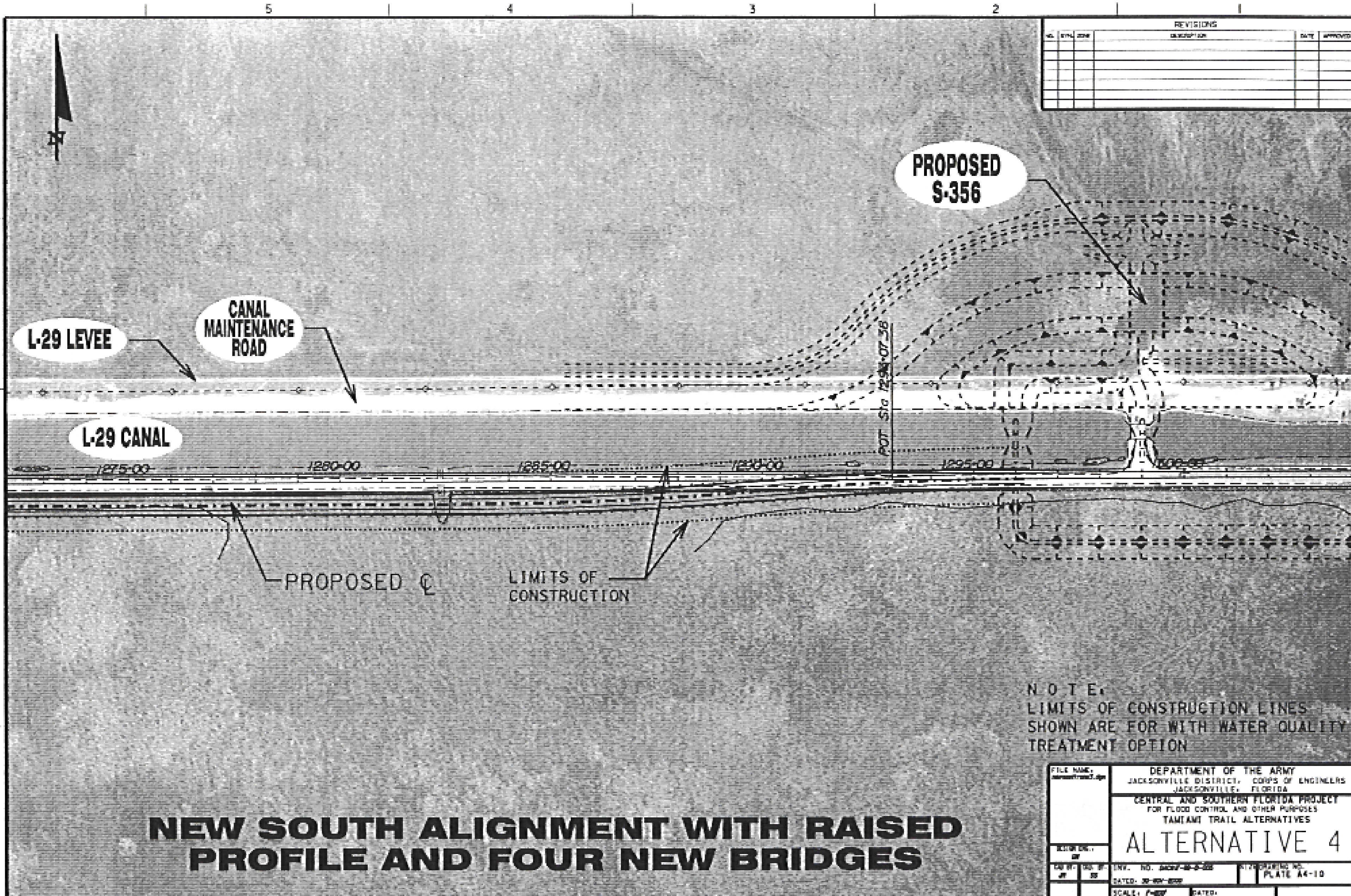

CANAL MAINTENANCE ROAD
L-29 CANAL
L-29 LEVEE
POT Sta 951+52.31
POT Sta 972+34.95
EQUATION:
Sta 951+52.31 AH
Sta 951+52.30 BK
950+00
955+00
960+00
965+00
970+00
AIRBOAT ASSOCIATION OF FLORIDA
LIMITS OF CONSTRUCTION
PROPOSED ℄
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATE 4
PLATE A4-6
D.O.FILE NO. 0005
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

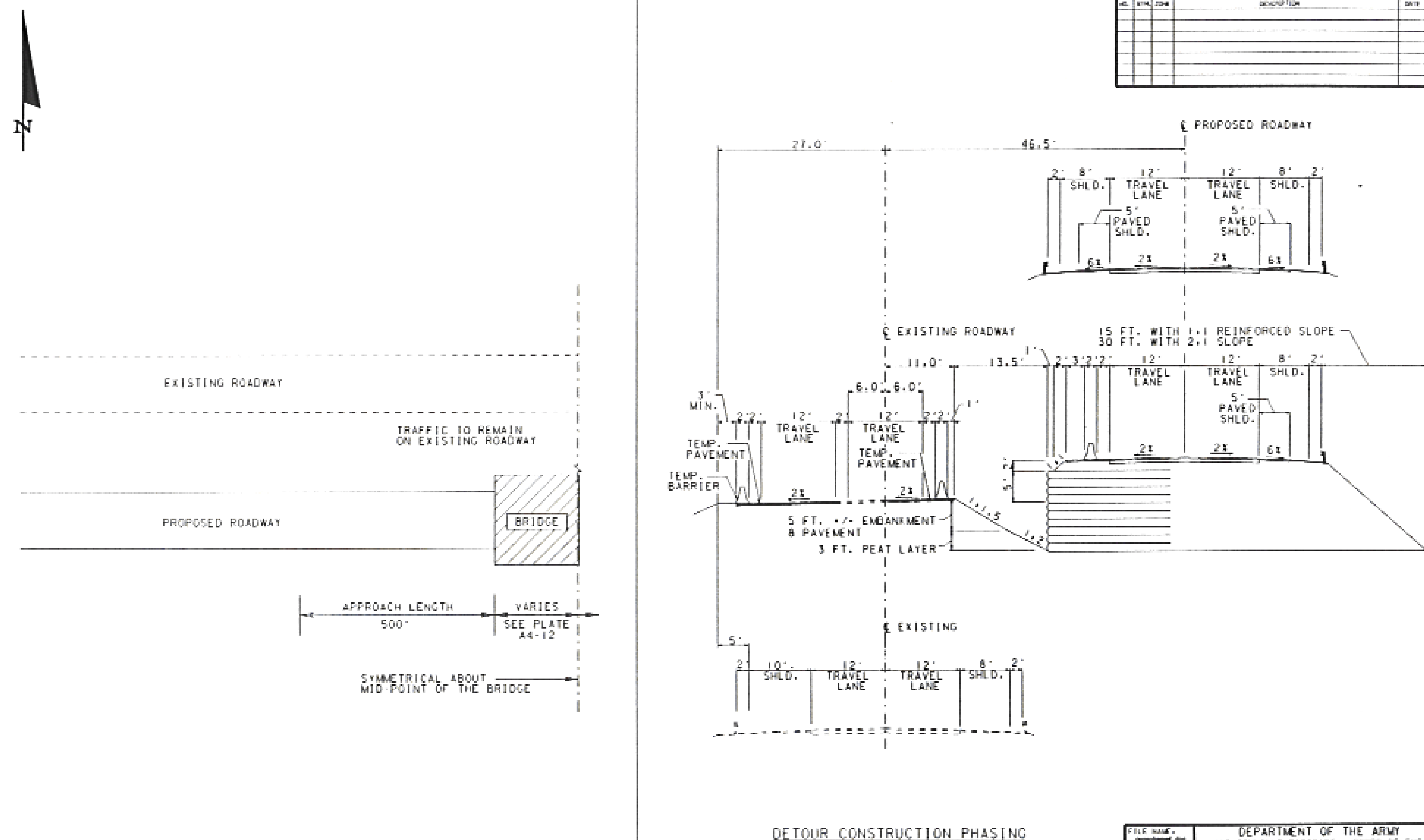


CANAL MAINTENANCE ROAD
S 355 A
L-29 LEVEE
L-29 CANAL
BREACH EXISTING ROADWAY
POT Sta 999+49.70
995+00
1000+00
1005+00
1010+00
1015+00
1020+00
PROPOSED ℄
PROPOSED BRIDGE #2
LIMITS OF CONSTRUCTION
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 4
PLATE A4-7
D.O.FILE NO. 0005


S 355 B
CANAL MAINTENANCE ROAD
L-29 CANAL
L-29 LEVEE
BREACH EXISTING ROADWAY
POT Sta 1128+50.23
EQUATION:
Sta 1128+50.23 AH
Sta 1128+50.21 BK
1120+00
1125+00
1130+00
1135+00
1140+00
1145+00
PROPOSED ℄
PROPOSED BRIDGE *3
LIMITS OF CONSTRUCTION
N O T E:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 4
PLATE A4-8
D.O.FILE NO. 0005


CANAL MAINTENANCE ROAD
PROPOSED WIER C
L-29 LEVEE
L-29 CANAL
BREACH EXISTING ROADWAY
PROPOSED ℄
POT Sta 1212+66.19
LIMITS OF CONSTRUCTION
PROPOSED BRIDGE #4
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 4
PLATE A4-9
D.O.FILE NO. 0005
REVISIONS


REVISIONS
PROPOSED S-356
CANAL MAINTENANCE ROAD
L-29 LEVEE
L-29 CANAL
POT Sta 1298+07.36
1275+00
1280+00
1285+00
1290+00
1295+00
PROPOSED ℄
LIMITS OF CONSTRUCTION
NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 4
PLATE A4-10
D.O.FILE NO. 0005




DETOUR CONSTRUCTION PHASING

REVISIONS

| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|

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JACKSONVILLE, FLORIDA

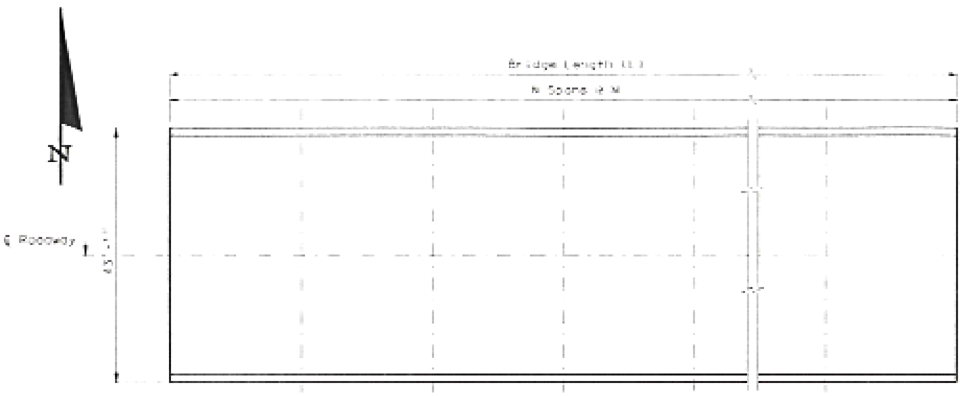
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 4

DRAWING NO. PLATE A4-11

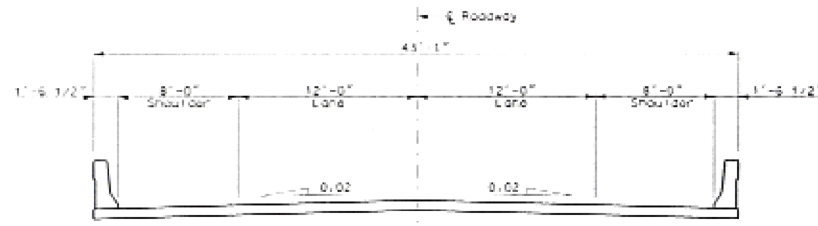
SCALE: NTS

D.O.FILE NO. 0005



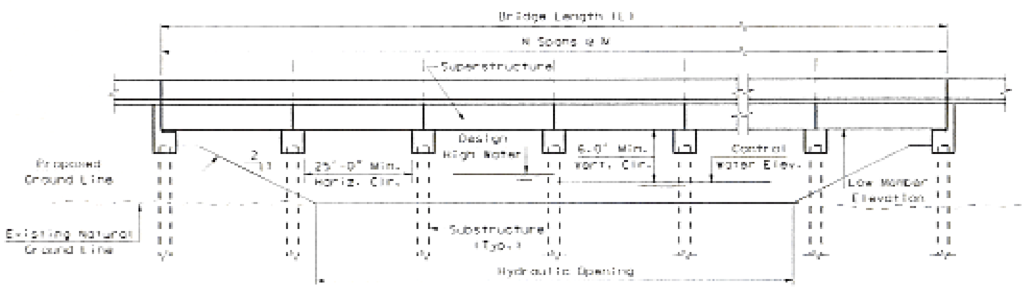

## BRIDGE PLAN

(All Bridges)




## BRIDGE TYPICAL SECTION

(All Bridges)




## BRIDGE ELEVATION

(All Bridges)

| Bridge Number | Bridge Type | Bridge Length (L) | Hydraulic Opening | Number of Spans (N) | Span Lengths (M) | Superstructure Type | Substructure Type | Design High Water | Control Water Elev. | Low Member Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 475.0' | 425' | 11 | 43.18' | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 2 | B | 345.5' | 300' | 8 | 43.19' | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 3 | B | 345.5' | 300' | 8 | 43.19' | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |
| 4 | A | 475.0' | 425' | 11 | 43.18' | AASHTO Type II | 18 in. Prestressed Pile | 10.5' | 9.0' | 15.0' |

## BRIDGE DATA

REVISIONS

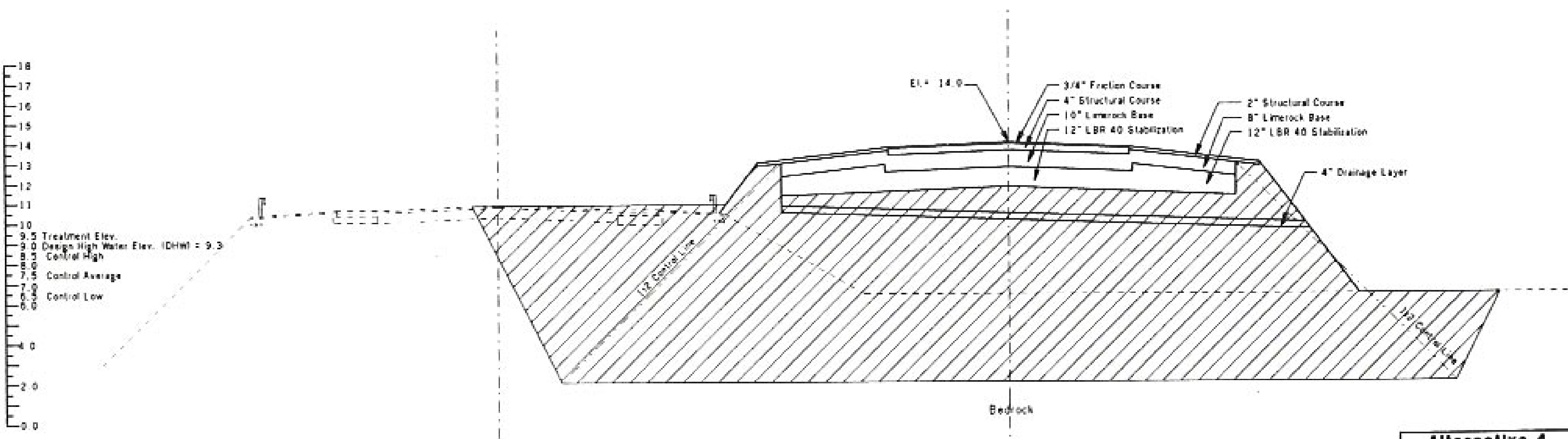
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# ALTERNATIVE 4

DRAWING NO. A4-12

D.O.J FILE NO. D005




**Alternative 4 Without Water Quality Treatment**

LOOKING EAST

1" = 10' HORIZONTAL
1" = 5' VERTICAL

LEGEND

= Select Fill (A-1, A-3)

# TYPICAL SECTIONS
# NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

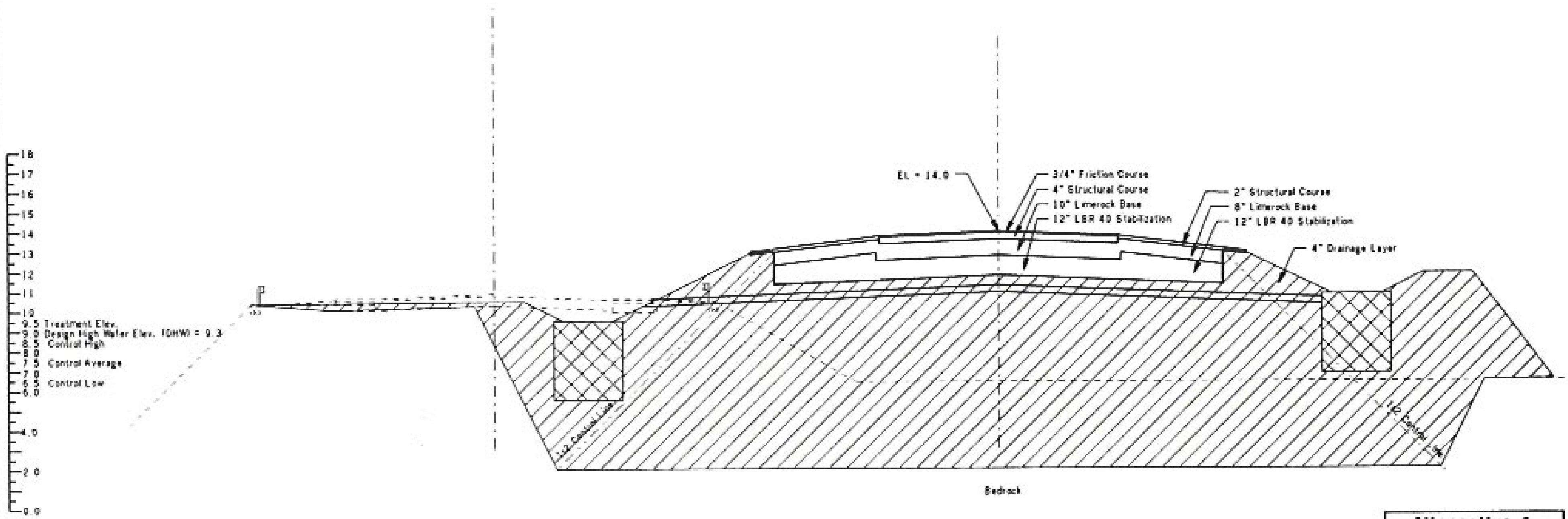
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 4

PLATE A4-13

SCALE: AS SHOWN

D.O.FILE NO. 0005




**Alternative 4 With Water Quality Treatment**

# TYPICAL SECTIONS
# NEW SOUTH ALIGNMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

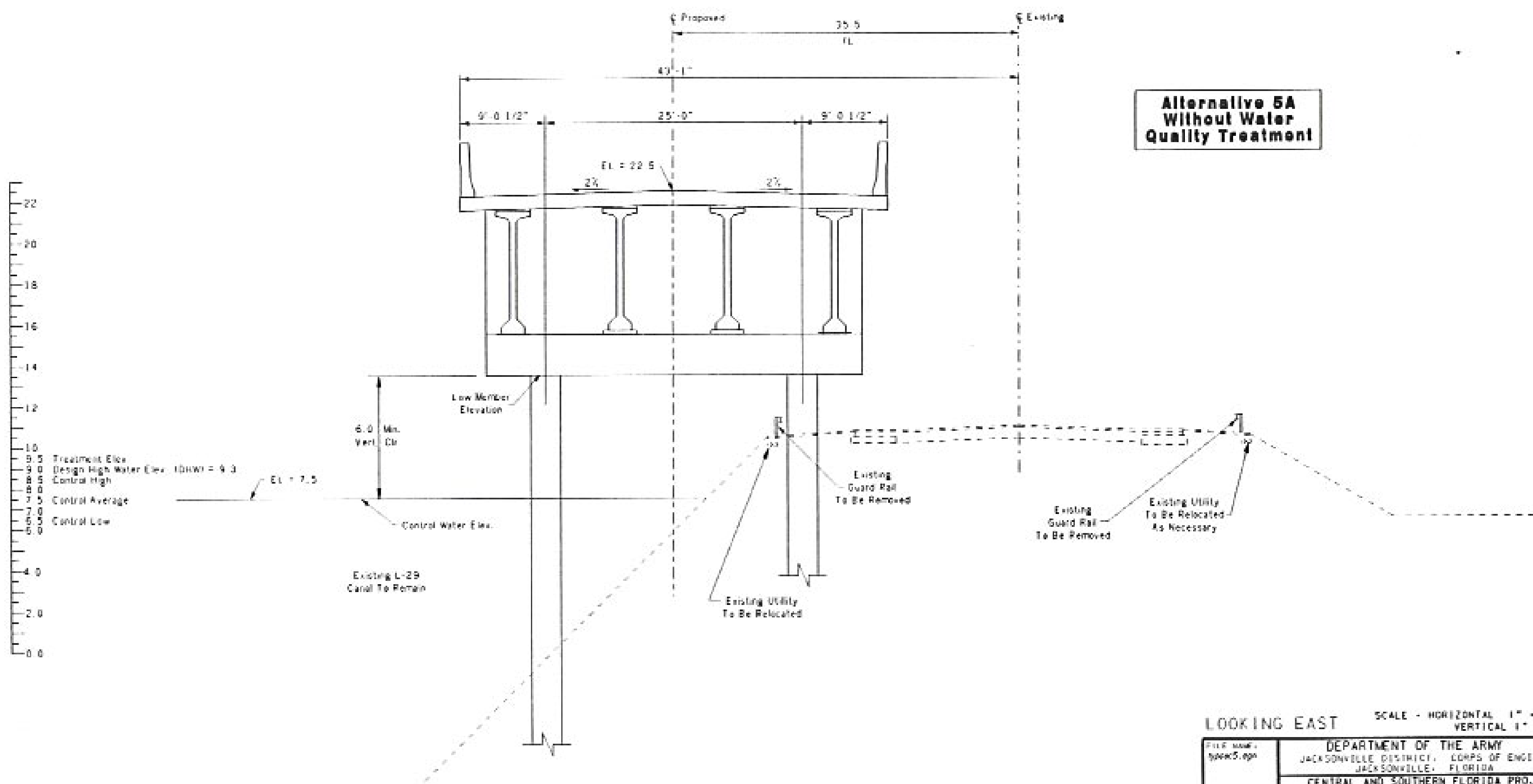
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 4

PLATE A4-14

D.O.FILE NO. 0005




**Alternative 5A Without Water Quality Treatment**

# TYPICAL SECTION
# NEW ALIGNMENT ON STRUCTURE

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

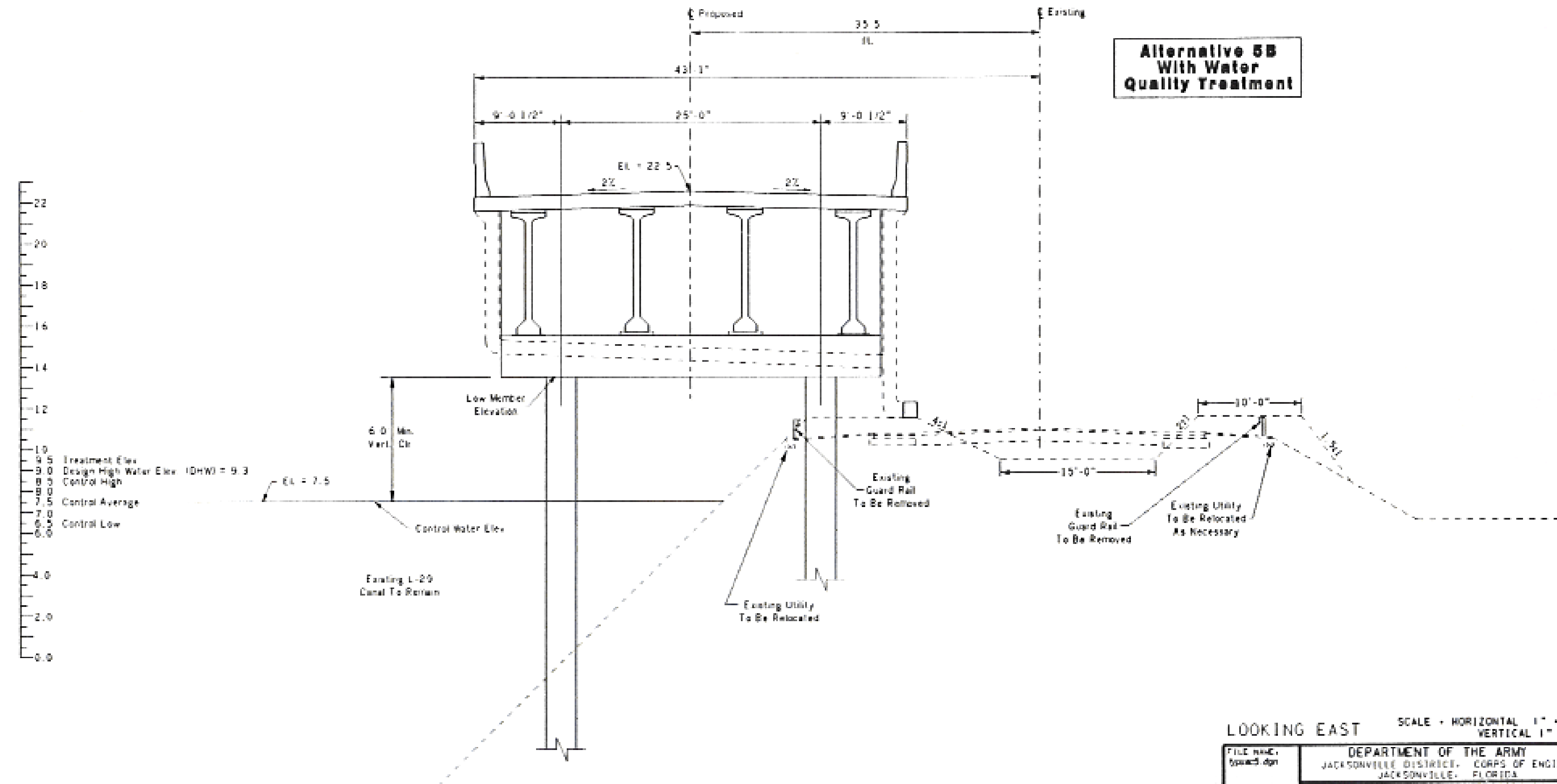
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 5

FILE NAME: typsec5.dgn
DESIGN ENG.: DW
CHK BY: JR
DRAWING NO.: PLATE A5-1

D.O.FILE NO. 0005

**Alternative 5B With Water Quality Treatment**




# TYPICAL SECTION
# NEW ALIGNMENT ON STRUCTURE

LOOKING EAST

SCALE : HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

FILE NAME: typsect5.dgn

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

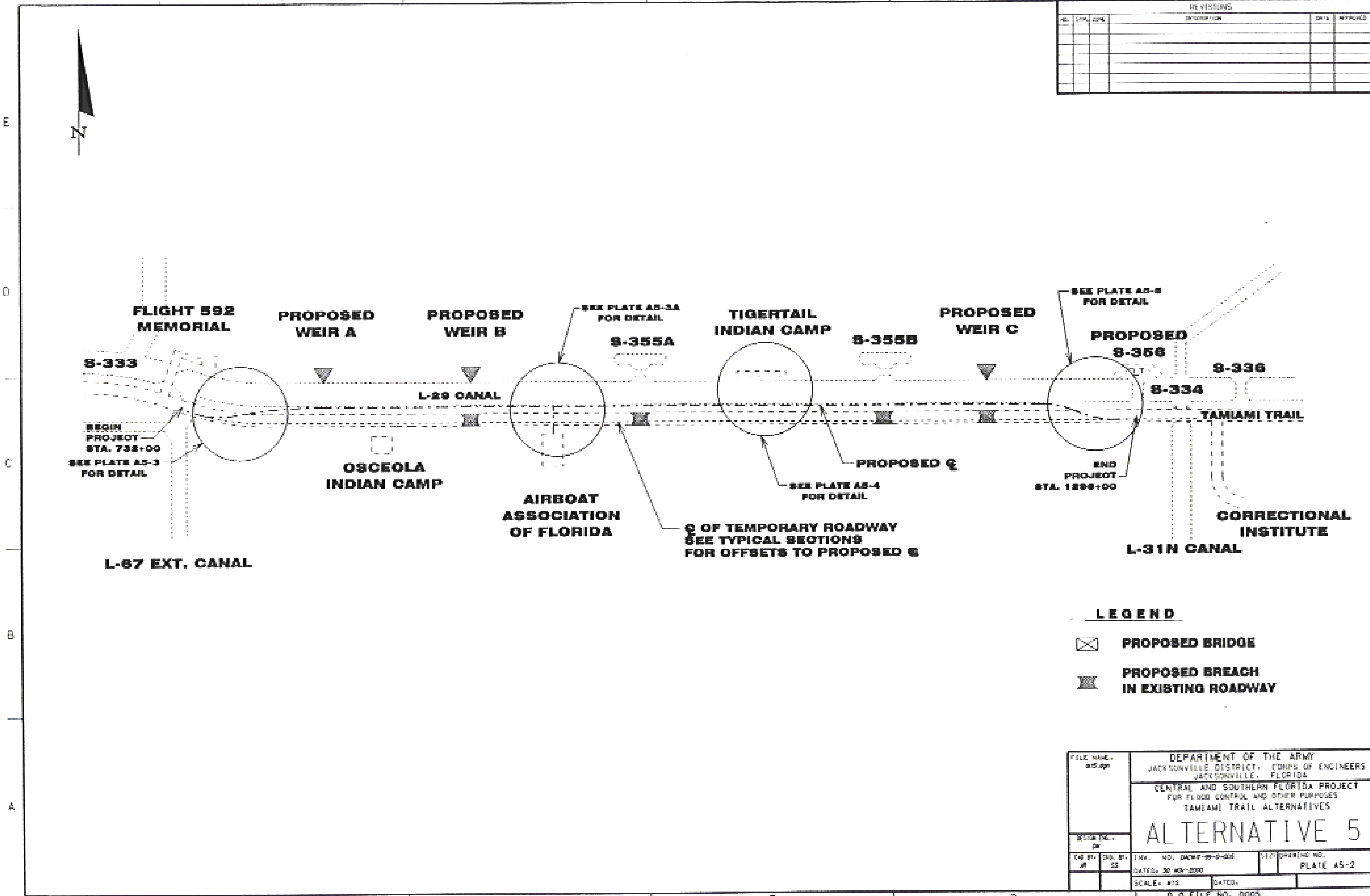
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 5

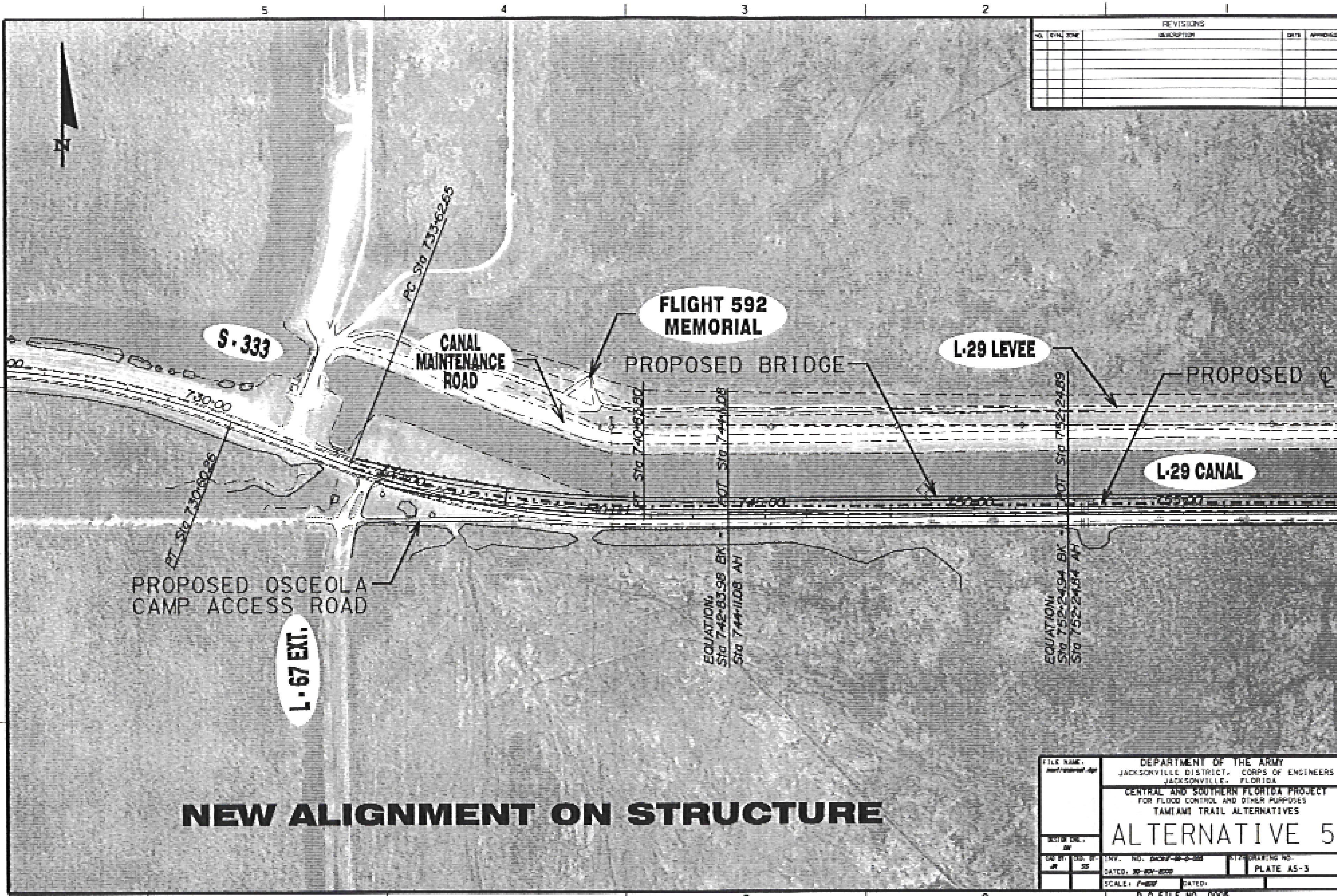
PLATE A5-1A

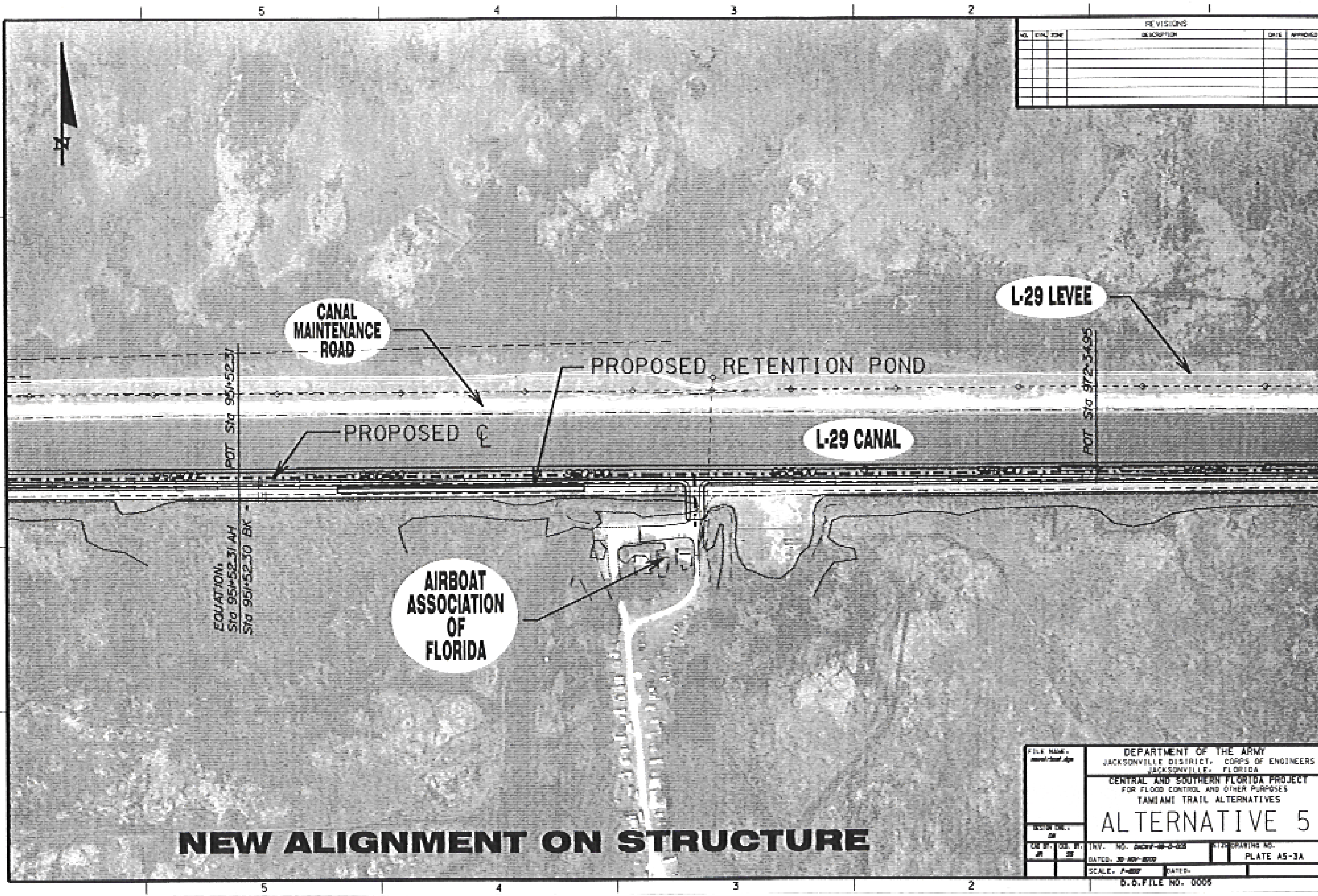
DATED: 8-DEC-2000

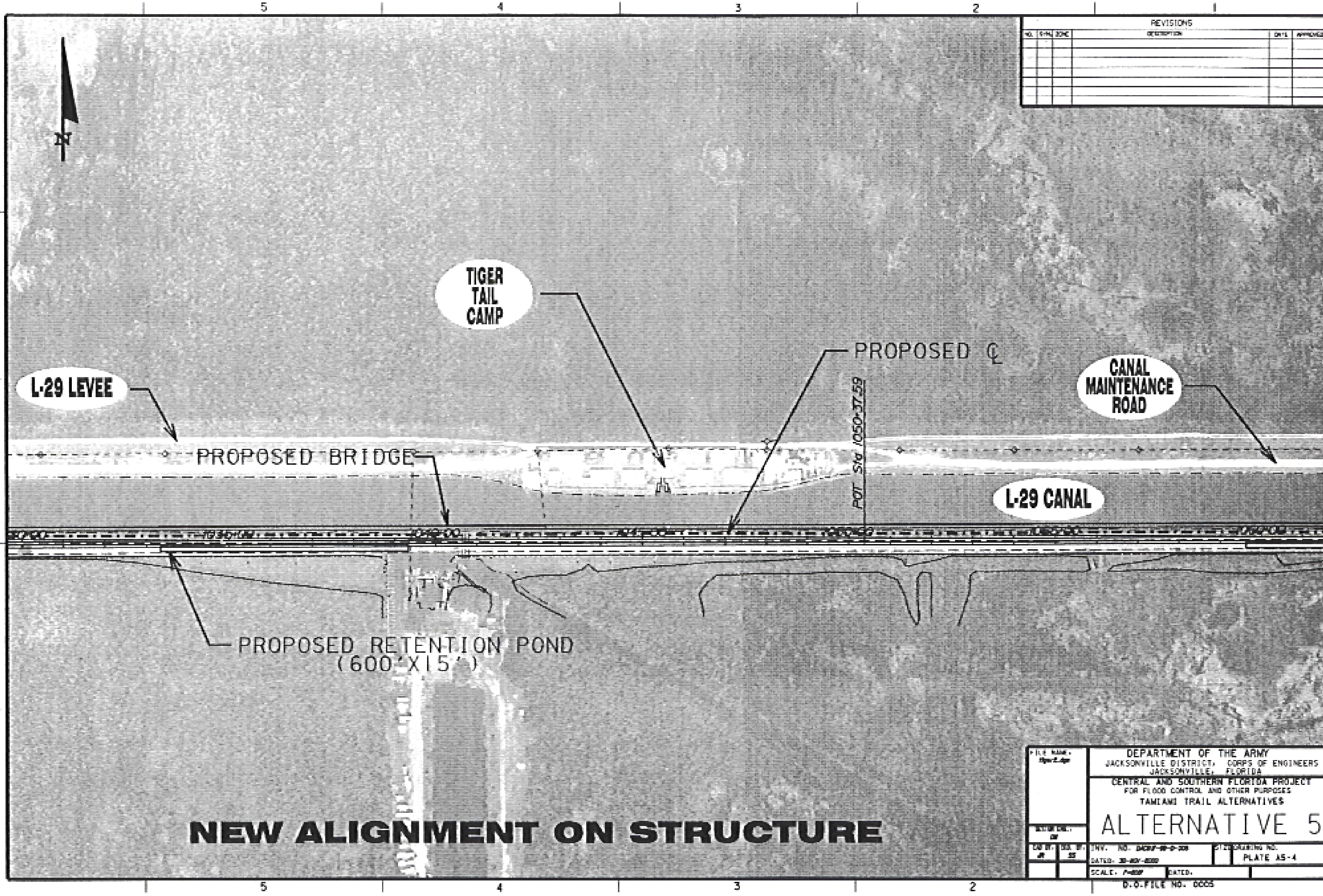
D.O.FILE NO. 0005

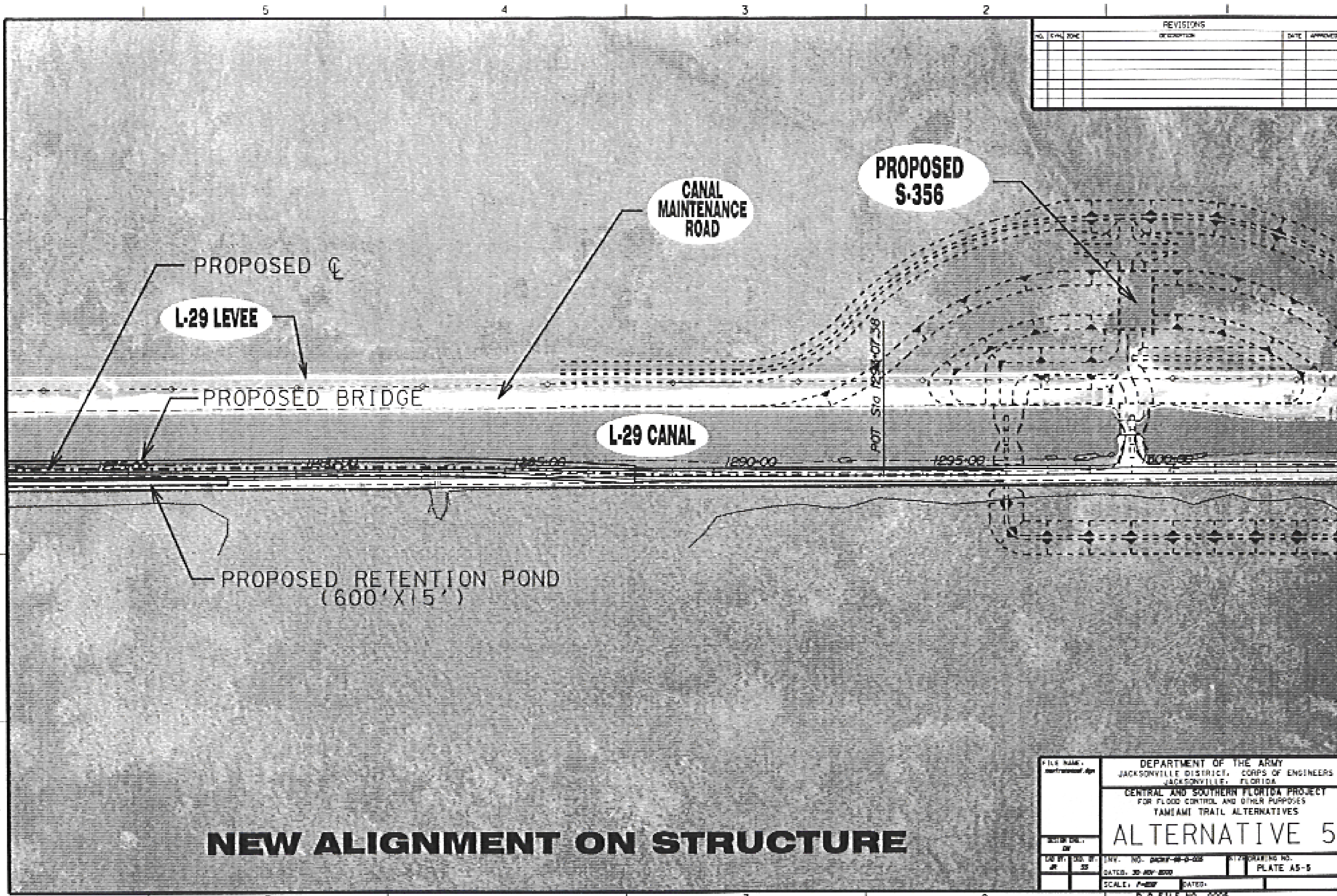



| | |
|---|---|
| | DEPARTMENT OF THE ARMY<br>JACKSONVILLE DISTRICT, CORPS OF ENGINEERS<br>JACKSONVILLE, FLORIDA |
| | CENTRAL AND SOUTHERN FLORIDA PROJECT<br>FOR FLOOD CONTROL AND OTHER PURPOSES<br>TAMIAMI TRAIL ALTERNATIVES |
| | ALTERNATIVE 5 |
| | DRAWING NO. PLATE A5-2 |
| | SCALE: NTS |
| | D.O. FILE NO. 0005 |

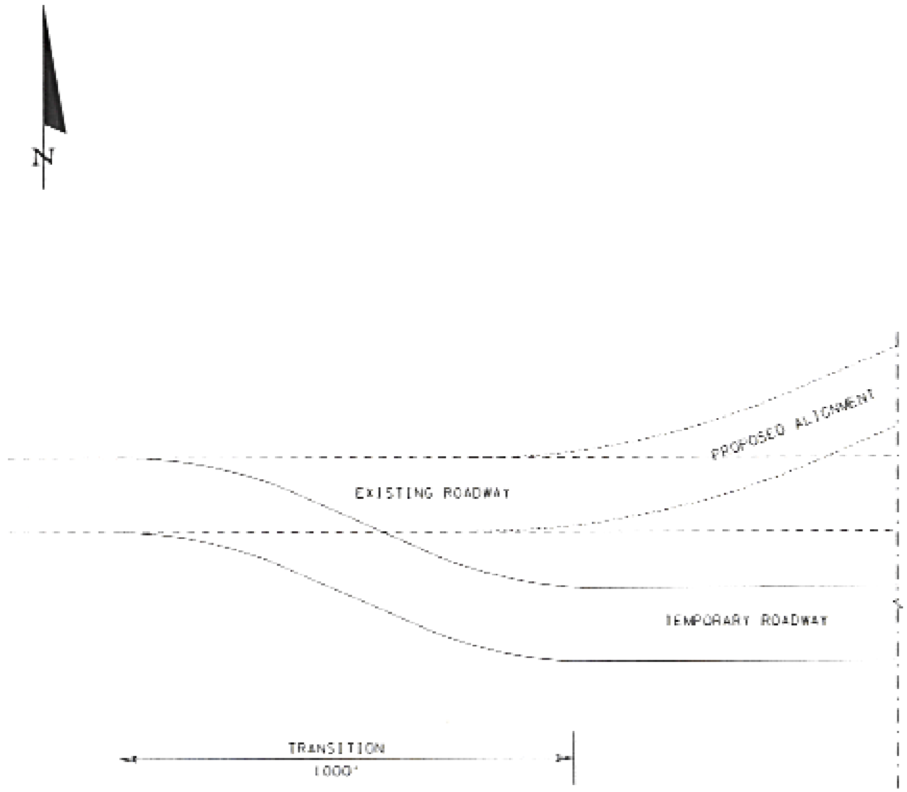

N
S - 333
CANAL MAINTENANCE ROAD
FLIGHT 592 MEMORIAL
PROPOSED BRIDGE
L-29 LEVEE
PROPOSED ℄
L-29 CANAL
PC Sta 733+62.65
PT Sta 730+60.26
PT Sta 740+63.80
POT Sta 744+11.08
POT Sta 752+24.89
EQUATION: Sta 742+83.98 BK = Sta 744+11.08 AH
EQUATION: Sta 752+24.94 BK = Sta 752+24.84 AH
730+00
PROPOSED OSCEOLA CAMP ACCESS ROAD
L - 67 EXT.
NEW ALIGNMENT ON STRUCTURE
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 5
PLATE A5-3
D.O.FILE NO. 0005


REVISIONS
CANAL MAINTENANCE ROAD
PROPOSED RETENTION POND
L-29 LEVEE
POT Sta 951+52.31
POT Sta 972+34.95
PROPOSED ℄
L-29 CANAL
EQUATION:
Sta 951+52.31 AH
Sta 951+52.30 BK
AIRBOAT ASSOCIATION OF FLORIDA
NEW ALIGNMENT ON STRUCTURE
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 5
PLATE A5-3A
D.O.FILE NO. 0005

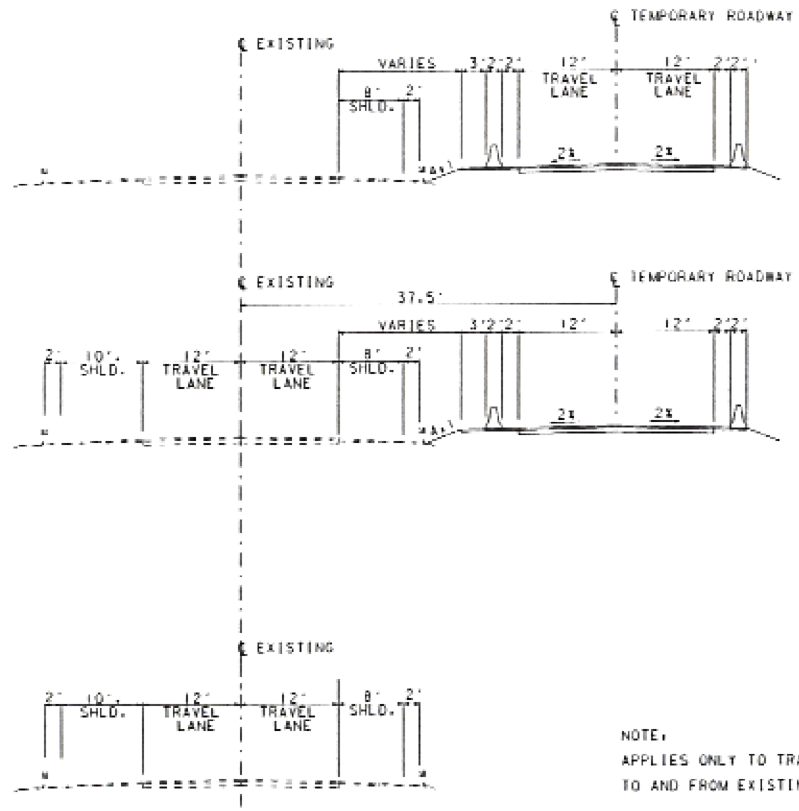

TIGER TAIL CAMP
PROPOSED ℄
L-29 LEVEE
CANAL MAINTENANCE ROAD
PROPOSED BRIDGE
POT Sta 1050+37.59
L-29 CANAL
PROPOSED RETENTION POND
(600'X15')
NEW ALIGNMENT ON STRUCTURE
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 5
PLATE A5-4
D.O.FILE NO. 0005



PROPOSED S-356
CANAL MAINTENANCE ROAD
PROPOSED ℄
L-29 LEVEE
PROPOSED BRIDGE
L-29 CANAL
POT Sta 1293+07.38
1290+00
1295+00
PROPOSED RETENTION POND (600'X15')
NEW ALIGNMENT ON STRUCTURE
REVISIONS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 5
PLATE A5-5
D.O.FILE NO. 0005




TEMPORARY ROADWAY TRANSITIONS



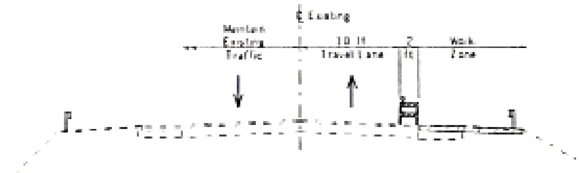

NOTE:
APPLIES ONLY TO TRANSITIONS
TO AND FROM EXISTING ROADWAY

DETOUR CONSTRUCTION PHASING

| | |
|---|---|
| FILE NAME: | DEPARTMENT OF THE ARMY<br>JACKSONVILLE DISTRICT, CORPS OF ENGINEERS<br>JACKSONVILLE, FLORIDA<br>CENTRAL AND SOUTHERN FLORIDA PROJECT<br>FOR FLOOD CONTROL AND OTHER PURPOSES<br>TAMIAMI TRAIL ALTERNATIVES<br>ALTERNATIVE 5 |
| DESIGN ENG.: DW | INV. NO. DACW17-98-D-005 |
| CAD BY: JP / CKD. BY: SS | DATED: 30-NOV-2000 / SCALE: NTS / DATED: / DRAWING NO. PLATE A5-6 |

D.O.FILE NO. 0005

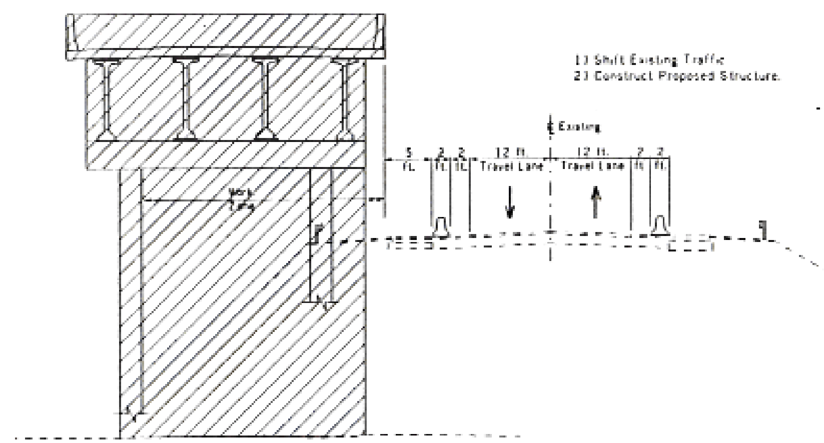
## PHASE I




1) Remove Existing Guardrail on south side
2) Place temporary pavement on south shoulder

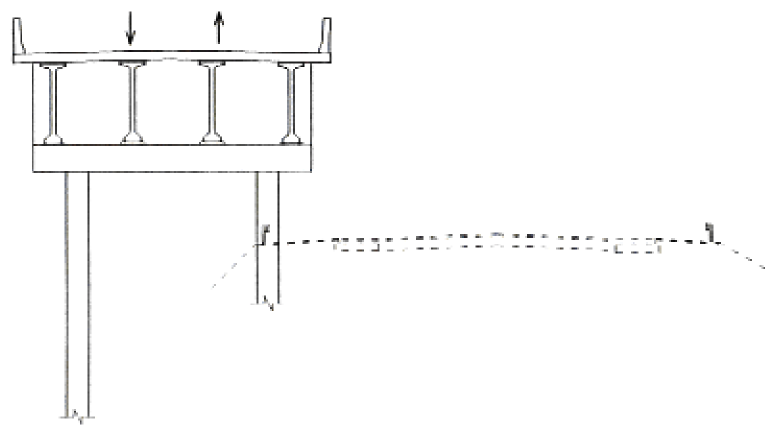
NOTE: Work in Phase I is to be done in 1/4 mile segments.

## PHASE II




1) Shift Existing Traffic
2) Construct Proposed Structure.

## PHASE III



| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |

FILE NAME: mod5.dgn

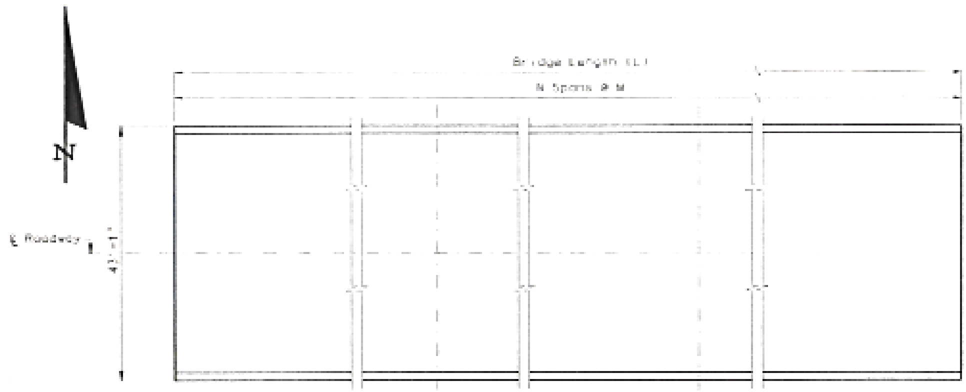
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

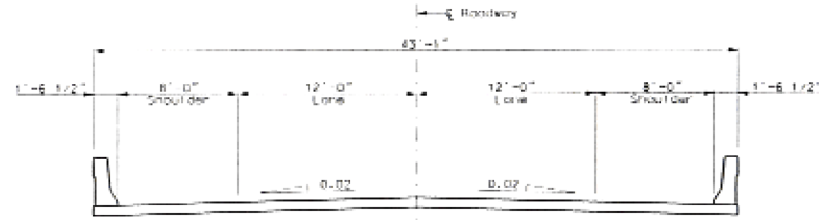
# CONSTRUCTION PHASES

DESIGN ENG.: DW
CAD BY: JR
CKD. BY: SS
INV. NO. DACW17-99-B-005
DATED: 29-NOV-2000
SIZE
DRAWING NO. PLATE A5-6A
SCALE: NTS
DATED:

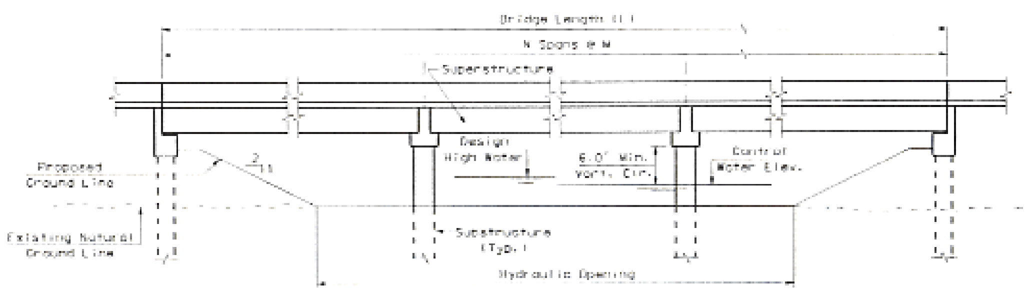
D.O.FILE NO. 0005



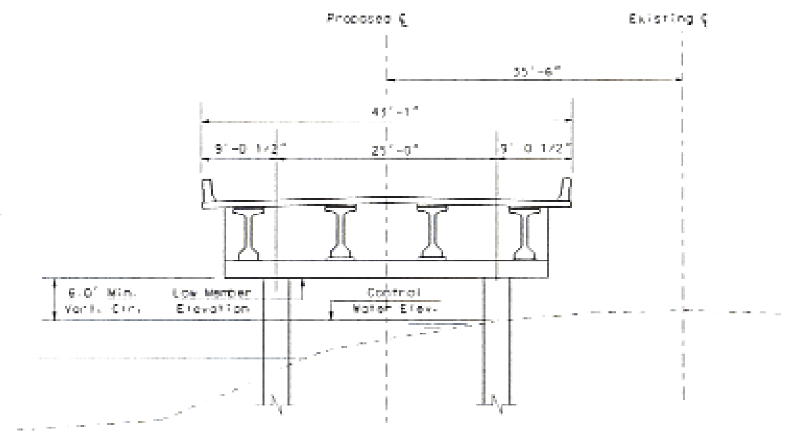

BRIDGE PLAN




BRIDGE TYPICAL SECTION




BRIDGE ELEVATION




SECTION
(LOOKING EAST)

| Bridge Number | Bridge Type | Bridge Length (L) | Hydraulic Opening | Number of Spans (N) | Span Lengths (M) | Superstructure Type | Substructure Type | Design High Water | Control Water Elev. | Low Member Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | H | 59220' | N/A | 555 | 106.70' | AASHTO Type V | 36" Drilled Shaft | 9.3' | 7.5' | 15.5' |

BRIDGE DATA

REVISIONS

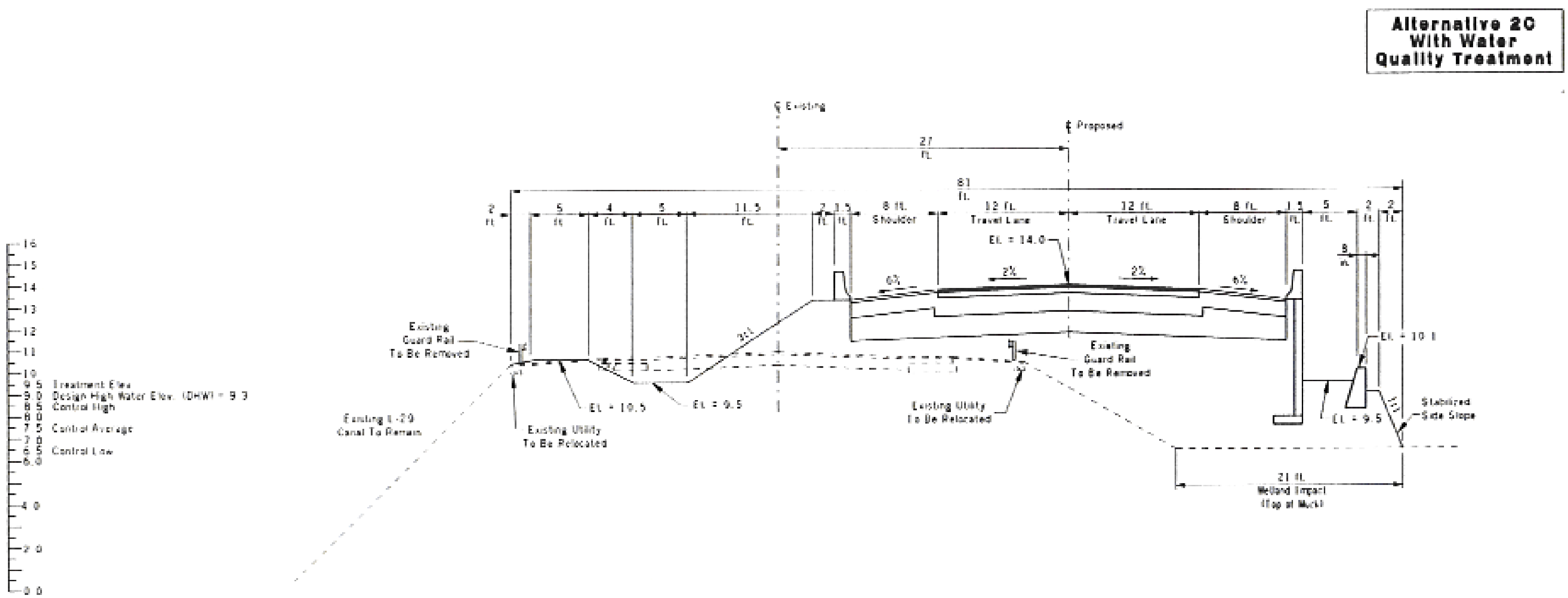
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 5

DRAWING NO. A5-T

D.O.FILE NO. 0005




**OPTION 1-A**

# TYPICAL SECTION
## RAISED PROFILE AND FOUR NEW BRIDGES WITH WALLS ON THE SOUTH SIDE

LOOKING EAST

SCALE • HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

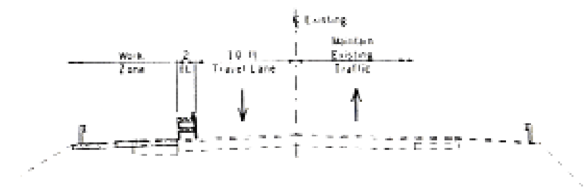
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

WATER QUALITY TREATMENT OPTIONS

PLATE WQ-1

D.O.FILE NO. 0005

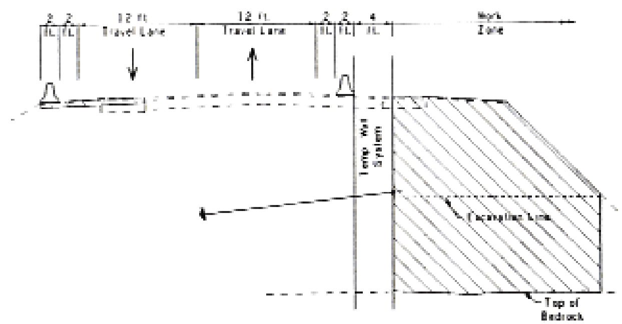
## PHASE I




1) Remove Existing Guardrail on north side.
2) Place temporary pavement on north shoulder.

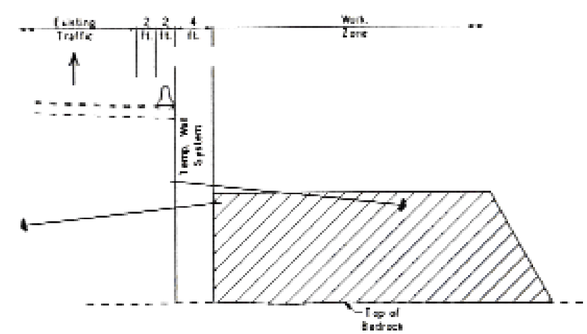
NOTE: Work in Phase I is to be done in 1/4 mile segments.

## PHASE II



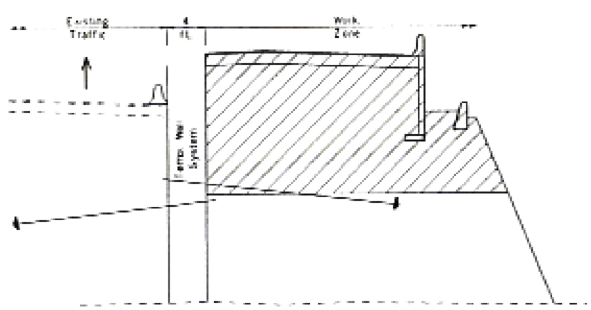

1) Place concrete barrier on north side of Westbound travel lane
2) Shift existing traffic
3) Place concrete barrier on south side of Eastbound travel lane.
4) Begin installation of Temporary Wall System.
5) Excavate on south side of Temporary Wall System to El. 7.0.
6) Install tie-back anchorage system.
7) Excavate retaining fill to top of Bedrock.

## PHASE III



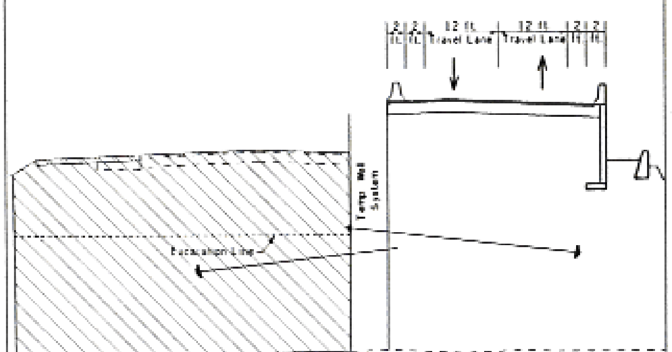

1) Fill Earthwork up to Elev. 7.0.
2) Install tie-back anchor on south side of Temporary Wall.

## PHASE IV



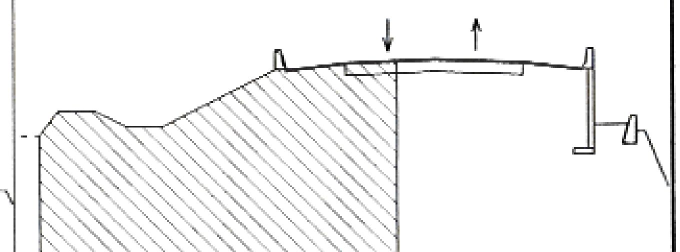

1) Complete construction of new Roadway on south side of Temporary Wall.
2) Contractor shall not proceed to next Phase until all construction activities are complete to this point.

## PHASE V




1) Shift traffic on to new construction.
2) Excavate on north side of temporary wall to El. 7.0.
3) Install tie-back anchorage system for temporary wall.
4) Excavate remaining fill to top of bedrock, cutting off soil anchor installed in Phase II.

## PHASE VI



1) Fill Earthwork up to tie-back. Cut off anchorage.
2) Complete construction on north side of temporary wall.
3) Shift traffic to outside lanes of roadway.
4) Complete overlay activities to finalize crown location.
5) Shift traffic to ultimate location.

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SHEET | ZONE | DESCRIPTION | DATE | APPROVED |

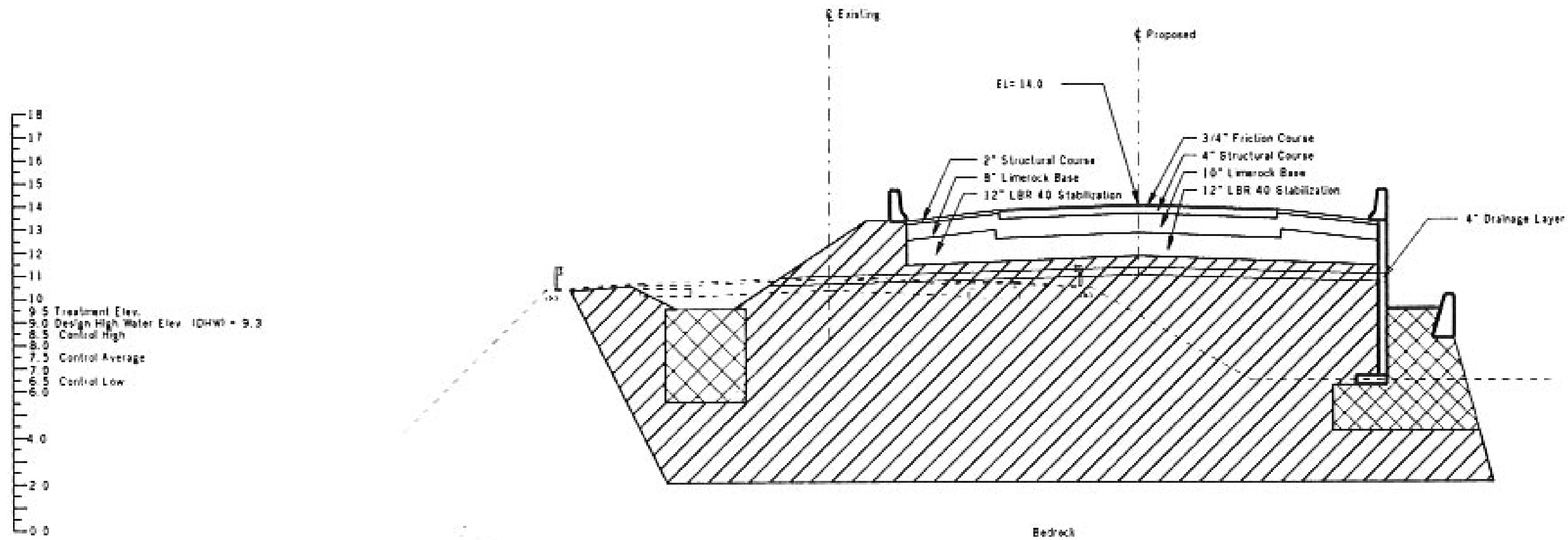
FILE NAME: mo12C.dgn

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# CONSTRUCTION PHASES ALTERNATIVE 2C

DESIGN ENG.: DW
CAD BY: JR
CKD. BY: SS
INV. NO. DACW17-99-D-0005
DATED: 8-DEC-2000
SCALE: NTS
DATED:
DRAWING NO. PLATE WO-1A
D.O.FILE NO. 0005




LEGEND

= Select Fill (A-1, A-3)

= Fine Aggregate (902-4)

# TYPICAL SECTION
# CANAL ENCROACHMENT WITH RAISED PROFILE AND FOUR NEW BRIDGES

LOOKING EAST

1" = 10' HORIZONTAL
1" = 5' VERTICAL

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

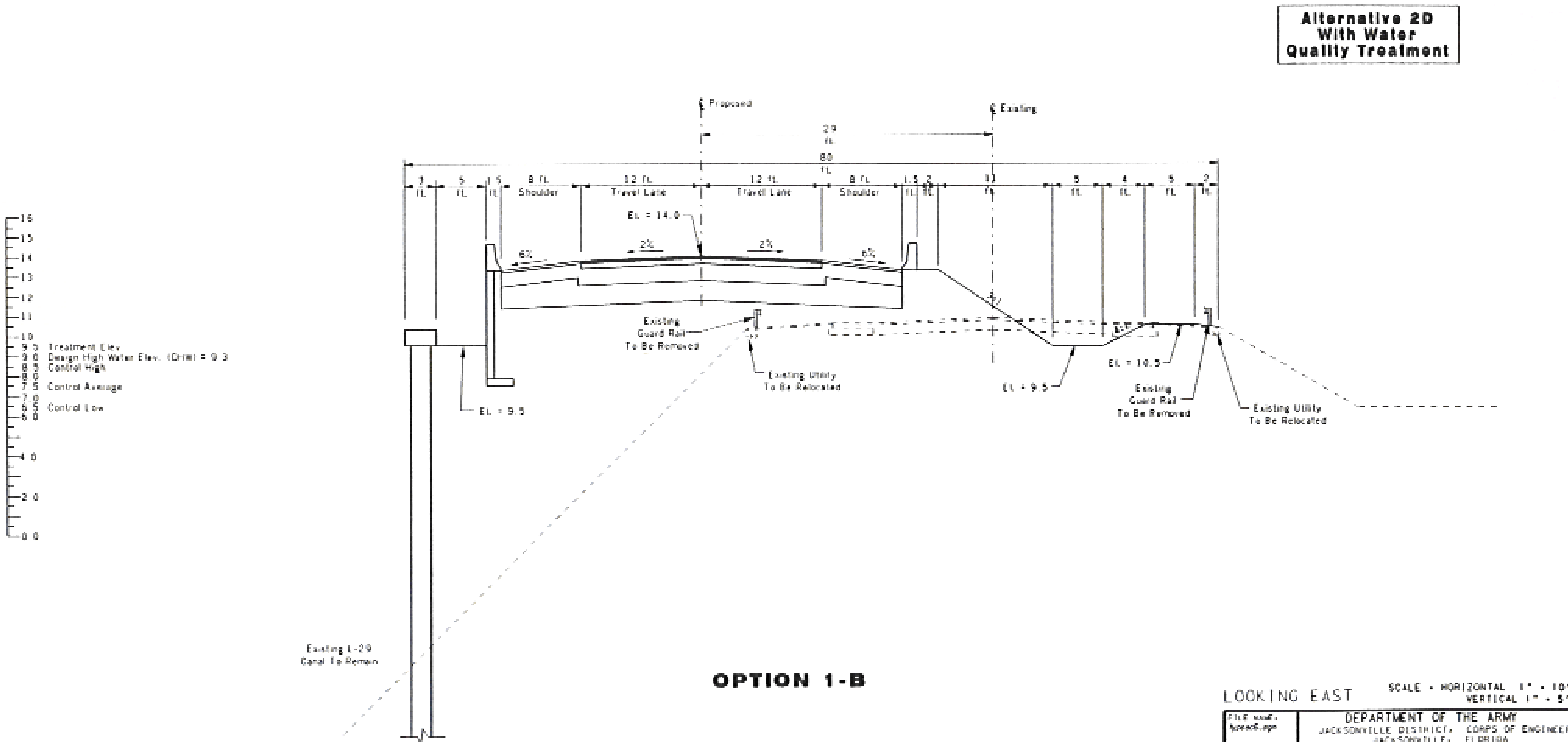
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 2C

DRAWING NO. WQ - 1B

SCALE: AS SHOWN

D.O.FILE NO. 0005




**OPTION 1-B**

# TYPICAL SECTION
# CANAL ENCROACHMENT WITH
# RAISED PROFILE AND FOUR NEW BRIDGES

LOOKING EAST

SCALE : HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA

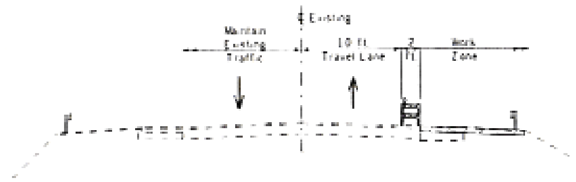
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

WATER QUALITY
TREATMENT OPTIONS

PLATE WQ-2

D.O.FILE NO. 0005

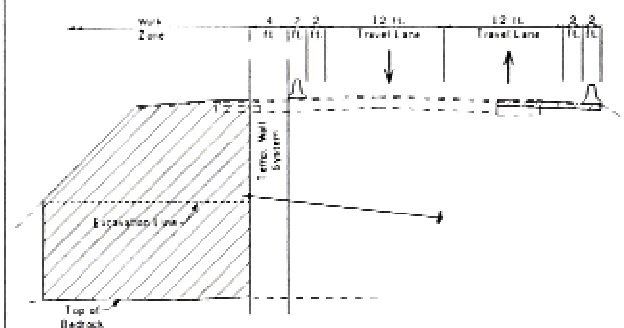
## PHASE I




1) Remove Existing Guardrail on south side.
2) Place temporary pavement on south shoulder.

NOTE: Work in Phase I is to be done in 1/4 mile segments.

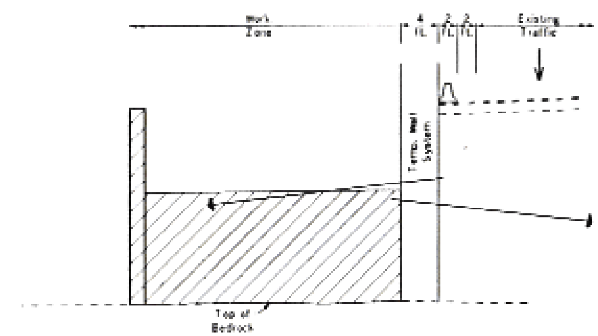
## PHASE II




1) Shift existing traffic.
2) Place concrete barrier on south side of Eastbound travel lane
3) Place concrete barrier on north side of Westbound travel lane.
4) Begin installation of Temporary Wall System.
5) Excavate on North side of Temporary Wall System to El. 7.0.
6) Install tie-back anchorage system.
7) Excavate retaining fill to top of Bedrock.

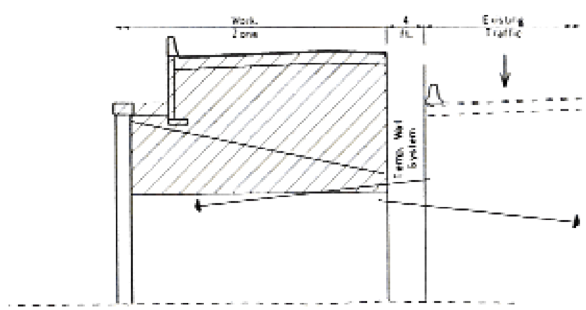
## PHASE III

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | ROW | ZONE | DESCRIPTION | DATE | APPROVED |



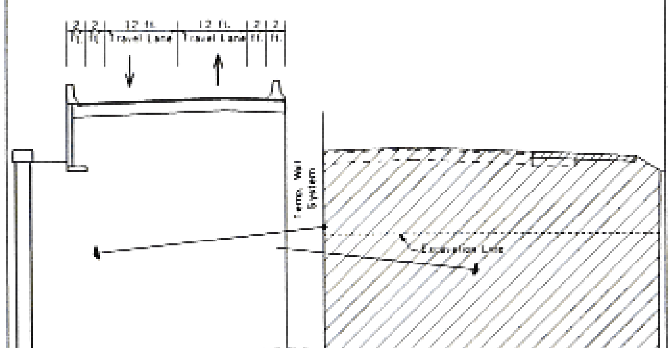

1) Construct Wall in Canal.
2) Fill Earthwork up to Elev. 7.0..
3) Install tie back anchor on North side of Temporary Wall.

## PHASE IV



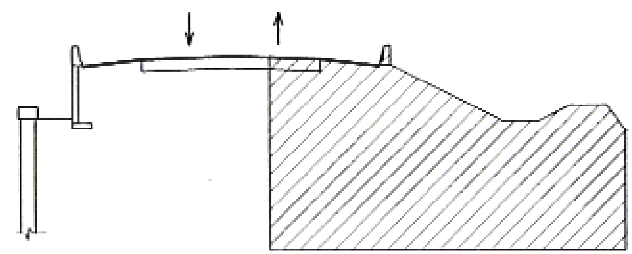

1) Construct concrete cap on canal wall.
2) Install permanent tie-back anchor
3) Complete construction of new Roadway on North side of Temporary Wall.
4) Contractor shall not proceed to next Phase until all construction activities are complete to this point.

## PHASE V




1) Shift traffic on to new construction.
2) Excavate on South side of temporary wall to El. 7.0..
3) Install tie-back anchorage system for temporary wall.
4) Excavate remaining fill to top of bedrock, cutting off soil anchor installed in Phase II.

## PHASE VI



1) Fill Earthwork up to tie-back. Cut off anchorage
2) Complete construction on South side of temporary wall.
3) Shift traffic to outside lanes of roadway.
4) Complete overlay activities to finalize crown location.
5) Shift traffic to ultimate location.

FILE NAME: mot2D.dgn

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

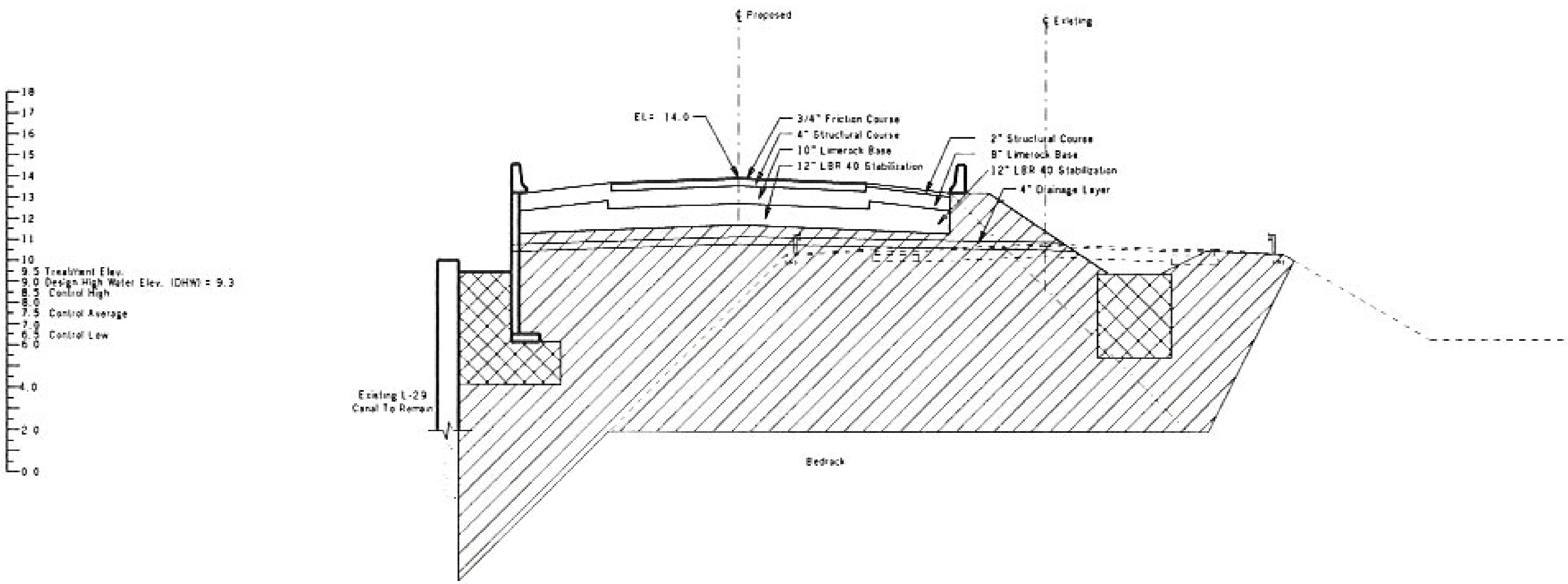
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# CONSTRUCTION PHASES ALTERNATIVE 2D

DESIGN ENG.: DW
CAD BY: JR
CKD. BY: SS
INV. NO. DACW17-99-D-005
DATED: 8-DEC-2000
SCALE: NTS
DRAWING NO. PLATE WO-2A
DATED:

D.O.FILE NO. 0005

X:\Transportation\Tamiami Trail\alternative 2\mot2D.dgn




LEGEND

= Select Fill (A-1, A-3)

= Fine Aggregate (902-4)

# TYPICAL SECTION
# CANAL ENCROACHMENT WITH
# RAISED PROFILE AND FOUR NEW BRIDGES

LOOKING EAST

1" = 10' HORIZONTAL
1" = 8' VERTICAL

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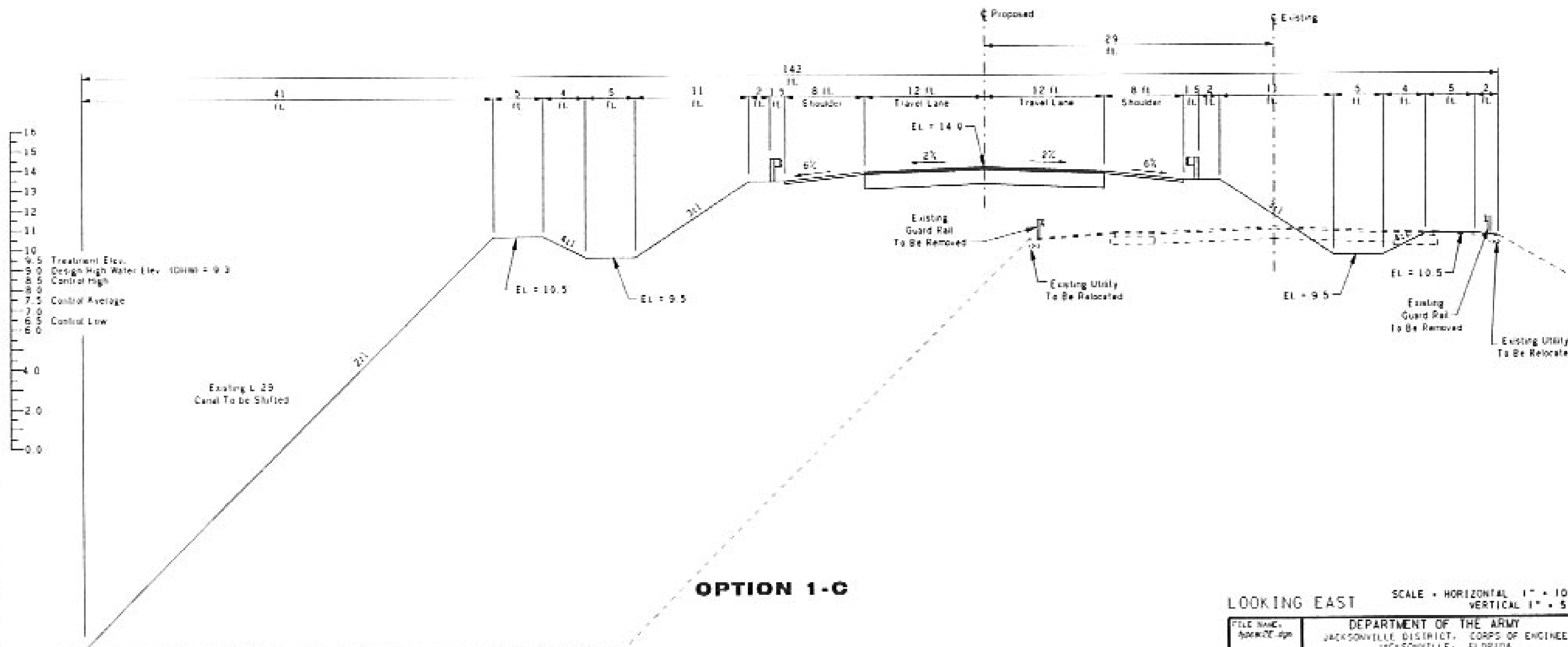
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 2D

PLATE WQ - 2B

D.O.FILE NO. 0005




## OPTION 1-C

# TYPICAL SECTION
# CANAL ENCROACHMENT WITH
# RAISED PROFILE AND FOUR NEW BRIDGES

LOOKING EAST

SCALE : HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

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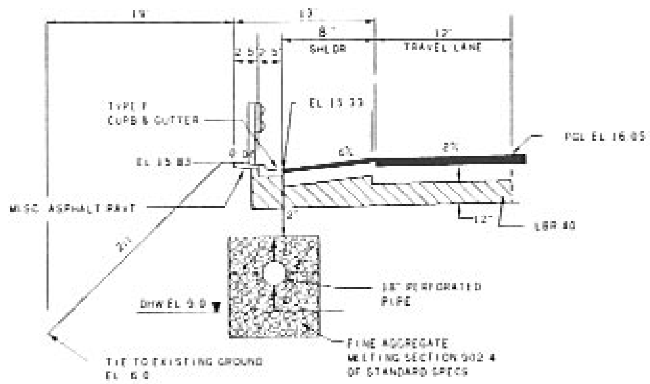
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

WATER QUALITY
TREATMENT OPTIONS

PLATE WQ-3

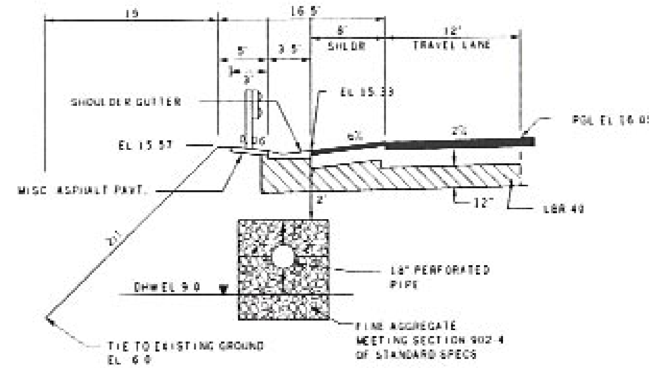
D.O.FILE NO. 0005




OPTION 2

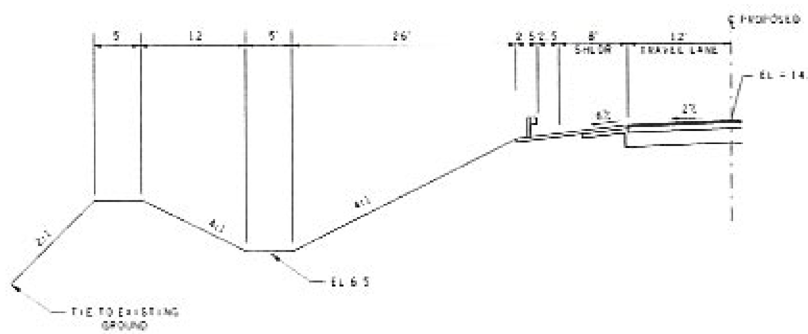
EXFILTRATION TRENCHES WITH CURB AND GUTTER

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| | | | | | |




OPTION 3

EXFILTRATION TRENCHES WITH SHOULDER GUTTER




OPTION 4

WET DETENTION SYSTEM

FILE NAME:

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# WATER QUALITY TREATMENT OPTIONS

DESIGN ENG.: AB

CAD BY: AL | CKD. BY: DW

INV. NO. DACW17-99-D-0015

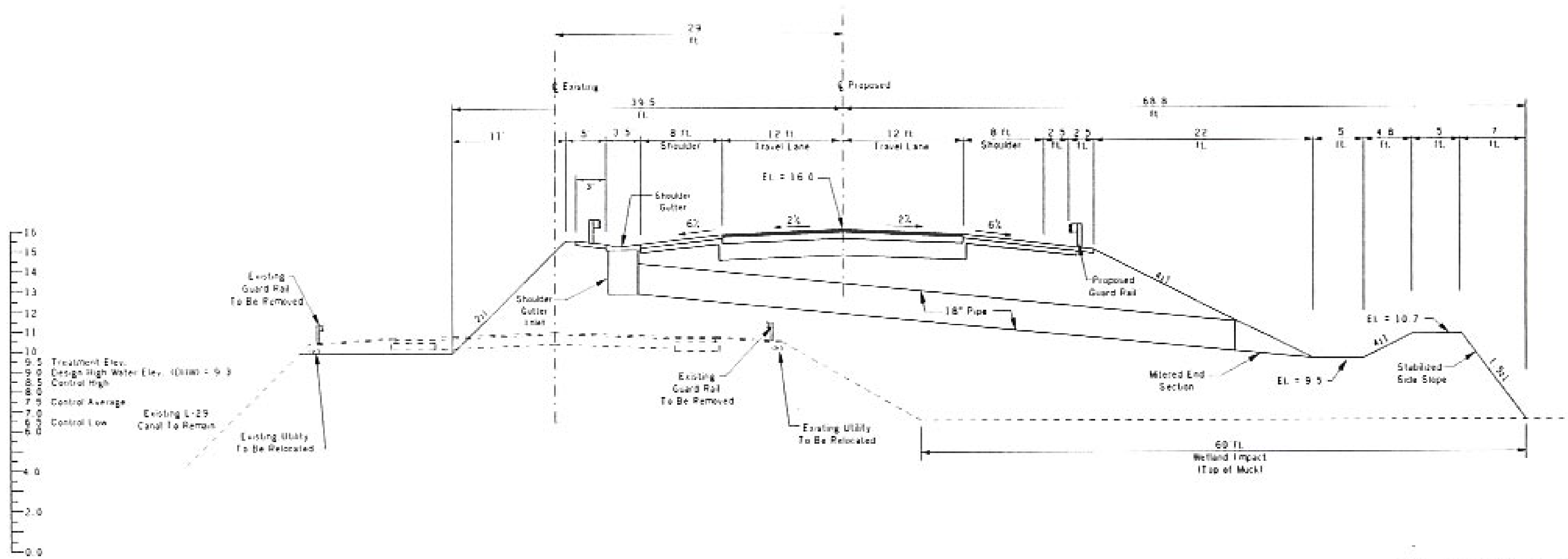
DATED: 30-NOV-2000

SCALE: NTS

DATED:

SIZE | DRAWING NO. PLATE WQ-4

D.O. FILE NO. 0005




LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |

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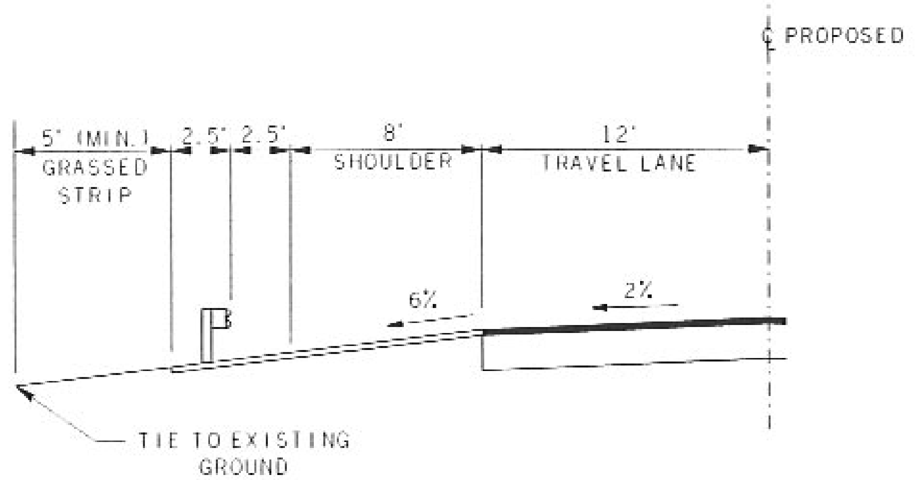
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
WATER QUALITY
TREATMENT OPTIONS

FILE NAME: option-5.dgn
DESIGNED: DW
CAD BY: JM
CKD BY: SS
INV. NO. DACW17-99-D-005
DATED: 30-NOV-2000
SCALE:
PLATE WQ-5
D.O. FILE NO. 0005

**OPTION 5**

# TYPICAL SECTION
# SINGLE DRY DETENTION SWALE SYSTEM




MINIMAL GRASS STRIP OPTION

REVISIONS

| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|

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FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# WATER QUALITY TREATMENT OPTIONS

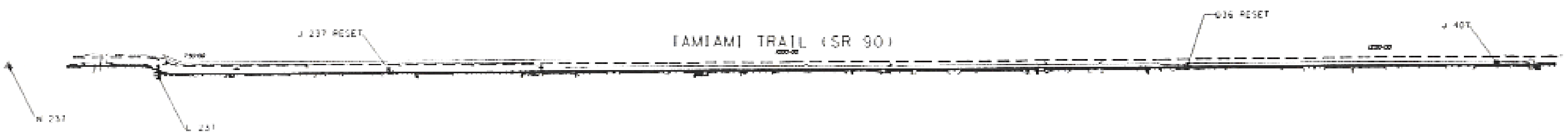
DRAWING NO. PLATE WQ-6

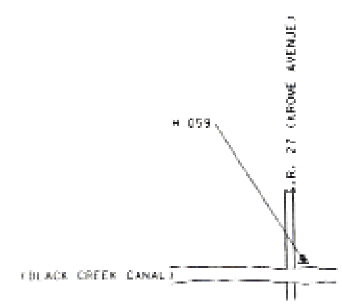
SCALE: NTS

D.O. FILE NO. 0005

SURVEYOR'S NOTES:

1. CONTROL STATIONS FOR THIS PROJECT WERE DERIVED FROM THE U.S. NATIONAL GEODETIC SURVEY (NGS) DATA SHEETS DOWNLOADED FROM NGS WEBSITE, HTTP://WWW.NGS.NOAA.GOV.
2. POINT DESCRIPTIONS CAN BE RETRIEVED BY USING THE ATTACHED POINT IDENTIFICATION NUMBERS (PID).
3. ALL HORIZONTAL CONTROL IS RELATED TO NAD83/90 AND ALL VERTICAL CONTROL IS RELATED TO NGVD1929.
4. ALL FIELD LOCATIONS WERE ACQUIRED USING A COMBINATION OF GLOBAL POSITIONING SYSTEMS (G.P.S.) TECHNIQUES, CONVENTIONAL TOTAL STATION SURVEYS AND DIFFERENTIAL LEVELING.
5. THE BASELINE OF SURVEY WAS RECOVERED FROM DATA FURNISHED BY THE FLORIDA DEPARTMENT OF TRANSPORTATION, DISTRICT 6.
6. ALL MEASUREMENTS WERE CONDUCTED IN ENGLISH UNITS OF MEASUREMENT.




## CONTROL POINTS TABULATION

| HORIZONTAL CONTROL | VERTICAL CONTROL |
|---|---|
| N 237<br>PID: AC0511<br>LATITUDE: 25°45'43.46685"<br>LONGITUDE: 080°41'35.17155"<br>NORTHING: 519334.05 FEET<br>EASTING: 757169.43 FEET<br>CONVERGENCE: -0°08'00.2"<br>SCALE FACTOR: 0.99995287<br>ELEVATION: 11.46 FEET(NAVD88)<br>ELEVATION: 12.97 FEET(NGVD29)<br>STATION: N/A<br>OFFSET: N/A<br>DESCRIPTION: SURVEY DISK IN CONCRETE N 237,1965 | J 237 RESET<br>PID: AC4748<br>LATITUDE: 25°45'40"<br>LONGITUDE: 080°38'40"<br>ELEVATION: 9.59 FEET(NGVD29)<br>DESCRIPTION: SURVEY DISK IN CONCRETE J 237,1965<br><br>L 237<br>PID: AC0507<br>LATITUDE: 25°45'39"<br>LONGITUDE: 080°40'27"<br>ELEVATION: 10.69 FEET(NGVD29)<br>DESCRIPTION: F.D.O.T. SURVEY DISK IN CONCRETE |
| H 059<br>PID: AC3939<br>LATITUDE: 25°39'39.61045"<br>LONGITUDE: 080°28'50.85855"<br>NORTHING: 482824.67 FEET<br>EASTING: 827187.89 FEET<br>CONVERGENCE: -0°13'29.4"<br>SCALE FACTOR: 0.99997472<br>STATION: N/A<br>OFFSET: N/A<br>DESCRIPTION: MIAMI-DADE COUNTY SURVEY DISK IN CONCRETE | J 407<br>PID: AC4738<br>LATITUDE: 25°45'40"<br>LONGITUDE: 080°30'09"<br>ELEVATION: 7.38 FEET(NGVD29)<br>DESCRIPTION: SURVEY DISK IN CONCRETE J 407,1965<br><br>O 36 RESET<br>PID: AC4741<br>LATITUDE: 25°45'40"<br>LONGITUDE: 080°32'32"<br>ELEVATION: 8.71 FEET(NGVD29)<br>DESCRIPTION: SURVEY DISK IN CONCRETE |

REVISIONS

| NO. | SYM. | COMP. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|
| | | | | | |

FILE NAME: control_sheet.dgn

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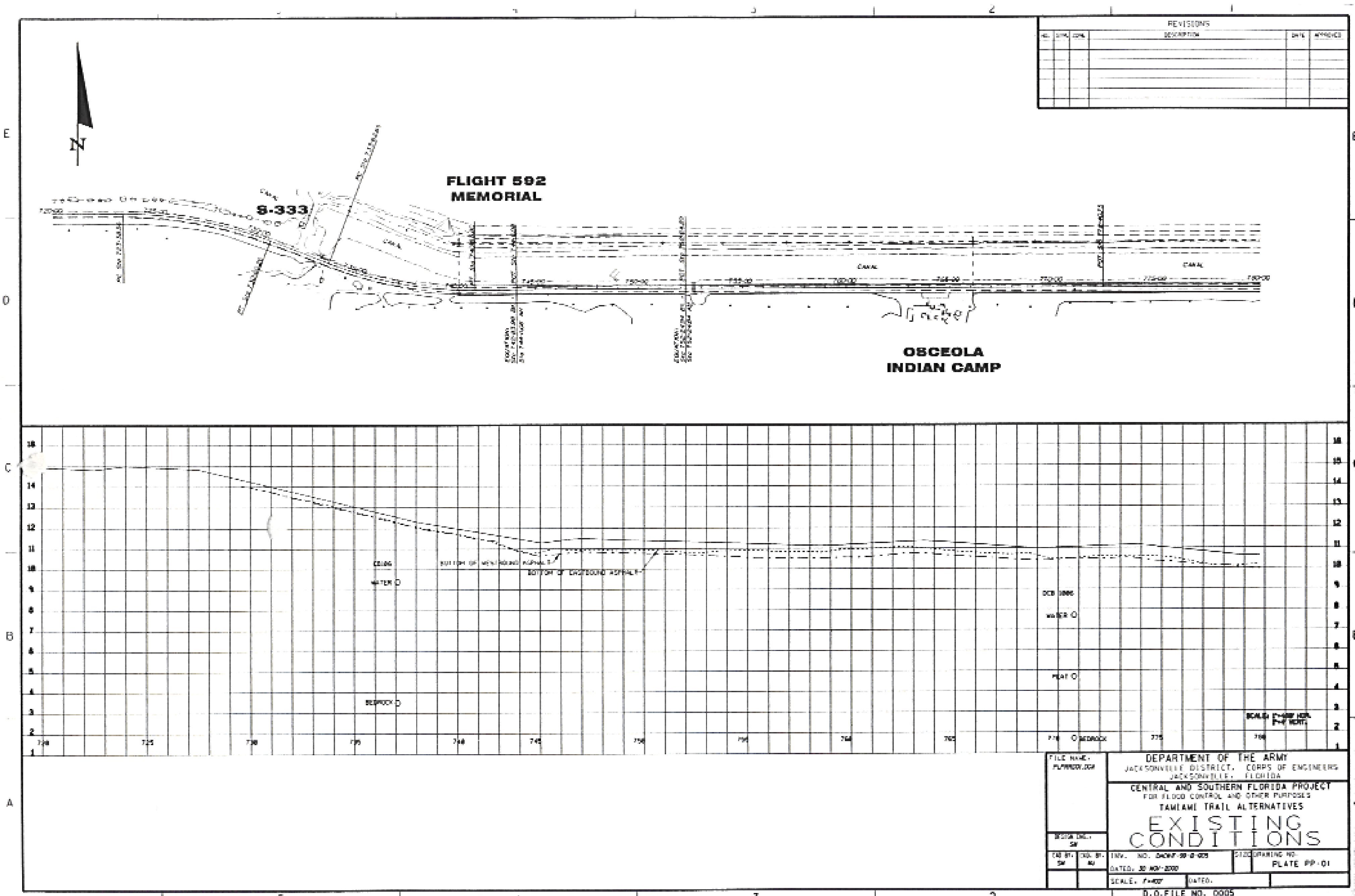
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# SURVEY CONTROL SHEET

DESIGN ENG.: DF
CAD BY: JA
CKD. BY: SS
INV. NO. DACW17-99-D-005
DATED: 8-DEC-2000
SCALE: 1"=2000'
DATED:
DRAWING NO.: PLATE PP-0

D.O.FILE NO. 0005


REVISIONS
FLIGHT 592
MEMORIAL
S-333
CANAL
OSCEOLA
INDIAN CAMP
BOTTOM OF WESTBOUND ASPHALT
BOTTOM OF EASTBOUND ASPHALT
WATER
BEDROCK
PEAT
DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA
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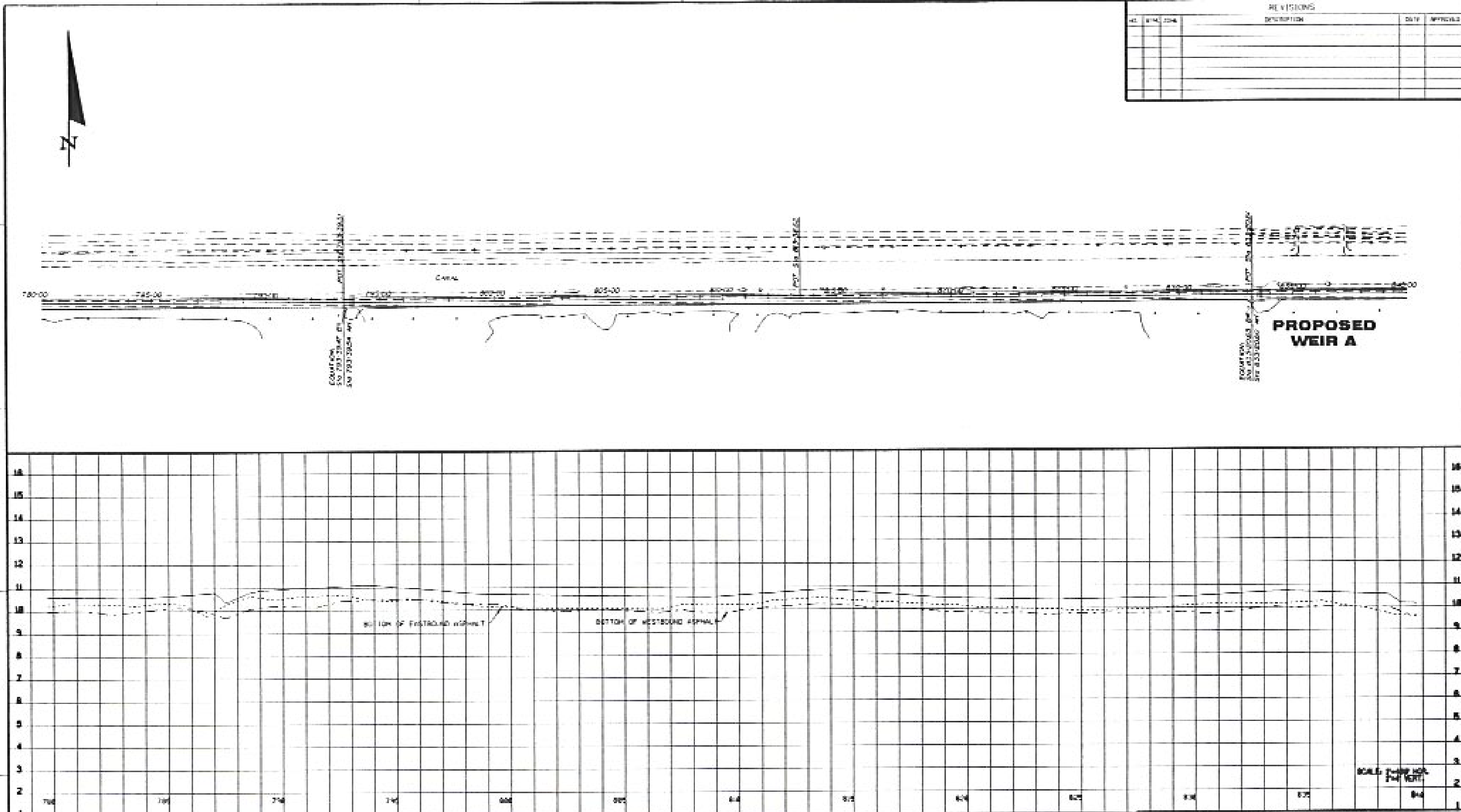
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
EXISTING
CONDITIONS
PLATE PP-01
D.O.FILE NO. 0005




FILE NAME:
DESIGN ENG.:

DEPARTMENT OF THE ARMY
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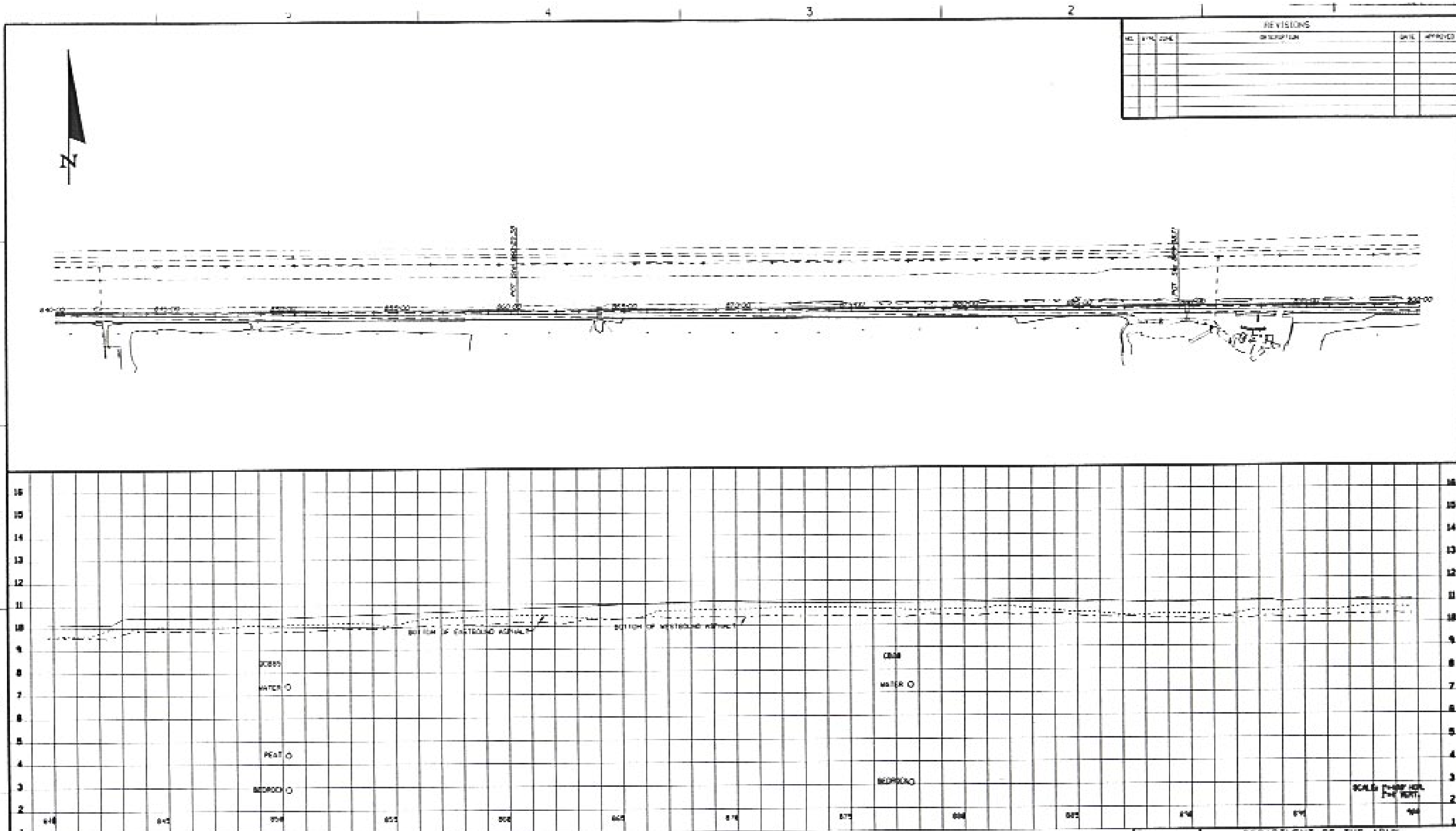
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# EXISTING CONDITIONS

DATED:
SCALE:
DRAWING NO.
PLATE PP-02

D.O.FILE NO. 0005




FILE NAME: PLANADO3.DGN

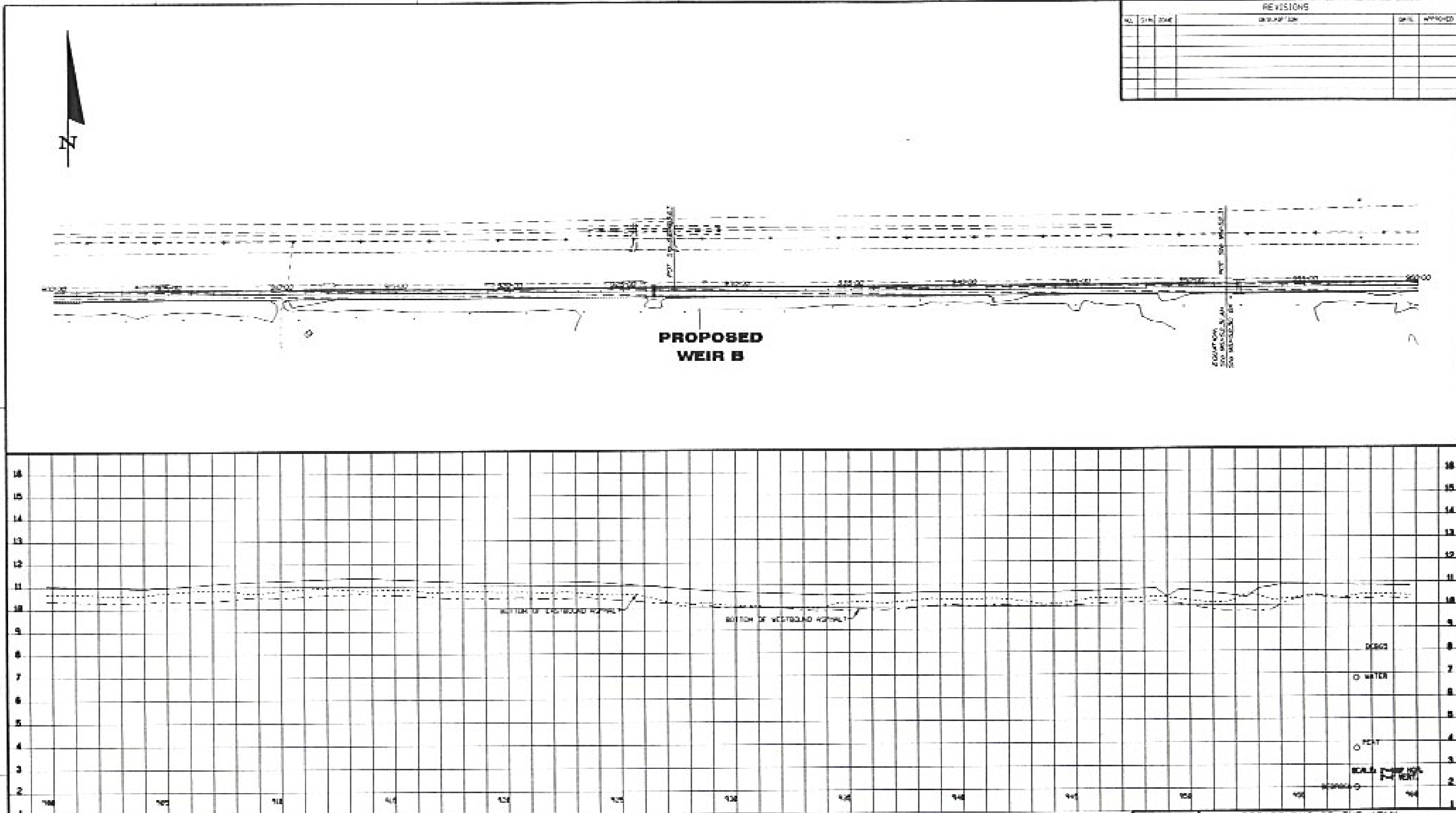
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# EXISTING CONDITIONS

DESIGN ENG.: SW
CAD BY: SW | CKD. BY: MJ
INV. NO. DACW17-99-D-005
DATED: 30-NOV-2000
SCALE: 1"=400'
DATED:
DRAWING NO. PLATE FP-03

D.O. FILE NO. 0005




FILE NAME: PLPP004.DGN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

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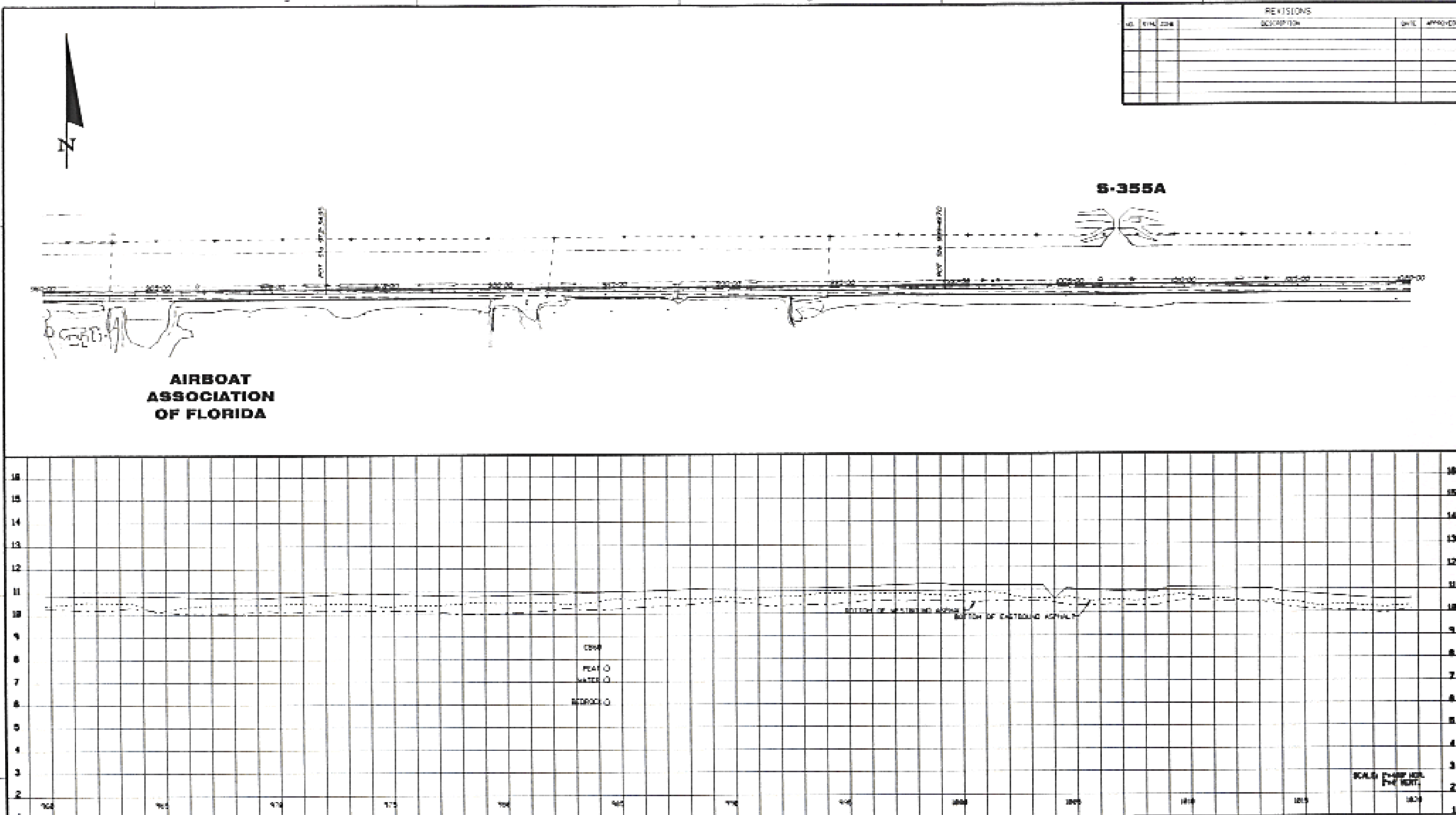
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# EXISTING CONDITIONS

DESIGN ENG.: SW
CAD BY: SW | CKD. BY: AV
INV. NO. DACW17-99-D-005
DATED: 30 NOV 2000
SCALE: 1"=400'
DRAWING NO. PLATE PP-04
DATED:

D.O.FILE NO. 0005

h:\Tamiami\Tamiami Trail\Plan_Profile\pp004.dgn




FILE NAME: PLPR0005.DGN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# EXISTING CONDITIONS

DESIGN ENG.: SW

CAD BY: SW | CKD. BY: BJ

DRAWING NO.: PLATE PP-05

D.O.FILE NO. 0005

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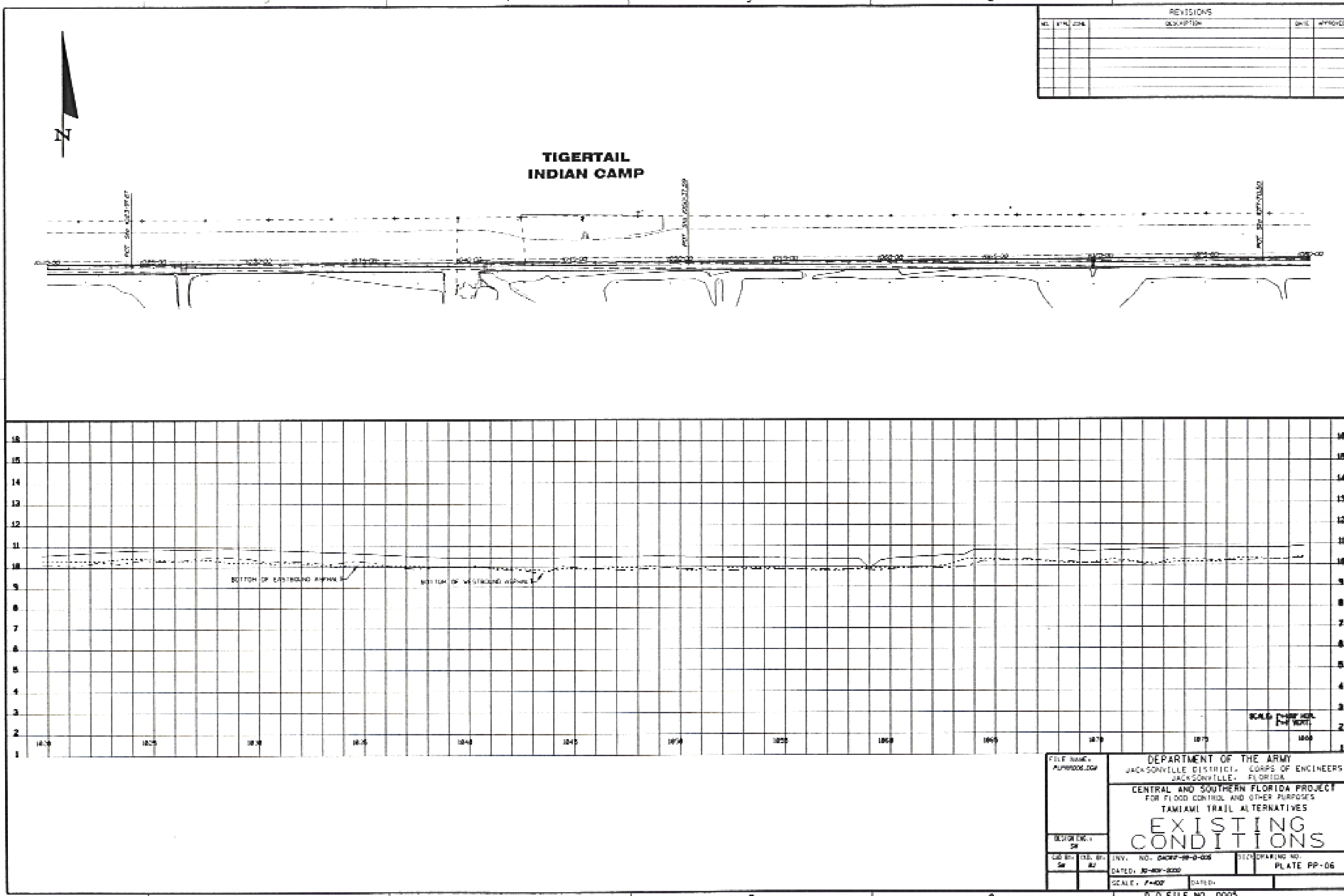
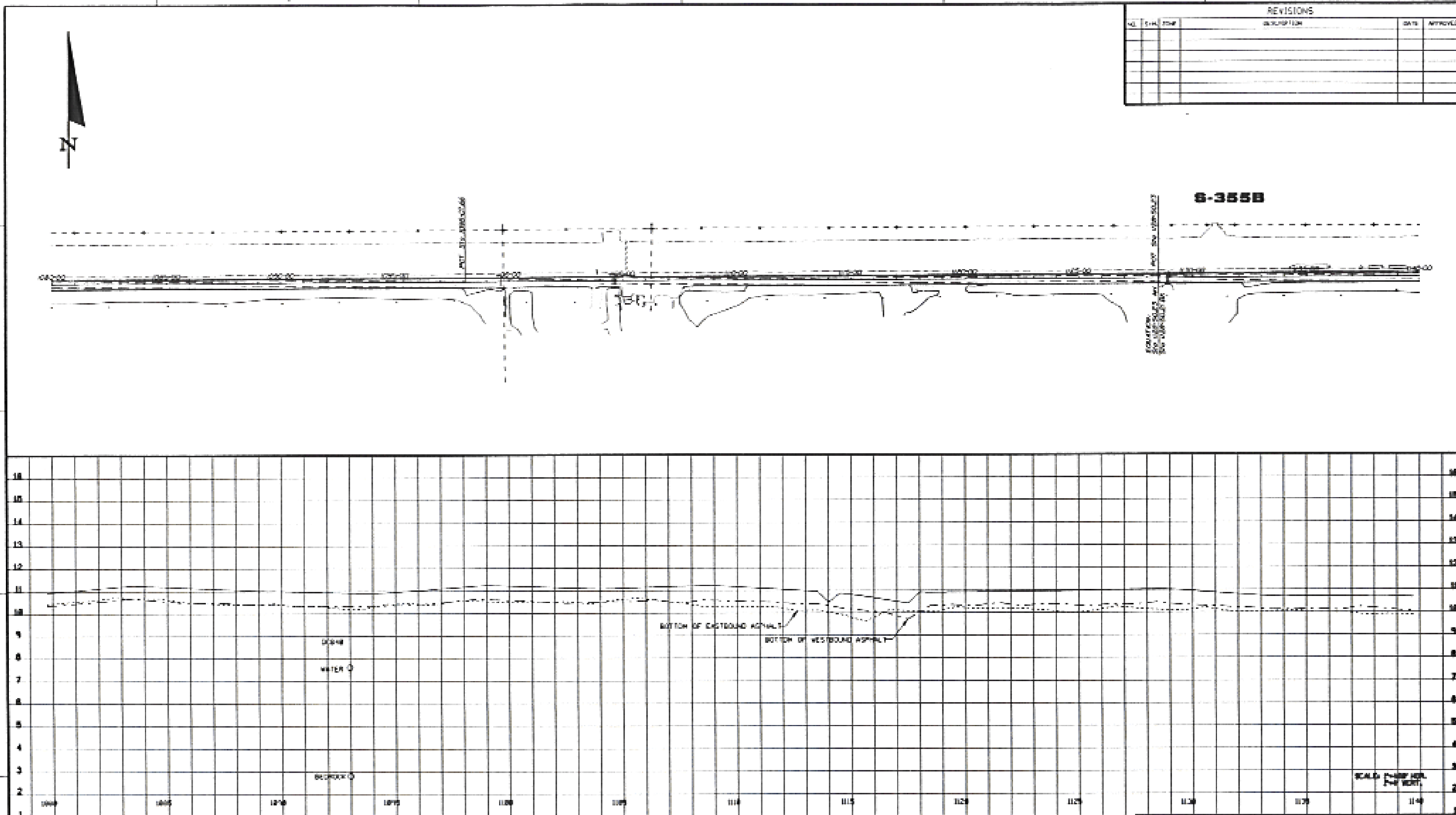


TIGERTAIL
INDIAN CAMP
N
REVISIONS
DESCRIPTION
DATE
APPROVED
BOTTOM OF EASTBOUND ASPHALT
BOTTOM OF WESTBOUND ASPHALT
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
EXISTING CONDITIONS
FILE NAME:
DESIGN ENG.:
INV. NO.
DATED:
SCALE:
DRAWING NO.
PLATE PP-06
O.D.FILE NO. 0005




DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# EXISTING CONDITIONS

DRAWING NO.: PLATE PP-07

D.O.FILE NO. 0005

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
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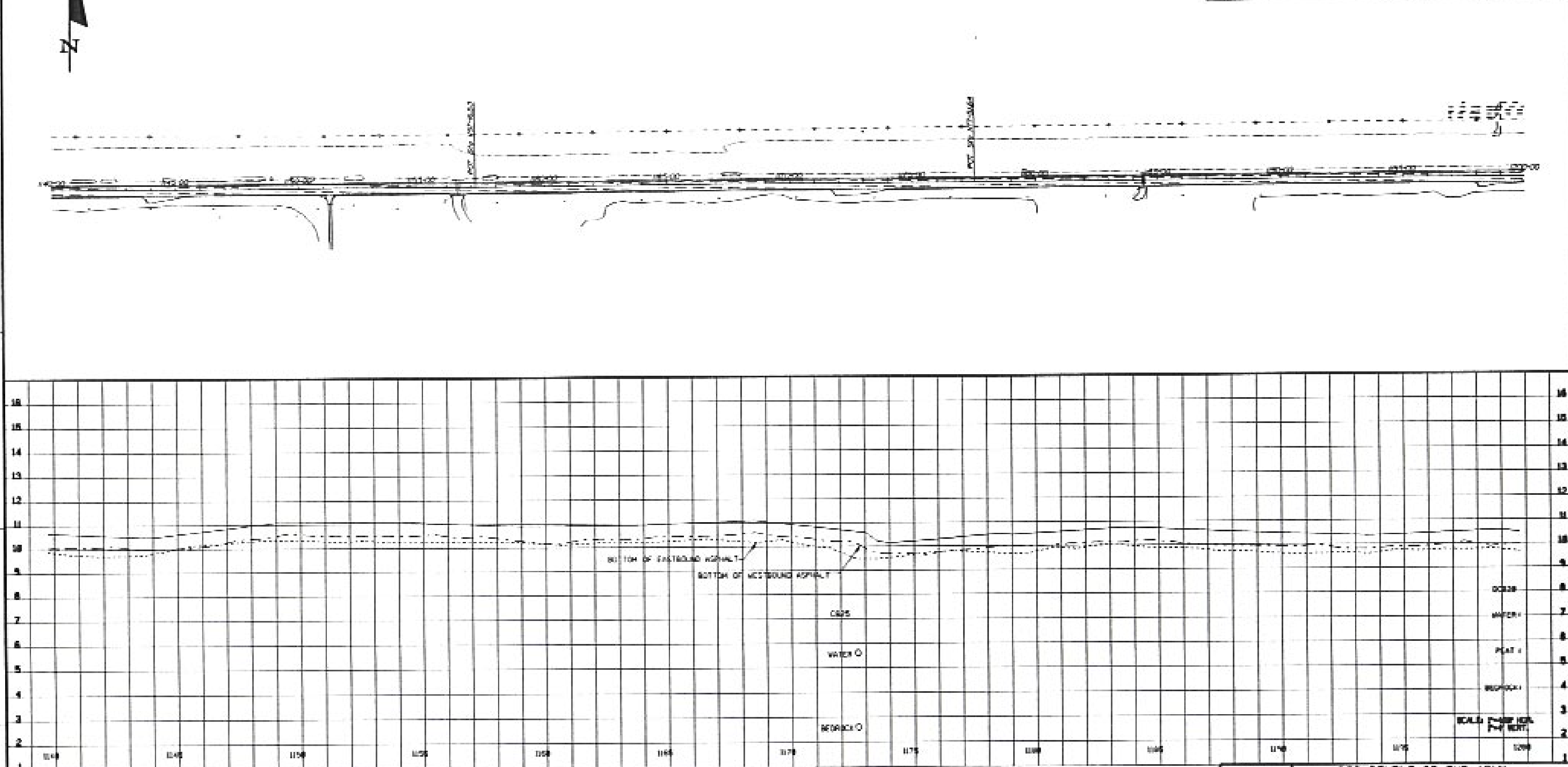


FILE NAME: PLPP08.DGN

DESIGN ENG.: SW

DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

# EXISTING CONDITIONS

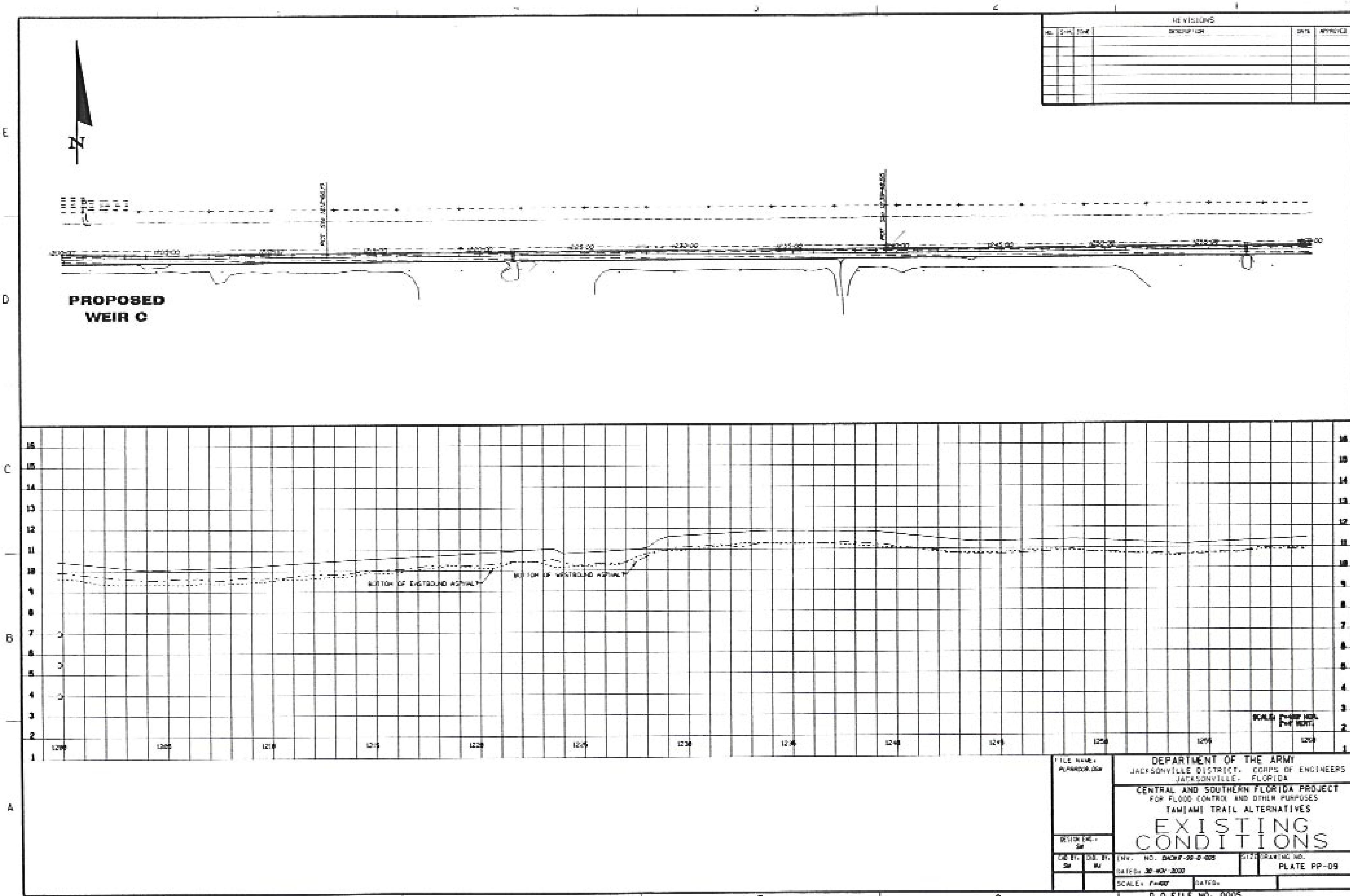
DRAWING NO. PLATE PP-08

DATED: 30-NOV-2000

SCALE:

DATED:

D.O.FILE NO. 0005


REVISIONS
DESCRIPTION
DATE
APPROVED
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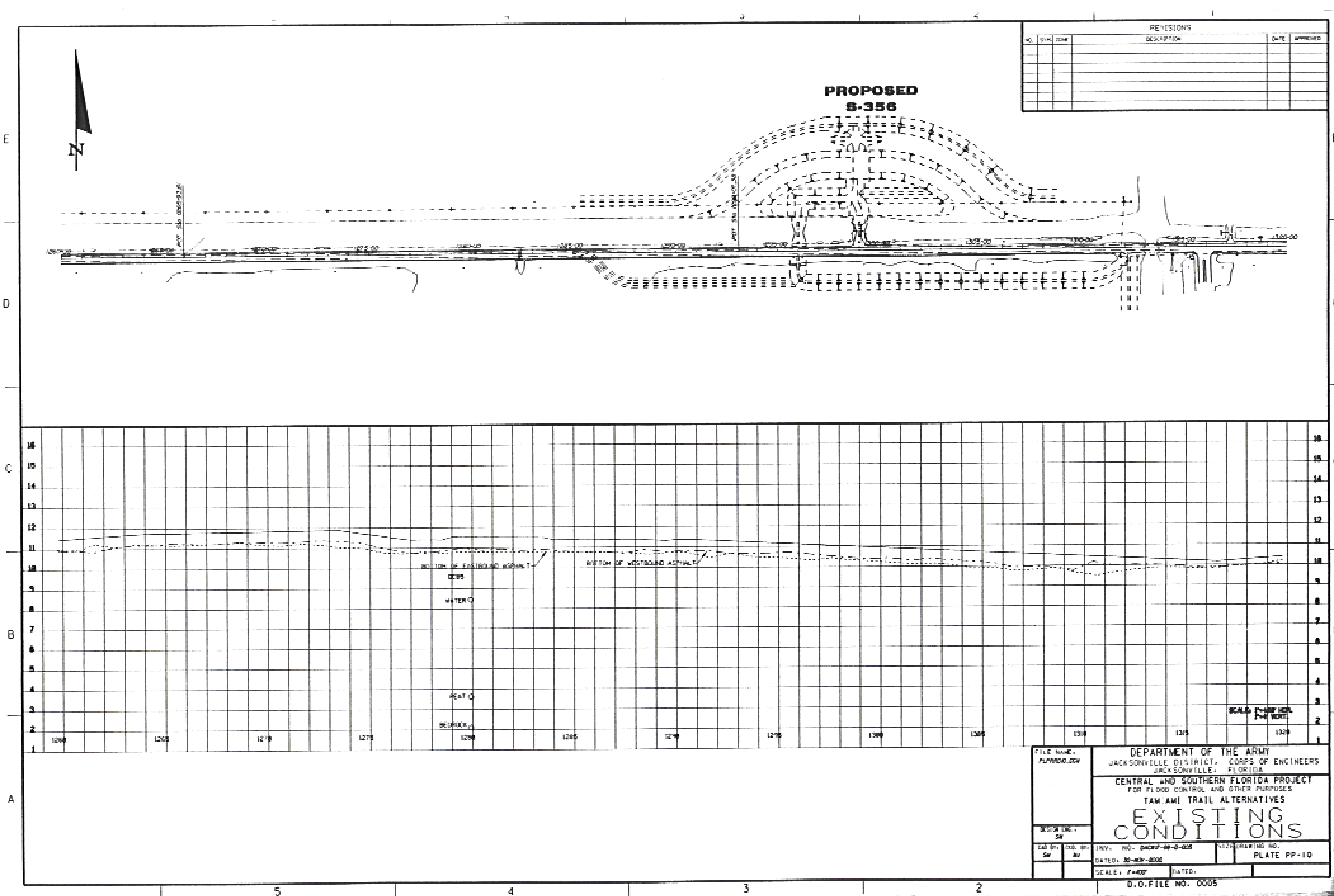
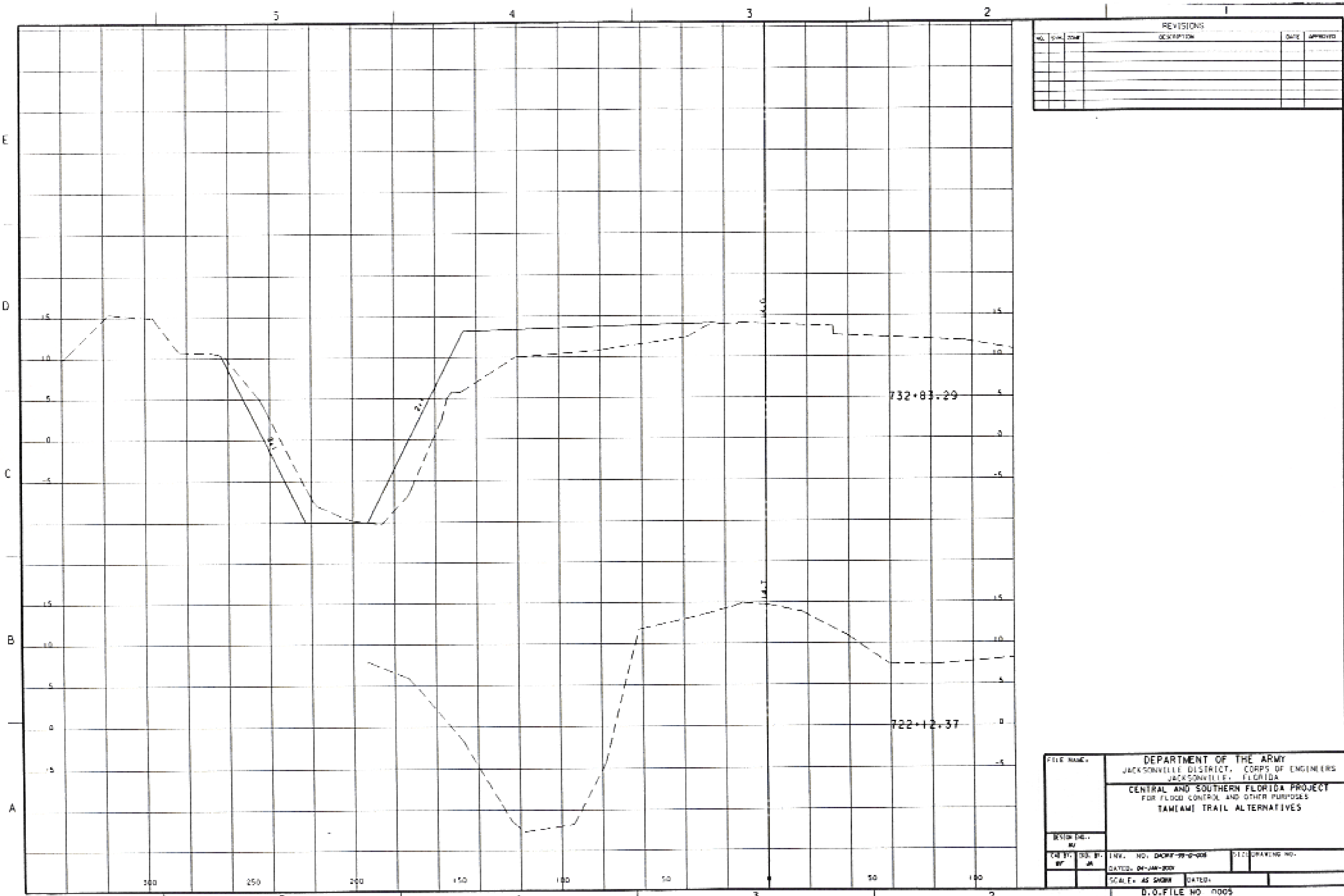
PROPOSED
WEIR C
BOTTOM OF EASTBOUND ASPHALT
BOTTOM OF WESTBOUND ASPHALT
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
EXISTING
CONDITIONS
PLATE PP-09
D.O.FILE NO. 0005



PROPOSED
S-356
N
REVISIONS
NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED
BOTTOM OF EASTBOUND ASPHALT
BOTTOM OF WESTBOUND ASPHALT
WATER
PEAT
BEDROCK
SCALE: 1"=400' HOR. 1"=4' VERT.
1260
1265
1270
1275
1280
1285
1290
1295
1300
1305
1310
1315
1320
FILE NAME: PLPPP010.DGN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
EXISTING CONDITIONS
DESIGN ENG.: SW
CAD BY: SW
CKD. BY: AV
DATED: 30-NOV-2000
SCALE: 1"=400'
DATED:
PLATE PP-10
D.O.FILE NO. 0005


732+83.29
722+12.37
REVISIONS
NO.
SYM.
ZONE
DESCRIPTION
DATE
APPROVED
FILE NAME:
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
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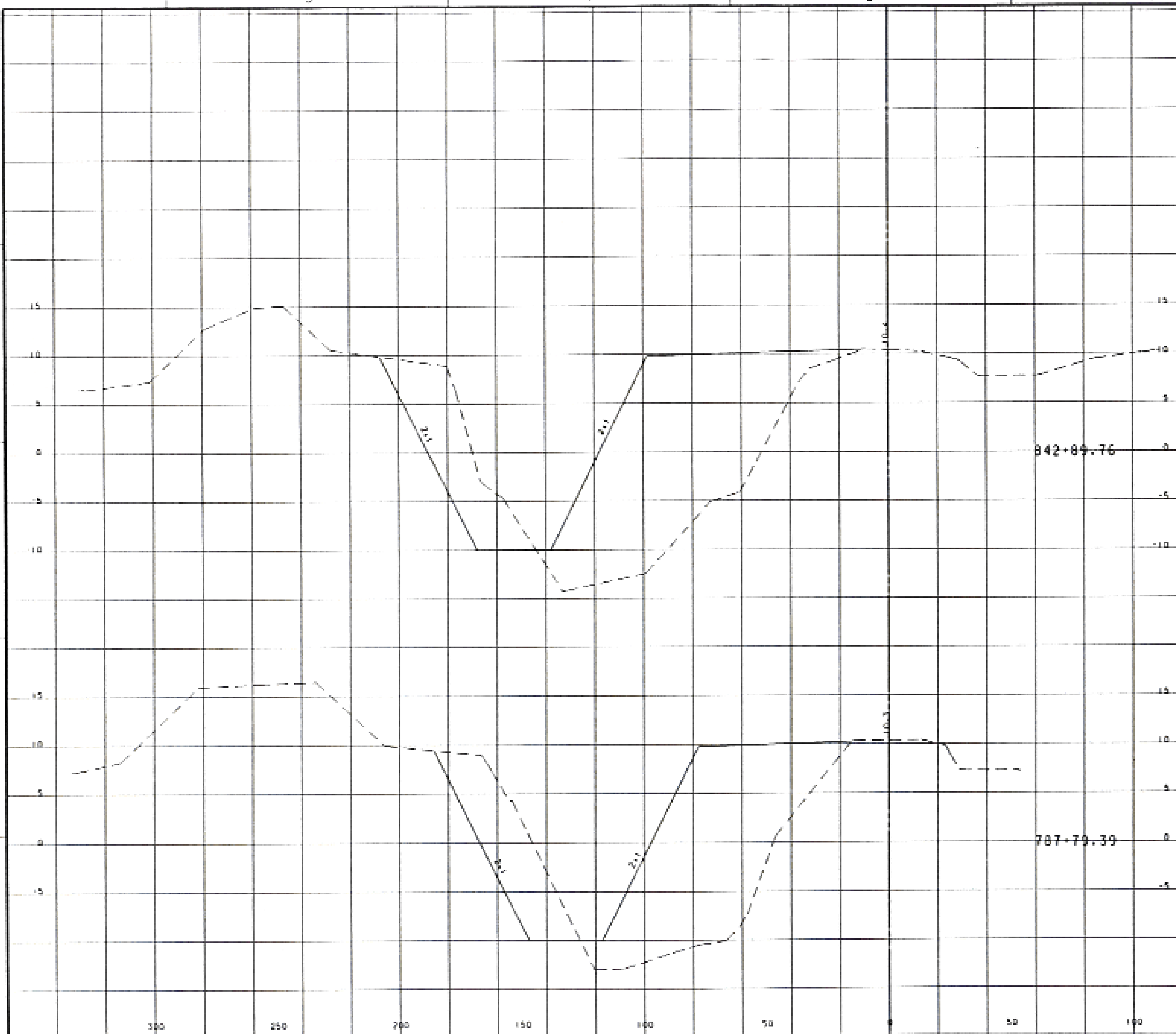
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
DESIGN ENG.:
CAD BY:
CKD. BY:
INV. NO.:
DATED: 04-JAN-2001
SCALE: AS SHOWN
DATED:
SIZE
DRAWING NO.
D.O.FILE NO. 0005




REVISIONS

| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
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CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

FILE NAME:

DESIGN ENG.:

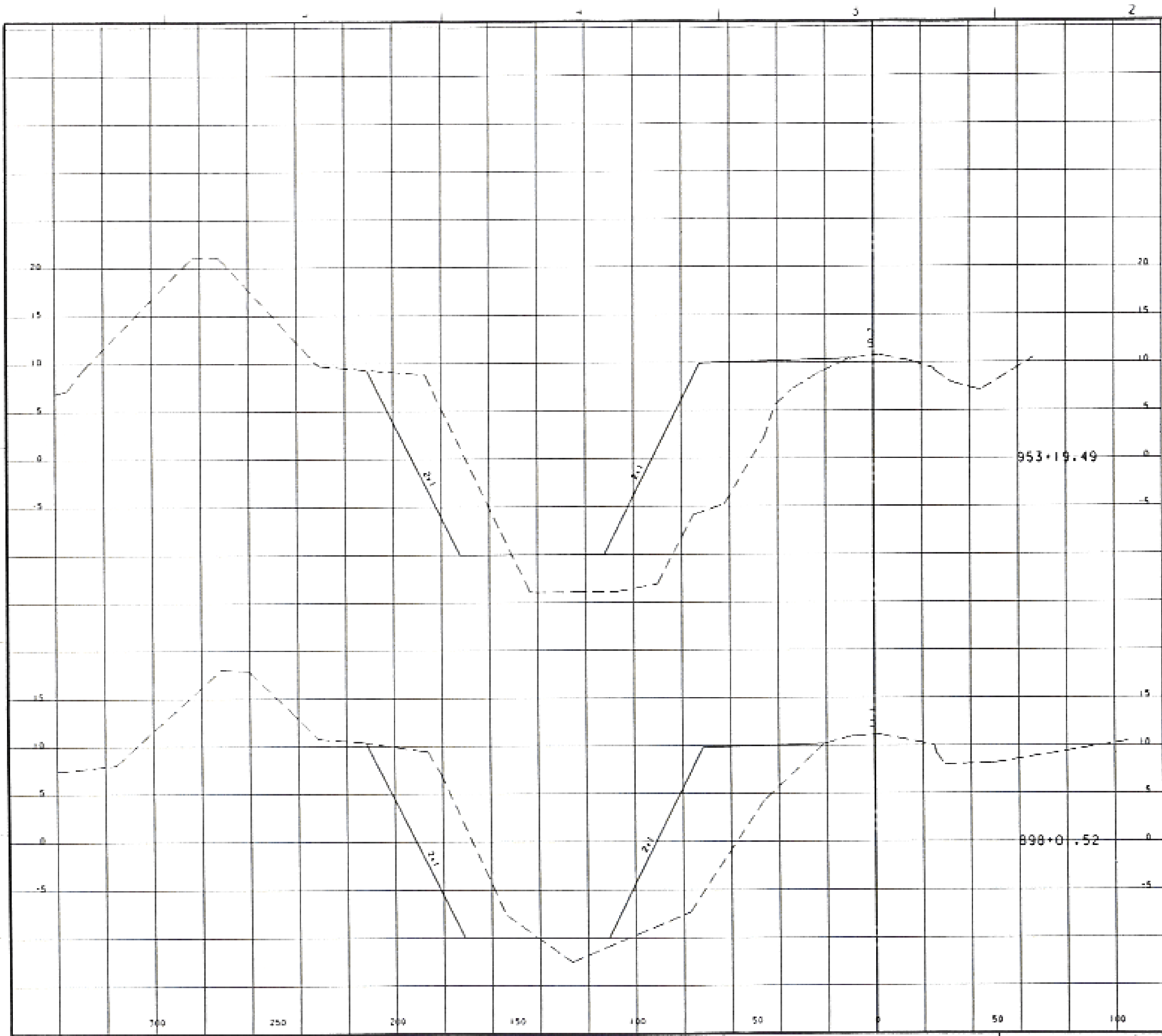
INV. NO.

DATED:

SIZE DRAWING NO.

SCALE: AS SHOWN DATED:

D.O.FILE NO. 0005




REVISIONS

| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|

FILE NAME:

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
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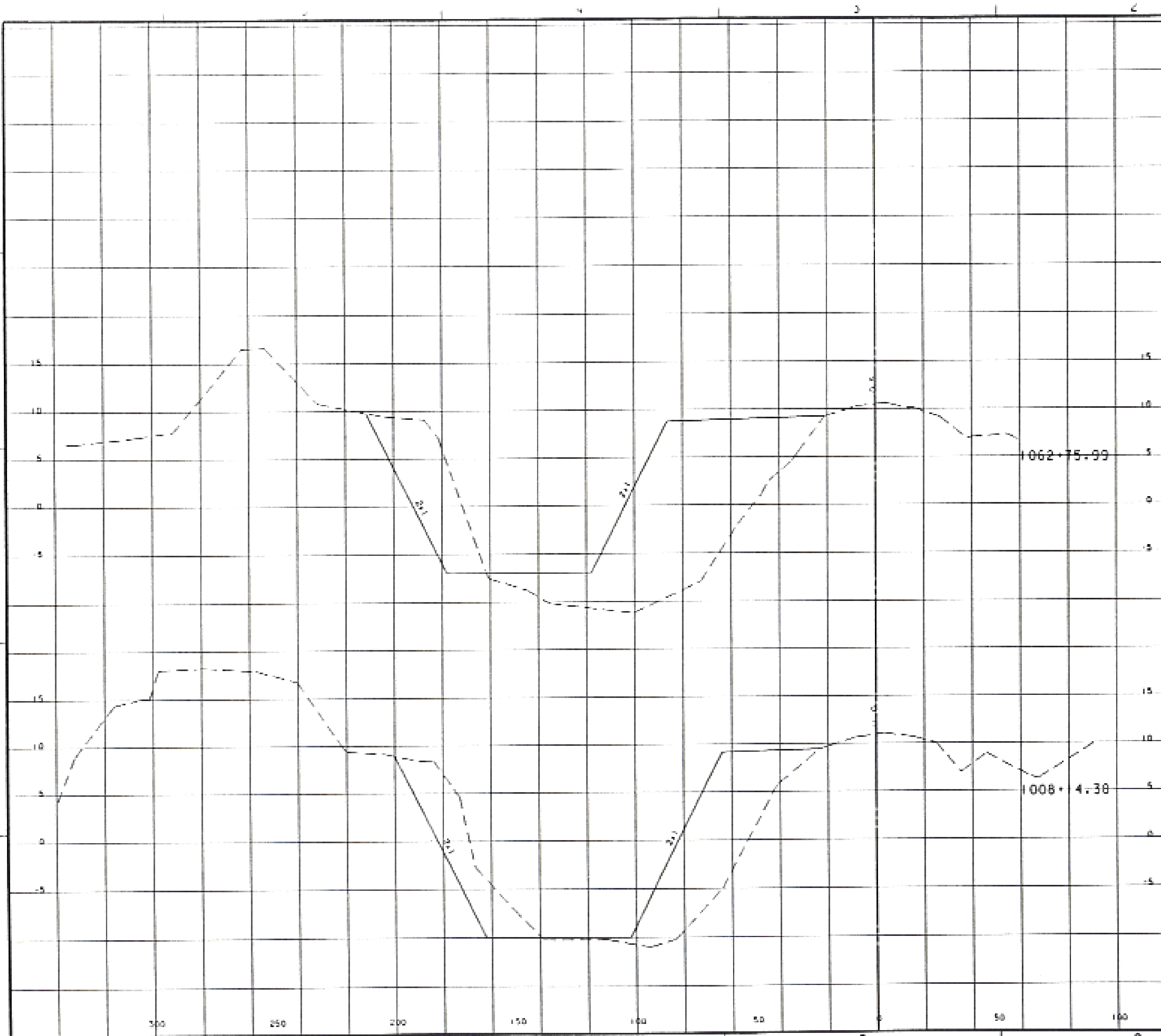
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

DESIGN ENG.:

SCALE: AS SHOWN

DRAWING NO.

D.O.FILE NO. 0005




| REVISIONS | | | | | |
| --- | --- | --- | --- | --- | --- |
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |

FILE NAME:

DESIGN ENG.:

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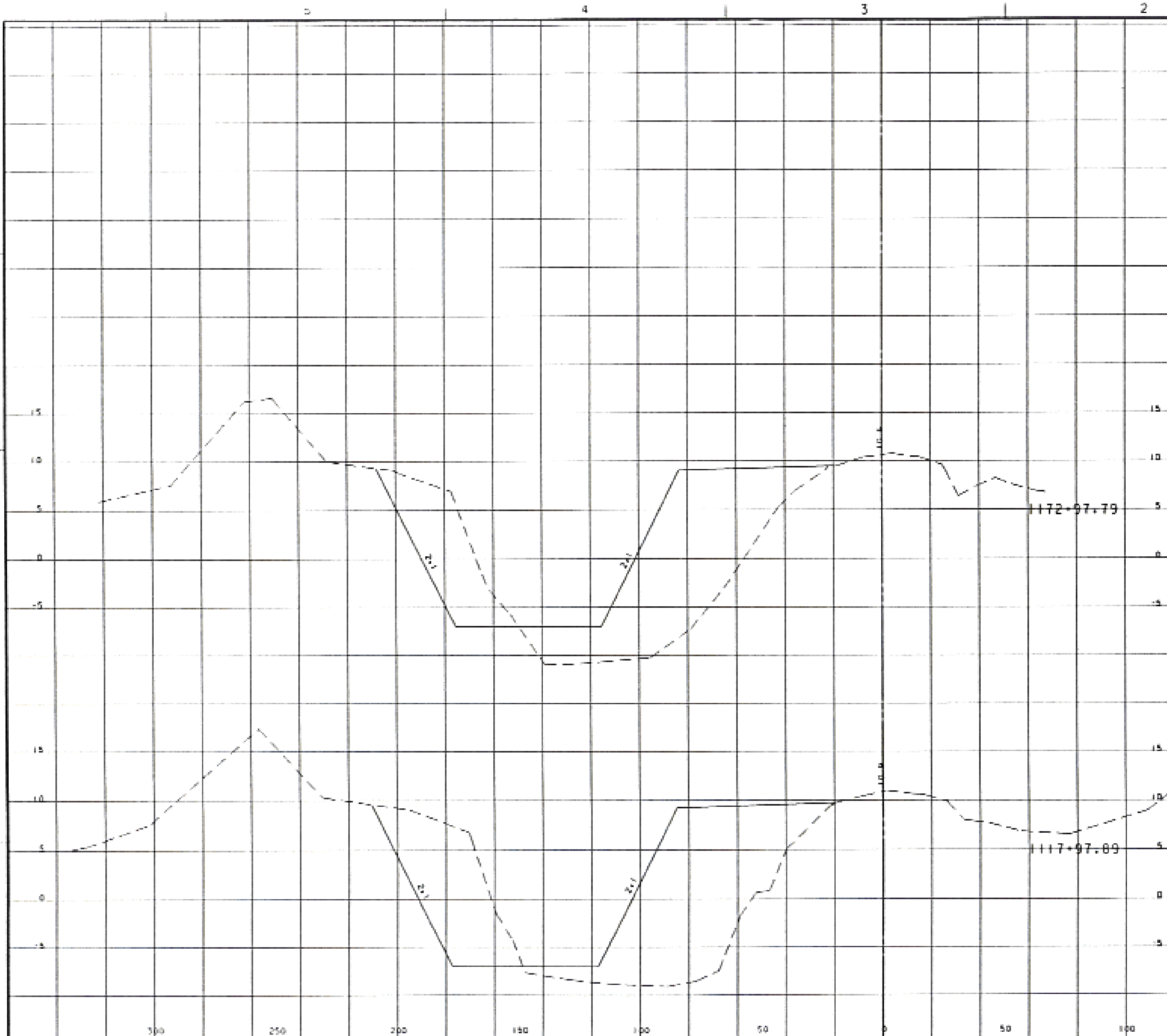
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

**CENTRAL AND SOUTHERN FLORIDA PROJECT**
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

CAD DR. | CKD. BY. | INV. NO. | DATED: | SIZE | DRAWING NO.

SCALE: AS SHOWN | DATED:

D.O.FILE NO. 0005




REVISIONS

| NO. | SYMBOL | ZONE | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|

FILE NAME:

DESIGN ENG.: WJ

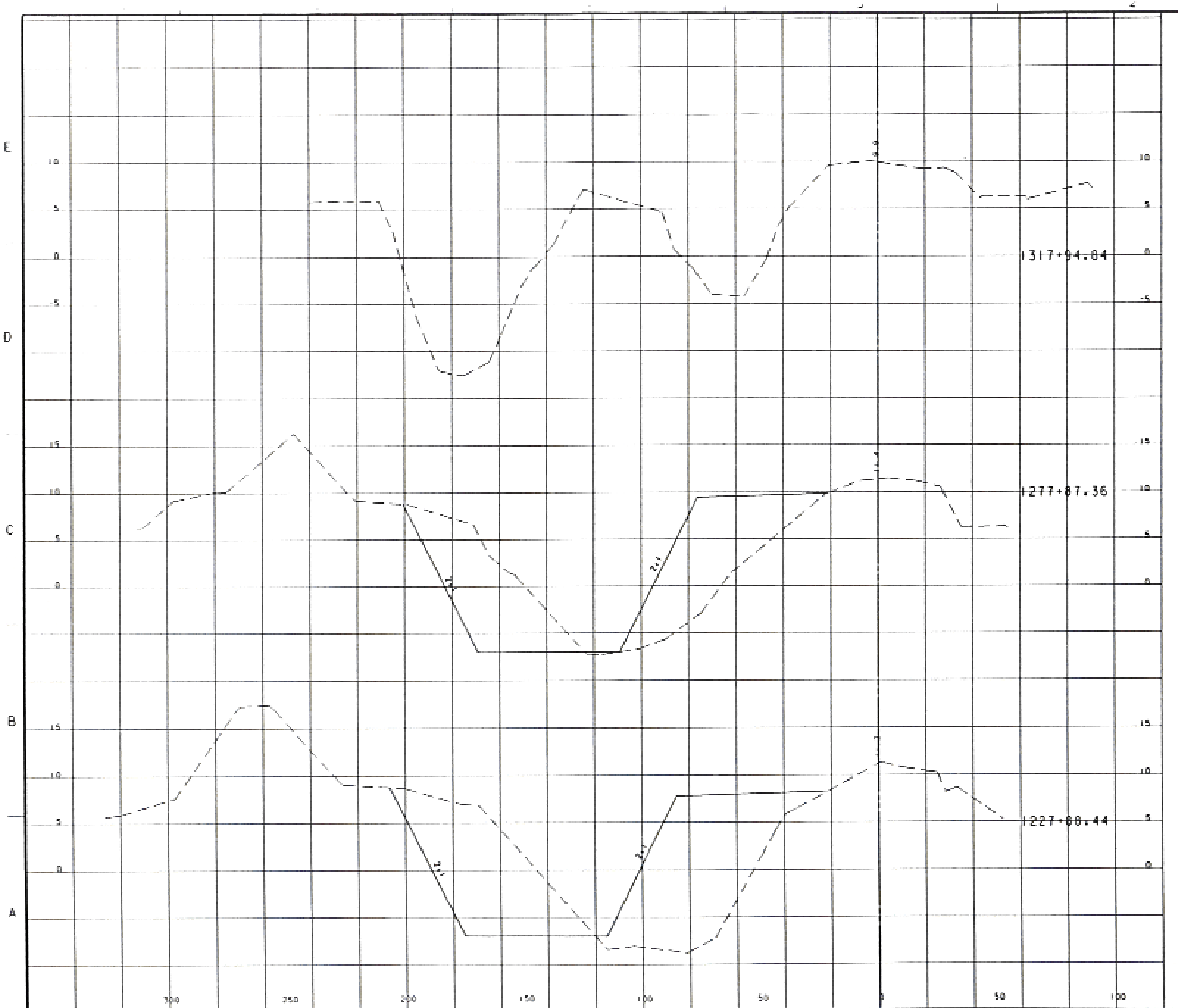
CAD BY: WF | CKD. BY: JR

**DEPARTMENT OF THE ARMY**
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

**CENTRAL AND SOUTHERN FLORIDA PROJECT**
FOR FLOOD CONTROL AND OTHER PURPOSES
**TAMIAMI TRAIL ALTERNATIVES**

INV. NO. [illegible]
DATED: 04-JAN-2001
SCALE: AS SHOWN | DATED:
SIZE | DRAWING NO.

D.O.FILE NO. 0005




REVISIONS

| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|---|

FILE NAME:

DESIGN ENG.:

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

DATED: 04-JAN-2001
SCALE: AS SHOWN
DATED:
DRAWING NO.

D.O.FILE NO. 0005