CONCEPTUAL DRAINAGE REPORT

Florida Department of Transportation

District 6

SR 994/SW 200th Street/Quail Roost Drive PD&E Study

From West of SW 137th Avenue to East of SW 127th Avenue

Miami-Dade County, Florida

Financial Management Number: 445804-1-22-01

ETDM Number: 14429

June 18, 2024

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by FDOT pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022, and executed by FHWA and FDOT.

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(FINAL DRAFT)

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Project Development & Environment Study
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Efficient Transportation Decision-Making Number: 14429

Prepared for:
Florida Department of Transportation
District 6
1000 NW 111th Avenue
Miami, Florida 33172

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1.0 Project Background

1.1 Project Description

The Florida Department of Transportation (FDOT), District Six (D6), is conducting a Project Development and Environmental (PD&E) Study for SR 994 / SW 200th Street / Quail Roost Drive from west of SW 137th Avenue (MP 4.000) to east of SW 127th Avenue (MP 5.162), in southwest-unincorporated Miami-Dade County, Florida. The SR 994 Corridor is classified as a rural major collector from begin of project to just west of SW 137th Avenue and as an urban minor arterial from just west of SW 137th Avenue to the end of project. The corridor primarily has a C3R Suburban Residential Context Classification and a posted speed of 40 miles per hour. Four major intersections are located along the project corridor, including two signalized intersections (SW 137th Avenue and SW 127th Avenue) and two unsignalized intersections (SW 134th Avenue and SW 132nd Avenue). Eight other minor (unsignalized) intersections are located within the study corridor.

The project scope includes widening of Quail Roost Drive from two to four lanes from SW 137th Avenue to SW 127th Avenue to address traffic capacity demand due to the population and employment growth along the corridor. Additionally, the project scope also includes improving safety conditions along the corridor, including evacuation and response times and enhancing mobility options and multimodal access.

The PD&E includes the evaluation of three (3) alternatives, Build Alternatives 1 thru 3. Build Alternative 1 does not sufficiently address the purpose and need of the project while Build Alternative 3 meets the purpose and need, but results in greater impacts than Build Alternative 2. As result Build Alternative 2 was selected as the preferred alternative. Build Alternative 2 typical section consists of curb and gutter type F, four (4) 11' wide lanes, a 16.5' median and 10' shared use paths at both sides.

1.2 Project Location

The project is located within southwest Unincorporated Miami Dade County. The project begins approximately 400-feet west of SW 139th Avenue and ends just east of SW 123rd Place with a total approximate length of 1.67-miles. The project is located within a section line and it is included within Township 56S, Range 39E, Sections 1 thru 3 and 10 thru 12.

1.3 Purpose

This concept drainage report is a component of the PD&E Study with the purpose of providing an outline of the project's drainage features, design and permit criteria including a preliminary analysis and design of the proposed drainage system to address the project's stormwater management needs.

1.4 Project Vertical Datum

The project survey geodetical vertical datum is NAVD88. The conversion from NAVD88 to NGVD 29 is 0.00' NAVD88= 1.55' NGVD29 as per USACE VERTCON.

2.0 Project Drainage Features

2.1 Land Use

The project land use west of SW 137th Avenue is generally described as rural and is mainly composed of agricultural lands. From SW 137th avenue to SW 127th Avenue the land use is urban and it is composed mainly of residential homes and the C-1W Canal crossing at the mid-section. The land use east of SW 127th Avenue continues to have an urban setup and it is composed of a mixture of residential homes and light commercial.

2.2 Topography

The project topography is relatively high with an existing edge of pavement elevation ranging from 8' to 13'-NAVD.

2.3 Soils

According to the USDA NRCS, the following soil types are located within and adjacent to the project limits:

4 – Pennsuco Marl
6 – Perrine Marl
7 – Krome Gravelly Loam
10 – Udorthents, Limestone Substratum Urban
13 – Biscayne Marl
15- Urban Land
99- Water

2.4 Percolation

Southwest Miami Dade County geologic conditions consist in general of a shallow and porous limestone formation which is highly transmissive and yields high percolation rates. Two (2) percolation tests were performed within the project limits, one test to the west and the other test to the east of the C-1 Canal crossing. Percolation test results as shown below are fairly consistent and indicates excellent percolation rates within the project limits which corroborates our assumption.

Table 2.4.1 – Percolation Test Results

Percolation Test No.	K, Hydraulic Conductivity @10'-depth cfs/ft^2-ft	K, Hydraulic Conductivity @15'-depth cfs/ft^2-ft	K, Hydraulic Conductivity @ 20'-depth cfs/ft^2-ft
EX-1	$2.24x10^{-4}$	$3.48x10^{-3}$	$4.05x10^{-3}$
EX-2	$1.66x10^{-4}$	$3.12x10^{-3}$	$4.06x10^{-3}$

2.5 Wellfield

A portion of the SW 127th Avenue intersection southwest quadrant is located within the South Miami Heights wellfield facility 210-day wellfield protection area.

2.6 Floodplain

As per Flood Insurance Rate Map number 12086C0583L Panels 583 and 584 of 1031 the majority of the project area is located within Zone X which translates to a low risk flood zone. The X zone (also known as "low-risk flood zone") is an area outside of the Special Flood Hazard Area. It shall be noted that because an area is designated as X zone does not mean that the area will never flood but there is low incidence of flooding. FEMA maps also show that a small project area in the immediate proximity to the C-1 Canal bridge crossing lies within Zone AH with 100-year floodplain elevation of 6.5'-NAVD (8.0'-NGVD). It should be noted that the existing bridge and roadway approaches pavement elevation ranges from 8.5' to 9.0'-NAVD so there are located above the 100-year flood. Also, the that existing bridge low member elevation is 7.0'-NAVD (8.5'-NGVD) which is also above the 100-year flood and translates into no overtopping flow incidence. Finally, the proposed bridge replacement and roadway approaches will be set at a higher elevation than the existing bridge with a proposed deck elevation at 14.0'-NAVD.

2.7 Groundwater

The project's design seasonal high groundwater table is established based on Miami Dade County DERM Average October Groundwater Level Map. The DERM Average October Groundwater elevation for the project is 3.0'-NAVD (4.5'-NGVD).

Average extreme high groundwater levels in Miami Dade County are depicted by DERM Average Yearly Highest Groundwater Level Map. This groundwater level is typically used in FDOT D6 drainage design to set groundwater peak boundaries for ICPR flood routing analysis for variable tailwater conditions. The DERM Average Yearly Highest Groundwater elevation for the project is 5.0'-NAVD (6.5'-NGVD).

2.8 Wetlands

There are no wetlands found within the limits of the project.

2.9 Contamination

Miami Dade County Department of Regulatory and Economic Resources (DRER) Pollution and Remediation Section (PRS) records indicate the presence of contaminated site #37089 at the 7-eleven store located at the south west corner of the SW 127th Avenue intersection. Restrictions are set for installing French drains and for dewatering construction activities nearby open contamination sites. Coordination with DRER PRS will be required.

2.10 Receiving Water Bodies

The project includes a bridge crossing over the C-1W Black Creek Canal approximately at the mid-section of the project. The C-1W Canal is a primary canal owned, operated and maintained by the South Florida Water Management District (SFWMD). However, the project does not have any existing outfall connections into this canal. The project existing drainage infrastructure is self-contained and consists mainly of roadside swales with inlets connected to isolated short segments for French drains providing runoff disposal. The project proposed stormwater management systems will be also designed as self-contained French drain systems.

The existing system east of SW 127th Avenue consists of a positive gravity storm sewer system which has an outfall connection into the SW 122nd Avenue Canal. The SW 122nd Avenue Canal is a secondary canal owned, operated and maintained by DRER. This canal is located beyond the project limits. The existing drainage infrastructure east of SW 127th Avenue within the project limits will be upgraded with French drains with an overflow connection into the remaining of the existing trunk-line that is beyond the project to address current water quality and quantity control requirements.

2.11 Regional Watershed

The C-1 Black Creek Basin has an area of approximately 56.0 square miles and it is located in southeastern Miami Dade County. The land use distribution is predominantly of single-family residential and vacant land, with a lesser proportion of agricultural, plant nurseries and pasture.

The C-1 watershed has a negligible topographic relief and it contains a variety of land uses drained by a complex network of dredged canals. The canals intercept the shallow groundwater table, which provides most of the base flow.

A number of canals within the C-1 Basin are tributaries to the main C-1 (Black Creek) Canal. C-100B connects C-1N and C-100 canals. C-100B joins C-1N one-half mile downstream of the F.E.C. railway. The canal leaves the basin at control structures S-111. Normal flows to the canal are to the north (into the C-100 Basin). The northern portion of the C-1 Basin has limited drainage capability and is subject to severe limitations on development. S-148 control stages in the upper reach of C-1/C-1W and regulates discharges into the lower reach. S-338 is a gated culvert located at Krome Avenue. It controls inflows from the L-31N borrow canal, and helps maintain optimum stage at the borrow canal. Flow in the C-1/C-1W canal is to the southeast with discharge via the S-21 control structure into Biscayne Bay.

3.0 Design Criteria

3.1 Base Clearance

Per FDOT Pavement Design Manual a minimum 3-feet base clearance is required to provide for pavement structural integrity protection. When the clearance is less than 3-feet the pavement designer must reduce the Design Resilient Modulus as follows:

- For 2-feet base clearance, a 25% modulus reduction
- For 1-foot base clearance, a 50% modulus reduction.

A minimum roadway edge of pavement elevation of 7.0'-NAVD is required to provide a 3-feet base clearance from SHGWT (3.0'-NAVD) to the bottom of base.

3.2 Conveyance Systems

The design of both, storm sewer systems and conveyance ditches are based on FDOT drainage design criteria. These criteria are summarized as follows:

1. For major interstates a 10-year recurrence interval shall be used in the design of storm sewer systems;
2. For interstates within a sag vertical curve with no outlet other than the storm sewer, a 50-year recurrence shall be used in the design of the storm sewer system. Also, for a depressed expressway with drainage provided by a pumping station a 50-year recurrence shall be used for the design of the storm sewer system;
3. Design of storm sewer system shall maintain hydraulic grade line HGL a minimum of 1-foot below gutter line when minor losses are not computed in the design. When minor losses are considered, HGL may be maintained at the gutter line;
4. Design of storm sewer system shall maintain a minimum and maximum velocities of 2.5 and 15 feet per second respectively;
5. Roadway and median ditches are designed to convey the 10-year frequency storm. Outfall ditches are designed to convey the 25-year frequency storm;
6. The maximum allowed velocity in grassed ditches is 5.5 feet per second. For velocities higher than 5.5 feet per second lining other than grass shall be used such as paved concrete, flexible, rip-rap, geo-grid and interlocking concrete blocks.

3.3 French Drains

French drains are allowed when in-situ soil hydraulic conductivity is sufficient to promote exfiltration of the required stormwater quality volumes. French drains must be designed in accordance with current FDOT District 6 Drainage Design Guidelines and the Exfiltration Trench Reference Manual (ETRM) dated February, 2020 and must address 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 a minimum of 24 inches in diameter with an invert elevation set at or above DERM average October groundwater elevation, to be accounted for water quality treatment;
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.

6. Trench width shall be a minimum of 4.5 feet;
7. Rock in trench must be enclosed in filter material, at least on the top and sides;
8. In-situ 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 6 gpm per foot of head of exfiltration capacity; and
9. Depth of French drain trench must be at or below the percolation test hole depth to a maximum of 20 feet as outlined in the FDOT-VI Drainage Section Pamphlet “Subsurface Drainage with French Drains: June 20, 1991”.

3.4 Spread

The minimum longitudinal gutter grade shall be kept at 0.3% to properly drain the pavement and reduce the width of the spread, thus decreasing the likelihood of hydroplaning. The careful spacing of the inlets is required to limit the spread resulting from a constant 4.0 inches per hour storm. Utilize curb inlets types 1 thru 4 to the maximum extent practicable to facilitate maintenance. Curb inlets type 5 and 6 shall be used when inlets type 1 thru 4 cannot be accommodated. Inlets type 5, 6, 9 and 10 are not permitted in concrete pavement sections. The spread criteria are summarized as follows:

Table 3.4.1 – Spread Criteria

Typical Section Condition	Design Speed (mph)	Spread Criteria
Parking Lane of Full Width Shoulder	All	No encroachment
Left Turn Lanes	Design Speed > 45	Keep 8’ of lane clear
Right Turn Lanes	All	Keep ½ lane clear
All Other	Design Speed ≤ 45	Keep ½ lane clear
	45 < Design Speed ≤ 55	Keep 8’ of lane clear
	Design Speed > 55	No encroachment

3.5 FDOT D6 Drainage Guidelines

FDOT D6 has developed drainage design guidelines tailored to address the unique drainage conditions found within Miami Dade and Monroe County. These unique conditions include low-lying areas, flat terrain and highly transmissive limestone formation that allows for French drains to be the bulk of stormwater management systems used in District 6. These guidelines include the Exfiltration Trench Reference Manual, the ICPR Application Manual and the ICPR Technical Design Guide.

3.6 FDOT D6 Drainage System Design Flood Protection Level of Service (FPLOS)

FDOT stormwater systems shall be design to meet the 10-year storm FPLOS and shall be checked for performance for the 100-yr storm. Typically, analysis and design of system components including storm drains, French drains, swales, ponds, weirs, pollution control structures and pump station are conducted using ICPR flood routing analysis. The 10-yr, 1-hr, 8-hr and 24-hr storm events simulations are evaluated for system design while the 100-yr, 1-hr, 8-hr and 24-hr storm events simulation are evaluated for system performance.

3.7 Miami Dade Flood Criteria

Chapter 28 of the Miami Dade County Ordinance Code requires roadway facilities to meet flood criteria elevation to establish required roadway crown minimum elevation. As per Miami Dade County Flood Criteria Map the project flood criteria elevation is 6.0'-NAVD (7.5'-NGVD).

3.8 Sea Level Rise Resiliency Planning

The project is located relatively further inland, west of the salinity control line. C-1 Canal is a flood-controlled waterway and is not tidally influenced by Biscayne Bay tidal fluctuations. Also, project topography is relatively high (8' to 13'-NAVD) while SHGWT is relatively low (3.0'-NAVD). These conditions promote favorable conditions in terms of drainage and does not present an immediate risk in terms of SLR flooding impacts to the project.

4.0 Permit Criteria

This section describes the Federal, State, and local stormwater quality and quantity criteria applicable to the project. This section also outlines the Federal, State, and local permitting requirements. The criteria and parameters outlined in this section are from the pertinent published regulations, permit design manuals, and design standards.

4.1 Stormwater Quality

The South Florida Water Management District (SFWMD) and the Miami-Dade County Department of Regulatory and Economic Resources (DRER) have jurisdiction over the stormwater quality criteria for the project. The following subsections details the applicable criteria.

4.1.1 SFWMD Stormwater Quality Criteria

The SFWMD requires 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 proposed drainage improvements must meet the following volumetric retention/detention requirements, as described in the SFWMD Permit 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 of imperviousness, whichever is greater, must be detained on site. A wet detention system is a system, which maintains the bottom elevation below one foot from the seasonal high groundwater 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 bottom elevation at least one foot above the seasonal high groundwater elevation.
3. Retention systems must only provide 50 percent of the wet detention volume.
4. For projects with more than 50 percent of 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.

4.1.2 DRER Stormwater Quality Criteria

The Miami-Dade Department of Regulatory and Economic Resources (DRER) also requires that all projects meet the State water quality standards. To assure that this criteria is met, 100 percent of the first 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 Structures, 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 0.95 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

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

Where:

F = Storm frequency, years

C = previously defined

T_c = Time of concentration, minutes

i = Storm intensity, inches per hour

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

All variables previously defined.

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

4.2 Stormwater Quantity

The SFWMD and DERM both have jurisdiction over the stormwater quantity criteria for the Project. The following subsections outline these requirements.

4.2.1 SFWMD Stormwater Quantity Criteria

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; or
2. Rates determined in previous SFWMD permit actions; or
3. Basin allowable discharge rates.

The receiving water bodies within the project are the Miami River and its tributaries including the Lawrence Canal, the Wagner Creek and the Seybold Canal. These receiving water bodies do not have historic or allowable discharge criteria. Nevertheless, the SFWMD requires that pre-development peak discharge during a 25-year, 72-hour rainfall event does not increase for post-development conditions. The SFWMD also requires flood protection within the project as follows:

1. Building finish floor elevation must be set at or above the 100-year flood elevation, as determined from the Federal Flood Insurance Rate Maps (FIRM) or 100-year, 72-hour rainfall event peak stages;
2. Centerline of roadways must be set at or above the 5-year, 24-hour rainfall event peak stages or 2 feet above the seasonal high groundwater elevation, whichever is greater;
3. Parking lots served by French drains must be set at or above the 5-year, 1-hour rainfall event peak stages.

The SFWMD also requires that provisions be made to replace or otherwise mitigate the loss of historical basin storage provided by the project.

4.2.2 Variable Tailwater Conditions

Historically, the SFWMD has allowed French drain exfiltration in hydrologic/hydraulic modeling for only one-hour of rainfall duration or its equivalent of 3.28-inch precipitation deduction credit for a SFWMD 25-year, 72-hour storm event. This volume of runoff typically is the stormwater quality volume required to be retained onsite with French drains. However, because of the relatively excellent draining soils in Miami-Dade County, this criterion is overly conservative and stormwater management systems are over designed. Based on local design experience, French drains tend to exfiltrate throughout the duration of long-term rainfall events such as 24 and 72 hours and provide quick drawdown of retained stormwater runoff after the end of the rainfall event.

In the recent years, based on previous roadway projects and meetings between FDOT VI, SFWMD and DRER, the use of French drain exfiltration in flood routing modeling during the entire storm duration has been accepted for SFWMD 25-year, 72-hour pre-development versus post-development peak discharge analysis. However, this acceptance is subject to include in the model a boundary condition with groundwater and/or surface water levels representative of SFWMD 25-year, 72-hour storm event. Variable tailwater conditions were also used for all other design storms included in this report.

Tailwater boundary conditions for canal water levels and groundwater levels can be established based on two (2) FDOT D6 common design practice approach. The first approach is to set the initial and peak water level boundaries to DERM Average October Groundwater Level and Yearly Highest Groundwater Level respectively. The second approach is to use any recent DRER and/or SFWMD canal masterplan documentation, canal stormwater model and/or groundwater study. DRER has recently completed the Black Creek Cana C-1 master plan which includes the C-1 XPSWMM hydrologic and hydraulic model. Either approach is typically accepted by the Department.

4.2.3 DRER Stormwater Quantity Criteria

Sample Protection from flooding has long been the primary objective of Miami-Dade County. The sizing of a drainage system is determined by the design storm and the land use type. The design storm is based on the County Intensity Duration Frequency (IDF) curves as shown in W.C. 1.1 and W.C. 1.2. The table below summarizes this agency's requirements.

In addition, DRER states that a safety factor of 4, exfiltration trenches with 24 inches perforated pipes 100 feet long, and 18 inches pipes shall be used for section line and half section line roadways, and exfiltration trenches with 36 inches perforated pipes on arterial roads.

Table 4.2.3.1 – DRER Water Quantity Criteria

Storm Event Frequencies and Flood Limits		
Type of Area	Rainfall Frequency	Flood Limit
Residential and Commercial Areas	5-year	To crown of street, or to within 15' of a dwelling or other occupied building, whichever is lower
2-Lane Roads in Residential and Commercial Areas	5-year, except 10-year for bridge or culvert in the canal system	To crown of street
4-Lane Roads in high density, high traffic areas	10-year	To the outer edge of traffic lanes
Private parking lots and similar paved areas	5-year	As per Florida Building Code

4.3 Permit Requirements

The following permits are anticipated to be required for the project.

4.3.1 South Florida Water Management District (SFWMD)

4.3.1.1 SFWMD Environmental Resource Permit (ERP)

There is no existing Environmental Resource Permit (ERP) found in records within the project limits. The project exceeds the 2.0-acres additional impervious and the 10-acres total drainage area which is the threshold for permit exemption. The project existing and proposed drainage systems consist of self-contained French drain systems, which means no outfall or overflow connections into the Black Creek Canal C-1W. However, the project scope includes providing additional traffic lanes, replacing the bridge over the C-1W Canal and dredging and filling the canal. Therefore, an ERP permit will be required.

4.3.1.2 SFWMD Right of Way Occupancy Permit

The segment of the Black Creek Canal under the SR 994 Bridge Crossing is under the jurisdiction of SFWMD. Proposed bridge replacement construction activities will also require a SFWMD Right of Way Occupancy Permit. The existing right of way occupancy permit No. 1960 for previous SR 994 bridge work will require to be modified for proposed bridge widening construction. Incidental construction to bridge replacement will also include the watermain crossing replacement. This working activity will also need to be included under the SFWMD Right of Way Construction Permit.

4.3.1.3 SFWMD Water Use (Dewatering) Permit

Working activities including pipe and drainage structures construction within dense existing utilities and/or bridge foundation construction may require dewatering. Dewatering activities will require a Water Use General Permit by rule from the District. As per FDOT Standard Specification dewatering permit is typically handled by the contractor prior to construction activities commencement.

4.3.2 United States Army Corps of Engineers (USACE)

4.3.2.1 USACE Section 404 Permit Program

This program regulates the discharge of dredge and fill material into waters of the United States, including wetlands. The project includes bridge replacement and dredge and fill activities within the

Black Creek Canal C-1W and will require this permit. Coordination with FDOT D6 Environmental Section will be conducted to determine permitting process.

4.3.2.2 USACE Section 408 Permit Program

This program regulates the alteration of federally authorized projects. The project includes bridge replacement and dredge and fill activities within the Black Creek Canal C-1W. This proposed construction work will modify the canal sections and bridge opening. Therefore, the project may also require this permit. Coordination with FDOT D6 Environmental Section will be conducted to determine permitting process.

4.3.3 USEPA General Construction NPDES Permit

Sample text 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 re-disturbed 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.

4.3.4 Miami Dade Department of Regulatory and Economic Resources (DRER)

4.3.4.1 DRER Class I, II, IV and VI Permits

As per Florida Statute Chapter 335.02, Section 4, FDOT as a transportation agency and FDOT highways as facilities which are a component of the State Highway System ***is exempted*** of Miami Dade DRER Class I, II, IV, V and VI permits.

Class I Permit applies to Miami Dade tidal waters and coastal natural resources including mangroves, seagrass, corals and/or hard bottom sponge communities. Typically, any impact to coastal resources for this project is addressed under the SFWMD ERP permit.

Class II Permit applies for drainage construction with outfall connections into Miami Dade canals, lakes, wetlands or any other receiving water body. These activities addressed under the SFWMD ERP permit.

Class IV Permit applies for impacts to wetlands in Miami Dade. This activity is also addressed by the SFWMD ERP permit.

Class V Permit applies to construction dewatering activities. This activity is addressed by SFWMD Water User Permit.

Class VI Permit applies for work within contaminated sites. As per Miami Dade Pollution and Remediation Division, there is no open contamination found within the project limits. However, if there would be any contamination within the project it would also be addressed under the SFWMD ERP permit.

4.3.4.2 DRER Class III Permit

Sample Class III Permit applies for construction work within Miami Dade Canal Right of Way. This is more of proprietary type of permit and it is the only Miami Dade local permit which MDX is not exempted. However, there is no Miami Dade owned canal within the project limits. Consequently, project does not require a Class III permit.

5.0 Drainage Design & Analysis Approach

The SR 994 corridor presents favorable field conditions for drainage. The corridor is located within high terrain (elevation range 8' to 14'-NAVD), with a relatively low groundwater table (elevation 3.0'-NAVD) and excellent limestone percolation ($3x10^{-3}$ cfs/ft^2-ft). Given these conditions self-contained French drain system is found to be typically the most effective and economic stormwater management system for the project. The approach will include maintaining existing corridor drainage flow patterns which does not include existing outfall connections to the C-1W Canal. The proposed system will not be provided with outfall connections.

6.0 Pre-Development Drainage Conditions

6.1 Basin 1 – SR 994 from Begin Project to SW 137th Avenue

This basin includes is located within the rural section of the corridor. There is no drainage infrastructure located within this basin. The roadway directly sheet-flows into the adjacent agricultural lands.

6.2 Basin 2 – SR 994 from SW 137th Avenue to C-1 Canal Bridge Crossing

This basin includes a mixed rural and urban residential setup. The existing drainage infrastructure consists of roadside swales which provide runoff collection with ditch bottom inlets connected to isolated short segments of French drains which provide runoff disposal.

6.3 Basin 3 – SR 994 from C-1 Canal Bridge Crossing to just West of SW 127th Avenue

This basin includes an urban residential setup. As the previous segment the existing drainage infrastructure consists of roadside swales which provide runoff collection with ditch bottom inlets connected to isolated short segments of French drains which provide runoff disposal.

6.4 Basin 4 – SR 994 from just West of SW 127th Avenue to End of Project

This basin includes a mixed urban residential and commercial setup. The existing drainage infrastructure consists of a combined storm sewers and French drain trunk-line system which overflows into the SW 122nd Avenue Canal.

7.0 Post-Development Drainage Conditions

7.1 Basin 1 SR 994 from Begin Project to SW 137th Avenue

Basin 1 has a total drainage area of 2.87-acres. This basin includes two different roadway typical sections, one with curb and gutter at the intersection approach with SW 137th Avenue and the other one at the western end of the project which includes open shoulder with swale. The proposed drainage system within the curb and gutter section will consist of P-2 and P-4 inlets connected though lateral drains into a closed French drain trunk-line. The proposed drainage system within the open shoulder segment consists of swales, inlets and isolated French drain segments for runoff collection and disposal. Inlet tops of type P-2 and P-4 are preferred by FDOT Maintenance because of their ease of access.

Basin 1 bisects SW 137th Avenue into a north and south section referred to as B-137 AVE-N. and B-137 AVE-S. Basin 1 covers an area of 2.87 acres, while B-137 AVE-N and B-137 AVE-S cover an area of 2.85 acres, and 2.84 acres respectively.

7.2 Basin 2 – SR 994 from SW 137th Avenue to C-1W Canal Bridge Crossing

Basin 2 has a total drainage area of 7.47-acres. Basin 2 starts at the intersection of SW 137th Avenue and ends at the C-1W canal bridge. The roadway typical section is urban and consists of curb and gutter type F, four (4) 11' wide lanes, a 16.5' median and 5' Separated Bicycle Lane (SBL) with a 2' buffer to sidewalk at both sides. The proposed drainage system within the curb and gutter section will consist of P-2 and P-4 inlets connected though lateral drains into a closed French drain trunk-line.

Basin 2 covers an area of 7.47 acres. Minor improvement will be performed at the intersection of SR 994 with SW 134th Avenue. North of SR 994 the improvement will impact 0.52 acre and this drainage basin is referred to as B1-134 AVE-N. South of SR 994 the improvement will impact 0.78 acre and this drainage basin is referred to as B1-134 AVE-S.

7.3 Basin 3– SR 994 from C-1W Canal Bridge Crossing to SW 127th Avenue

Basin 3 has a total drainage area of 5.51-acres. Basin 3 starts at the C-1W canal bridge and ends at the intersection of SW 127th Avenue. The roadway typical section is urban and consists of curb and gutter type F, four (4) 11' wide lanes, a 16.5' median and 5' Separated Bicycle Lane (SBL) with a 2' buffer to sidewalk at both sides. The proposed drainage system within the curb and gutter section will consist of P-2 and P-4 inlets connected though lateral drains into a closed French drain trunk-line.

Basin 3 bisects SW 127th Avenue into a north and south section referred to as B-127 AVE-N. and B-127 AVE-S. Basin 3 covers an area of 5.51 acres, while B-127 AVE-N and B-127 AVE-S cover an area of 0.73 acres, and 1.61 acres respectively.

7.4 Basin 4 - SR 994 from SW 127th Avenue to End of Project

Basin 4 has a total drainage area of 4.04-acres. Basin 4 starts at the intersection of SW 127th Avenue and ends at SW 123rd Place which is the end of the project. The project scope includes widening improvements within this segment of the corridor. The roadway typical section is urban and consists of curb and gutter type F, four (4) 11' wide lanes, a 16.5' median and 5' Separated Bicycle Lane (SBL) with a 2' buffer to sidewalk at both sides. The proposed drainage system within the curb and gutter section will consist of P-2 and P-4 inlets as well as P-5 and P-6 inlets (where right of way is limited) connected though lateral drains into a new French drain trunk-line system.

8.0 Preliminary Construction Cost Estimate

A preliminary layout of the drainage systems for Basin 1 through 4 has been sized from the proposed geometry and profile. The preliminary construction cost estimate is evaluated at $3,099,658.84.

9.0 Conclusion and Recommendations

The proposed project drainage systems will not impact the surrounding areas, nor the C-1 West canal. The systems that have been designed and analyzed in this report consist of self-contained French drains that have no overflow to the adjacent water bodies. Where applicable inlets type P-2 and P-4 are being proposed to facilitate FDOT maintenance activities. The systems have been designed to satisfy State and local criteria for both water quality and quantity. Backwater elevations from the systems are limited to the lowest inlet elevation, or edge of pavement elevation, meaning no overflow into private properties.

SR 994/QUAIL ROOST DR. FROM W. OF SW 137 AVE TO E. OF SW 127 AVE.
PD&E STUDY - FPID 445804-1-22-01
POST-DEVELOPMENT DRAINAGE AREAS BREAKDOWN

BASIN ID.	PERVIOUS (AC)	IMPERVIOUS (AC)	TOTAL (AC)
BASIN 1	0.75	2.12	2.87
BASIN 2	0.93	6.54	7.47
BASIN 3	0.82	4.69	5.51
BASIN 4	0.26	3.78	4.04
B-137 AVE -N	0.76	2.09	2.85
B-137 AVE -S	0.62	2.22	2.84
B-127 AVE -N	0.13	0.6	0.73
B-127 AVE -S	0.27	1.34	1.61
B-134 AVE-N	0.12	0.4	0.52
B-134 AVE-S	0.28	0.5	0.78
TOTALS:	**4.94**	**24.28**	**29.22**

SR 994/QUAIL ROOST DR. FROM W. OF SW 137 AVE TO E. OF SW 127 AVE.
PD&E STUDY - FPID 445804-1-22-01
PRE-DEVELOPMENT DRAINAGE AREAS BREAKDOWN

BASIN ID.	PERVIOUS (AC)	IMPERVIOUS (AC)	TOTAL (AC)
BASIN 1	1.83	1.04	2.87
BASIN 2	4.44	3.03	7.47
BASIN 3	2.89	2.62	5.51
BASIN 4	0.78	3.26	4.04
B-137 AVE -N	1.76	1.09	2.85
B-137 AVE -S	1.34	1.50	2.84
B-127 AVE -N	0.28	0.45	0.73
B-127 AVE -S	0.71	0.90	1.61
B-134 AVE-N	0.22	0.30	0.52
B-134 AVE-S	0.42	0.36	0.78
TOTALS:	**14.67**	**14.55**	**29.22**

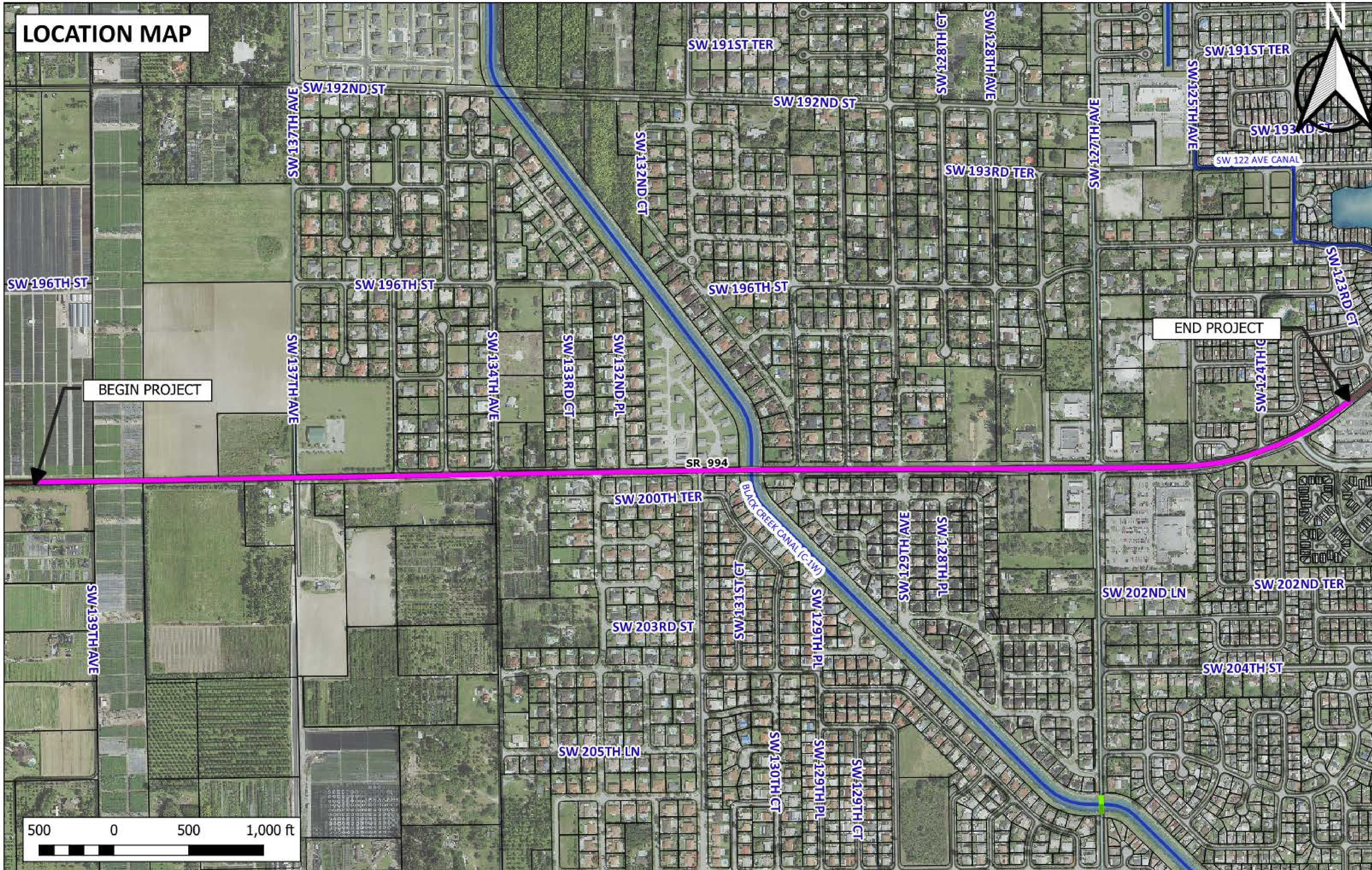
SR 994/SW 200th Street/Quail Roost Drive from West of SW 137th Avenue to East of SW 127th Avenue
Project Development & Environmental Study (PD&E) - Concept Drainage Report
FPID 445804-1-22-01
Preliminary Drainage Construction Cost Estimate

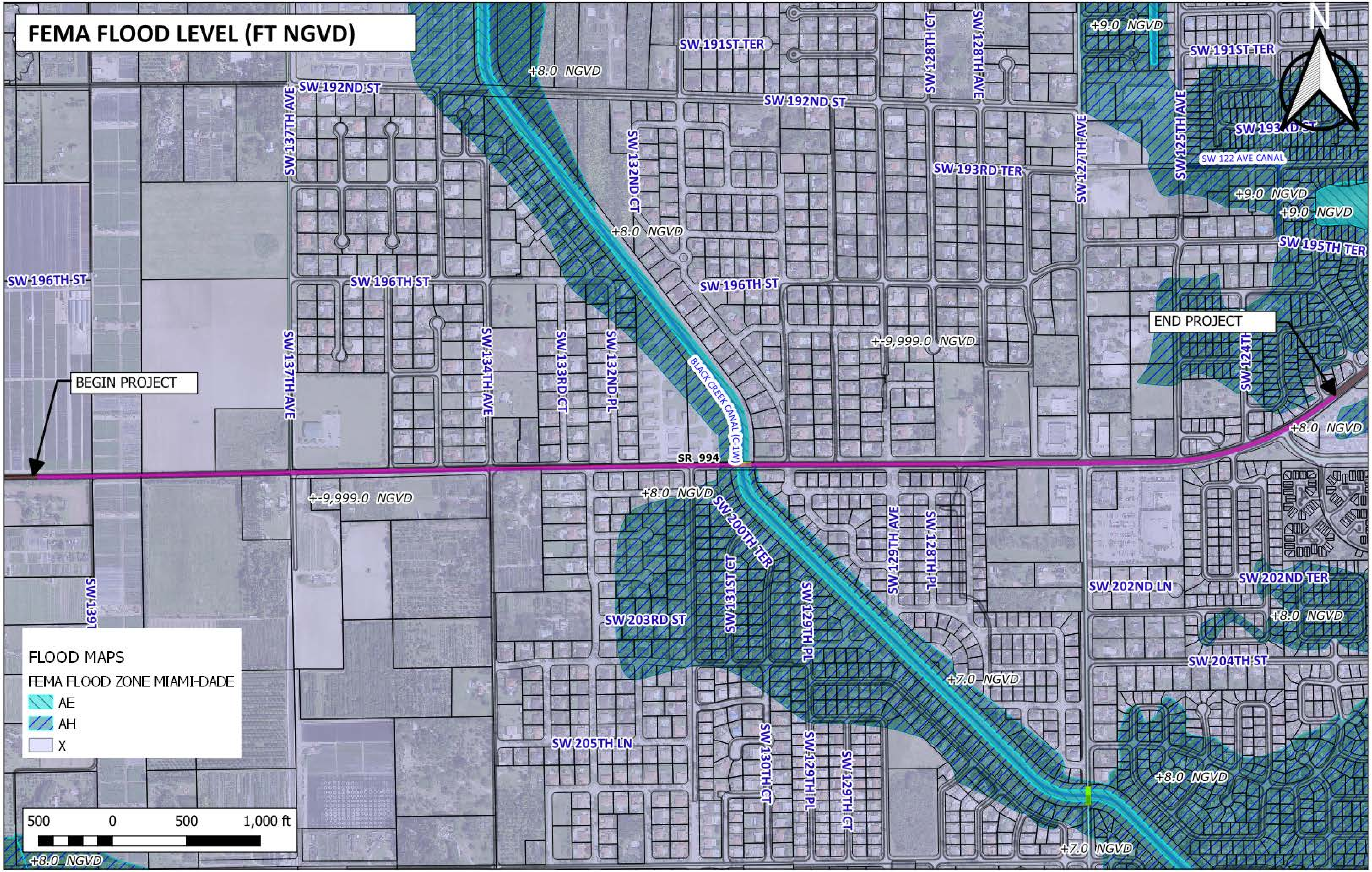
Prepared by: ER
Date: 6/11/2024
Checked by: CR
Date: 6/11/2024

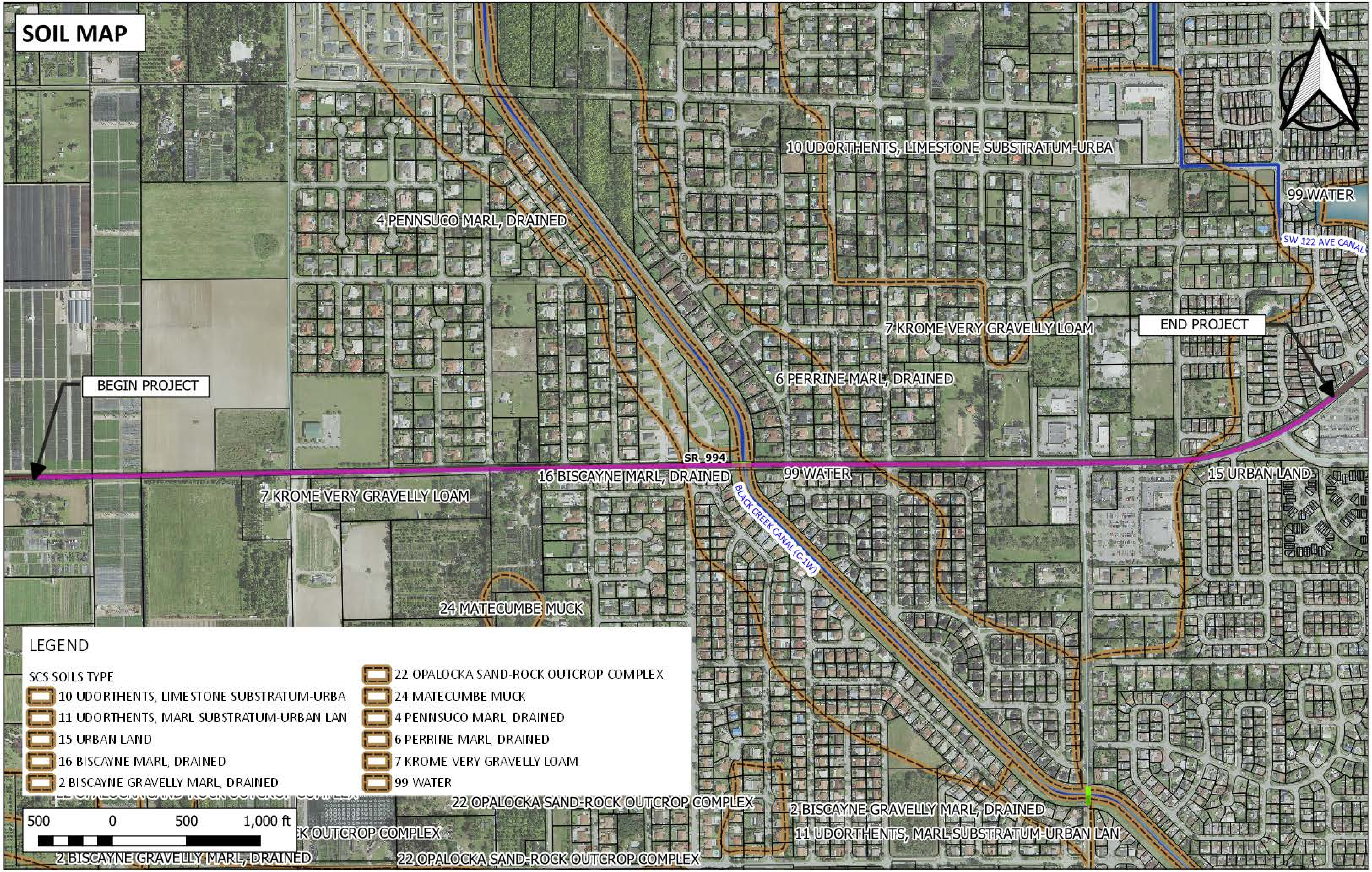
ESTIMATE USING 2024 STATEWIDE HISTORICAL AVERAGE AND AREA 13 From 2023/05/01 to 2024/04/30					
PAY-ITEMS	**DESCRIPTION**	**UNIT**	**UNIT COST**	**QUANTITIES**	**TOTAL COST**
0425 1211	INLETS, CURB, TYPE 10, <10'	EA	$ 7,000.00	32	$ 224,000.00
0425 1311	INLETS, CURB, TYPE P-1, <10'	EA	$ 11,500.00	48	$ 552,000.00
0425 1321	INLETS, CURB, TYPE P-2, <10'	EA	$ 14,100.00	13	$ 183,300.00
0425 1331	INLETS, CURB, TYPE P-3, <10'	EA	$ 16,942.28	1	$ 16,942.28
0425 1341	INLETS, CURB, TYPE P-4, <10'	EA	$ 11,231.77	3	$ 33,695.31
0425 1351	INLETS, CURB, TYPE P-5, <10'	EA	$ 9,801.52	5	$ 49,007.60
0425 1361	INLETS, CURB, TYPE P-6, <10'	EA	$ 10,960.30	4	$ 43,841.20
0425 1563	INLETS, DITCH BOTTOM, TYPE F, J BOT,	EA	$ 11,500.00	6	$ 69,000.00
0425 2 41	MANHOLES, P-7, <10'	EA	$ 8,597.14	28	$ 240,719.92
0430175118	PIPE CULVERT,OPTIONAL MATERIAL,ROUND, 18"S/CD	LF	$ 152.98	4293	$ 656,743.14
0430175124	PIPE CULVERT,OPTIONAL MATERIAL,ROUND, 24"S/CD	LF	$ 184.14	2568	$ 472,871.52
0443 70 4	FRENCH DRAIN, 24"	LF	$ 374.42	4904	$ 1,836,155.68
				TOTAL	**$ 4,378,276.65**

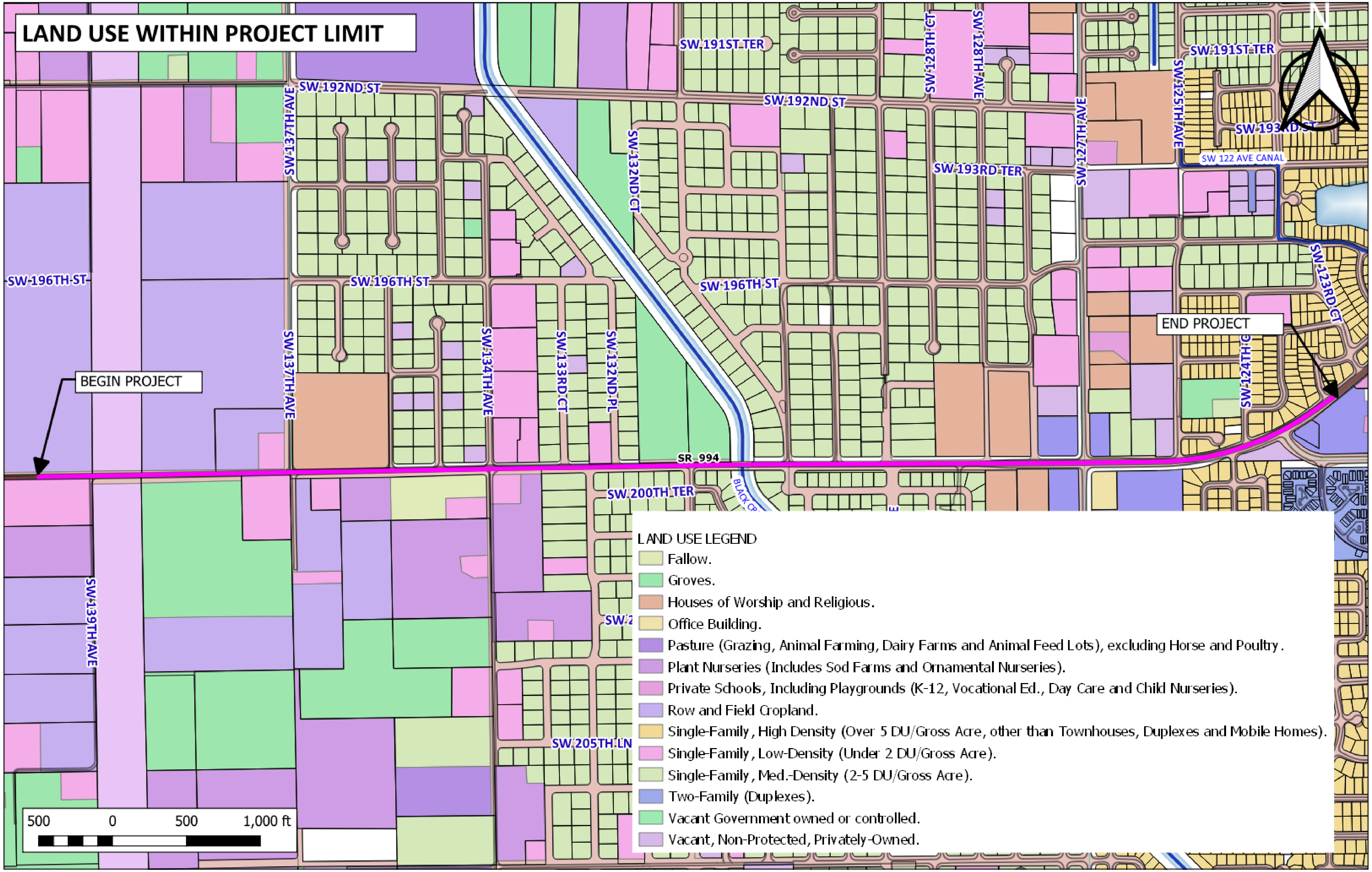
APPENDIX A

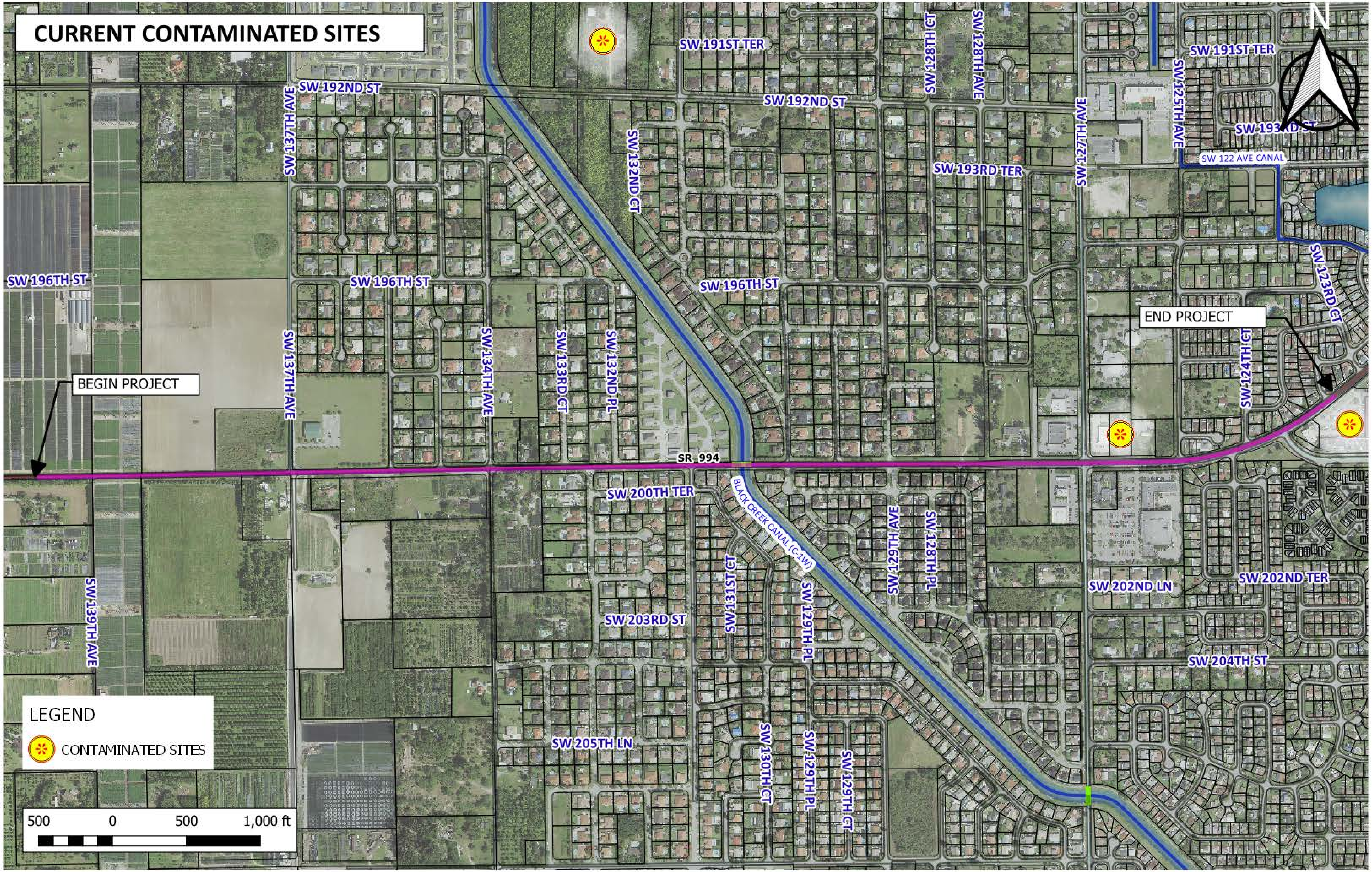
DRAINAGE EXHIBITS


LOCATION MAP
BEGIN PROJECT
END PROJECT
SR 994
SW 191ST TER
SW 192ND ST
SW 193RD TER
SW 196TH ST
SW 200TH TER
SW 202ND LN
SW 202ND TER
SW 203RD ST
SW 204TH ST
SW 205TH LN
SW 137TH AVE
SW 139TH AVE
SW 134TH AVE
SW 133RD CT
SW 132ND PL
SW 132ND CT
SW 131ST CT
SW 130TH CT
SW 129TH PL
SW 129TH AVE
SW 129TH CT
SW 128TH CT
SW 128TH AVE
SW 128TH PL
SW 127TH AVE
SW 125TH AVE
SW 124TH CT
SW 123RD CT
SW 122 AVE CANAL
BLACK CREEK CANAL (C-1W)
N
500 0 500 1,000 ft


FEMA FLOOD LEVEL (FT NGVD)
BEGIN PROJECT
END PROJECT
SR 994
BLACK CREEK CANAL (C-1W)
SW 122 AVE CANAL
+8.0 NGVD
+9.0 NGVD
+-9,999.0 NGVD
+7.0 NGVD
SW 191ST TER
SW 192ND ST
SW 193RD TER
SW 196TH ST
SW 137TH AVE
SW 134TH AVE
SW 133RD CT
SW 132ND PL
SW 132ND CT
SW 128TH CT
SW 128TH AVE
SW 127TH AVE
SW 125TH AVE
SW 124TH
SW 195TH TER
SW 200TH TER
SW 131ST CT
SW 129TH AVE
SW 128TH PL
SW 202ND LN
SW 202ND TER
SW 203RD ST
SW 129TH PL
SW 204TH ST
SW 205TH LN
SW 130TH CT
SW 129TH CT
FLOOD MAPS
FEMA FLOOD ZONE MIAMI-DADE
AE
AH
X
500 0 500 1,000 ft
N


SOIL MAP
N
10 UDORTHENTS, LIMESTONE SUBSTRATUM-URBA
99 WATER
SW 122 AVE CANAL
4 PENNSUCO MARL, DRAINED
7 KROME VERY GRAVELLY LOAM
END PROJECT
6 PERRINE MARL, DRAINED
BEGIN PROJECT
SR 994
16 BISCAYNE MARL, DRAINED
99 WATER
15 URBAN LAND
7 KROME VERY GRAVELLY LOAM
BLACK CREEK CANAL (C-1W)
24 MATECUMBE MUCK
LEGEND
SCS SOILS TYPE
10 UDORTHENTS, LIMESTONE SUBSTRATUM-URBA
11 UDORTHENTS, MARL SUBSTRATUM-URBAN LAN
15 URBAN LAND
16 BISCAYNE MARL, DRAINED
2 BISCAYNE GRAVELLY MARL, DRAINED
22 OPALOCKA SAND-ROCK OUTCROP COMPLEX
24 MATECUMBE MUCK
4 PENNSUCO MARL, DRAINED
6 PERRINE MARL, DRAINED
7 KROME VERY GRAVELLY LOAM
99 WATER
22 OPALOCKA SAND-ROCK OUTCROP COMPLEX
2 BISCAYNE GRAVELLY MARL, DRAINED
11 UDORTHENTS, MARL SUBSTRATUM-URBAN LAN
500 0 500 1,000 ft
K OUTCROP COMPLEX
2 BISCAYNE GRAVELLY MARL, DRAINED
22 OPALOCKA SAND-ROCK OUTCROP COMPLEX


LAND USE WITHIN PROJECT LIMIT
BEGIN PROJECT
END PROJECT
SR 994
SW 191ST TER
SW 192ND ST
SW 193RD TER
SW 193RD ST
SW 196TH ST
SW 200TH TER
SW 205TH LN
SW 139TH AVE
SW 137TH AVE
SW 134TH AVE
SW 133RD CT
SW 132ND PL
SW 132ND CT
SW 128TH CT
SW 128TH AVE
SW 127TH AVE
SW 125TH AVE
SW 124TH CT
SW 123RD CT
SW 122 AVE CANAL
N
500 0 500 1,000 ft
LAND USE LEGEND
Fallow.
Groves.
Houses of Worship and Religious.
Office Building.
Pasture (Grazing, Animal Farming, Dairy Farms and Animal Feed Lots), excluding Horse and Poultry.
Plant Nurseries (Includes Sod Farms and Ornamental Nurseries).
Private Schools, Including Playgrounds (K-12, Vocational Ed., Day Care and Child Nurseries).
Row and Field Cropland.
Single-Family, High Density (Over 5 DU/Gross Acre, other than Townhouses, Duplexes and Mobile Homes).
Single-Family, Low-Density (Under 2 DU/Gross Acre).
Single-Family, Med.-Density (2-5 DU/Gross Acre).
Two-Family (Duplexes).
Vacant Government owned or controlled.
Vacant, Non-Protected, Privately-Owned.


CURRENT CONTAMINATED SITES
SW 191ST TER
SW 192ND ST
SW 193RD TER
SW 196TH ST
SW 137TH AVE
SW 134TH AVE
SW 133RD CT
SW 132ND PL
SW 132ND CT
SW 128TH CT
SW 128TH AVE
SW 127TH AVE
SW 125TH AVE
SW 122 AVE CANAL
SW 123RD CT
SW 124TH CT
BEGIN PROJECT
END PROJECT
SR 994
SW 200TH TER
BLACK CREEK CANAL (C-1W)
SW 129TH AVE
SW 128TH PL
SW 202ND LN
SW 202ND TER
SW 203RD ST
SW 131ST CT
SW 129TH PL
SW 204TH ST
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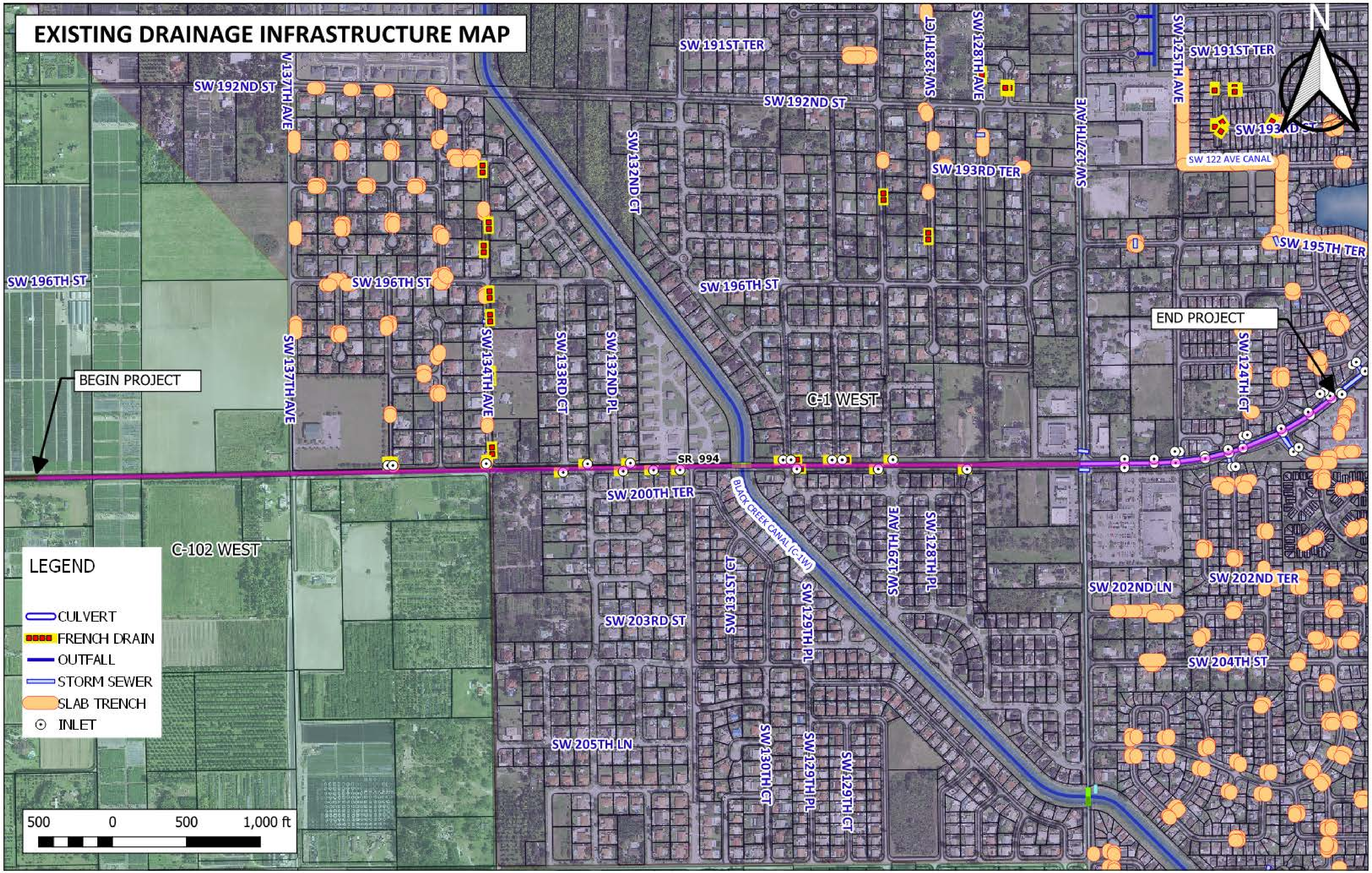
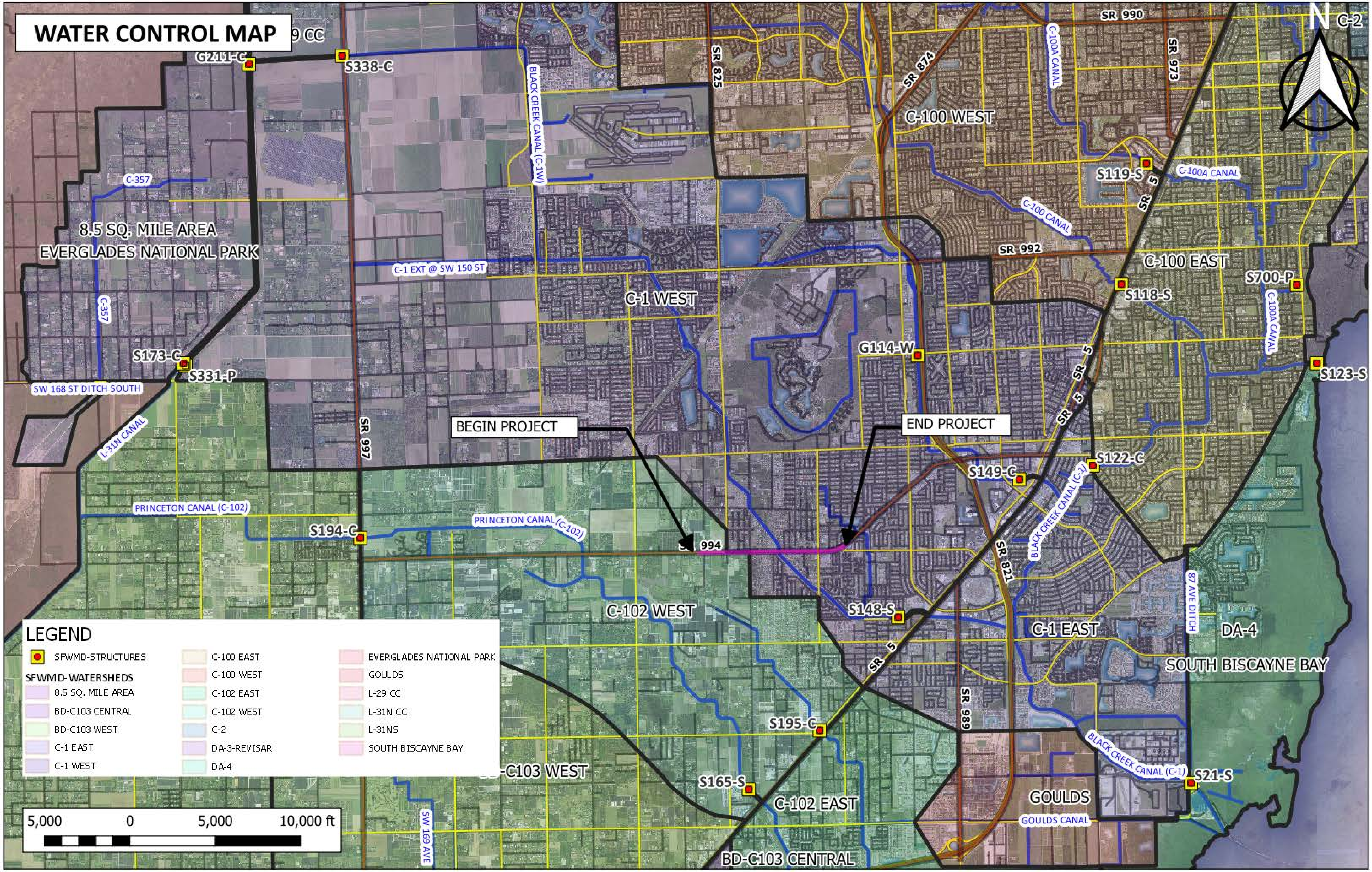
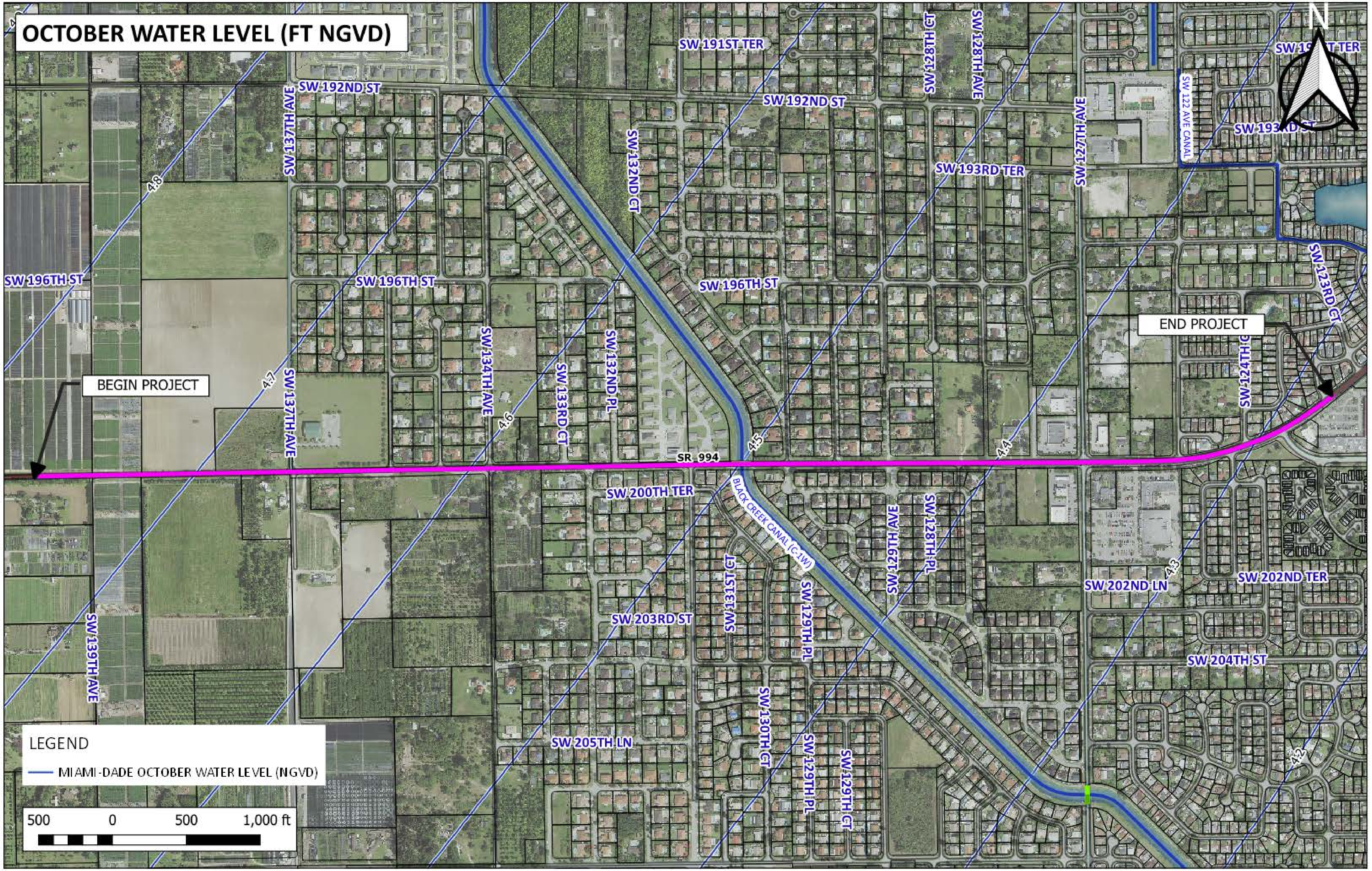
SW 130TH CT
SW 129TH CT
SW 139TH AVE
LEGEND
CONTAMINATED SITES
500 0 500 1,000 ft
N


EXISTING DRAINAGE INFRASTRUCTURE MAP
N
SW 191ST TER
SW 192ND ST
SW 193RD TER
SW 196TH ST
SW 195TH TER
SW 122 AVE CANAL
SW 137TH AVE
SW 134TH AVE
SW 133RD CT
SW 132ND PL
SW 132ND CT
SW 128TH CT
SW 128TH AVE
SW 127TH AVE
SW 125TH AVE
SW 124TH CT
BEGIN PROJECT
END PROJECT
C-1 WEST
C-102 WEST
SR 994
SW 200TH TER
BLACK CREEK CANAL (C-1W)
SW 131ST CT
SW 129TH AVE
SW 128TH PL
SW 129TH PL
SW 130TH CT
SW 129TH CT
SW 202ND LN
SW 202ND TER
SW 203RD ST
SW 204TH ST
SW 205TH LN
LEGEND
CULVERT
FRENCH DRAIN
OUTFALL
STORM SEWER
SLAB TRENCH
INLET
500 0 500 1,000 ft


WATER CONTROL MAP
BEGIN PROJECT
END PROJECT
8.5 SQ. MILE AREA
EVERGLADES NATIONAL PARK
C-1 WEST
C-100 WEST
C-100 EAST
C-102 WEST
C-102 EAST
C-1 EAST
C-103 WEST
BD-C103 CENTRAL
GOULDS
DA-4
SOUTH BISCAYNE BAY
LEGEND
SFWMD-STRUCTURES
SFWMD-WATERSHEDS
8.5 SQ. MILE AREA
BD-C103 CENTRAL
BD-C103 WEST
C-1 EAST
C-1 WEST
C-100 EAST
C-100 WEST
C-102 EAST
C-102 WEST
C-2
DA-3-REVISAR
DA-4
EVERGLADES NATIONAL PARK
GOULDS
L-29 CC
L-31N CC
L-31NS
SOUTH BISCAYNE BAY
5,000 0 5,000 10,000 ft


OCTOBER WATER LEVEL (FT NGVD)
BEGIN PROJECT
END PROJECT
SR 994
BLACK CREEK CANAL (C-1W)
SW 122 AVE CANAL
SW 191ST TER
SW 192ND ST
SW 193RD TER
SW 196TH ST
SW 200TH TER
SW 202ND LN
SW 202ND TER
SW 203RD ST
SW 204TH ST
SW 205TH LN
SW 137TH AVE
SW 139TH AVE
SW 134TH AVE
SW 133RD CT
SW 132ND PL
SW 132ND CT
SW 131ST CT
SW 130TH CT
SW 129TH PL
SW 129TH CT
SW 129TH AVE
SW 128TH PL
SW 128TH CT
SW 128TH AVE
SW 127TH AVE
SW 124TH CT
SW 123RD CT
4.8
4.7
4.6
4.5
4.4
4.3
4.2
N
LEGEND
MIAMI-DADE OCTOBER WATER LEVEL (NGVD)
500 0 500 1,000 ft

APPENDIX B
CONCEPT DRAINAGE PLANS

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.

1

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD
CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.
2

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REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

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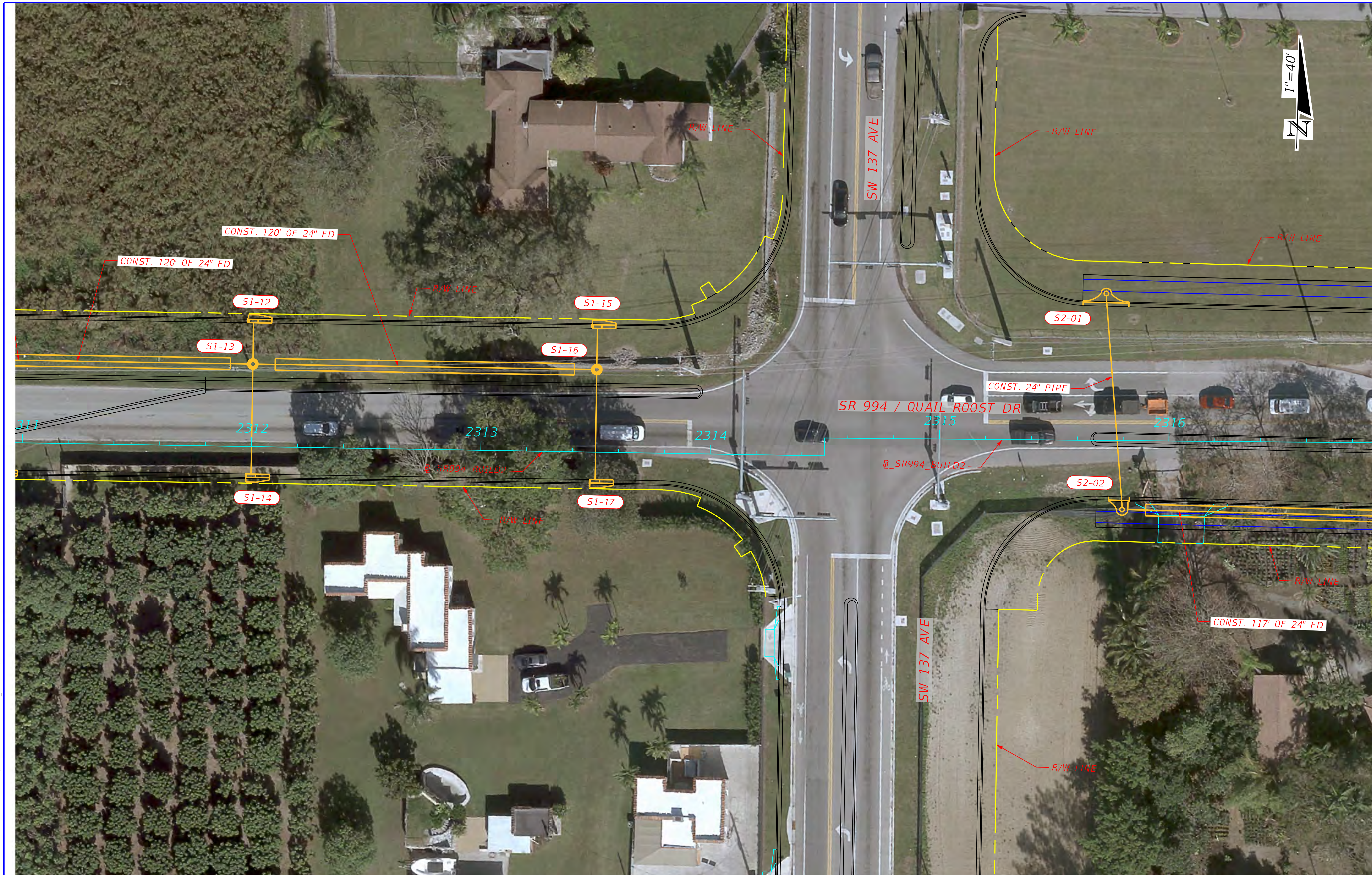

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.
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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

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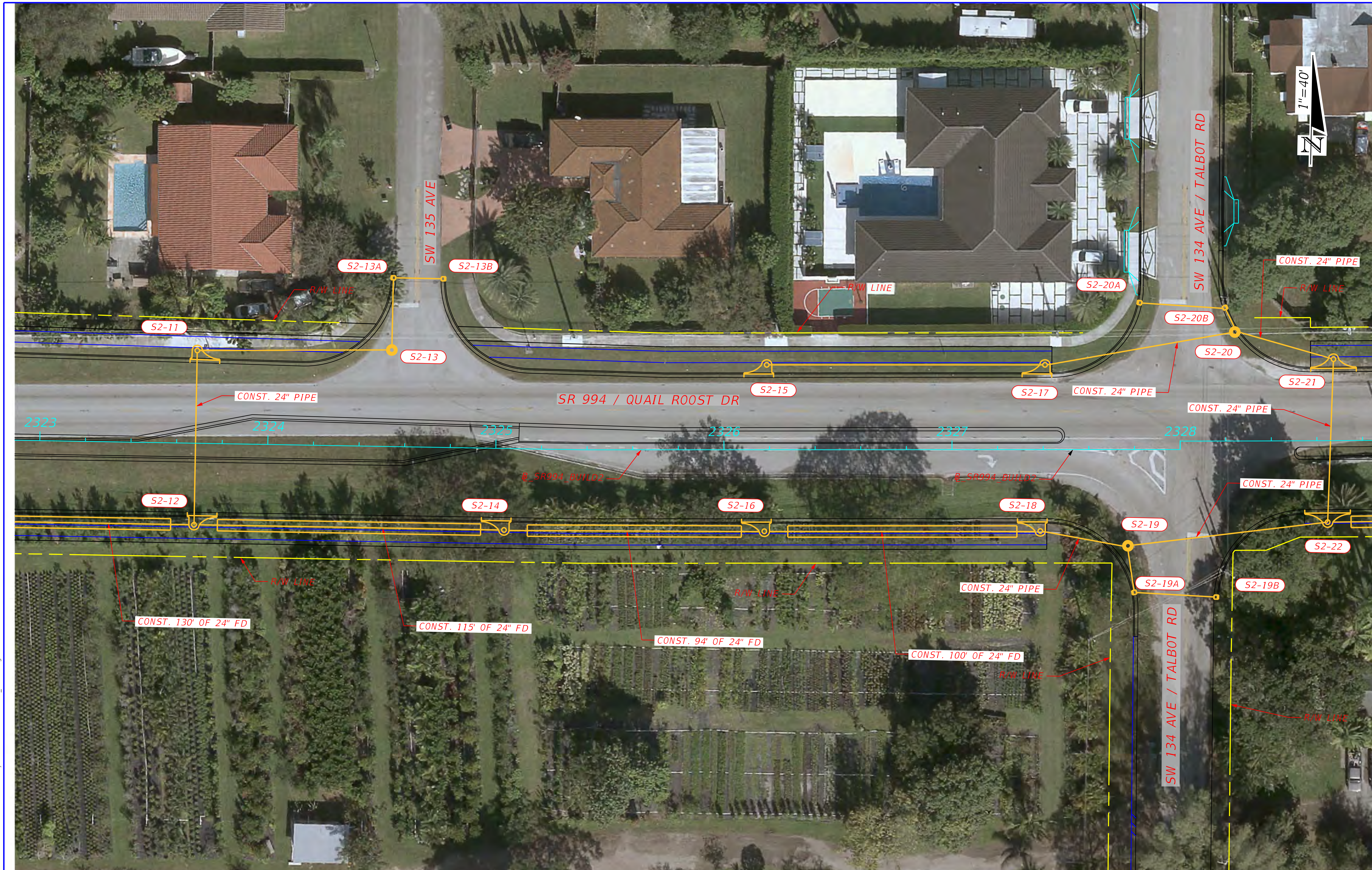

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.

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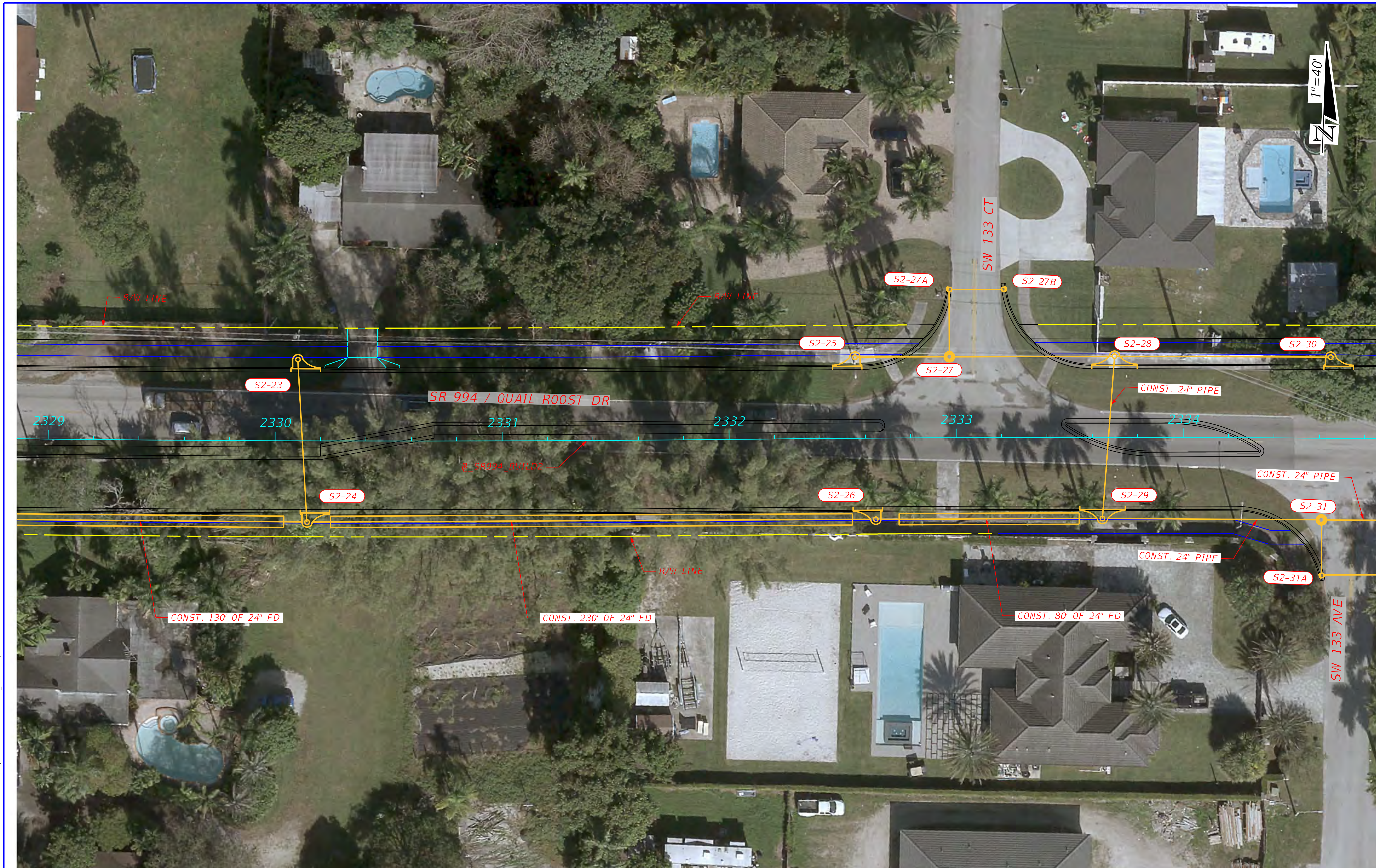

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD
CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.
7

REVISIONS				ENGINEER OF RECORD	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			CONCEPT DRAINAGE PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	CARLOS F. RIBBECK, P.E. LICENSE NUMBER 50543 RIBBECK ENGINEERING, INC. 14335 SW 120 STREET, SUITE 205 MIAMI, FL 33186	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
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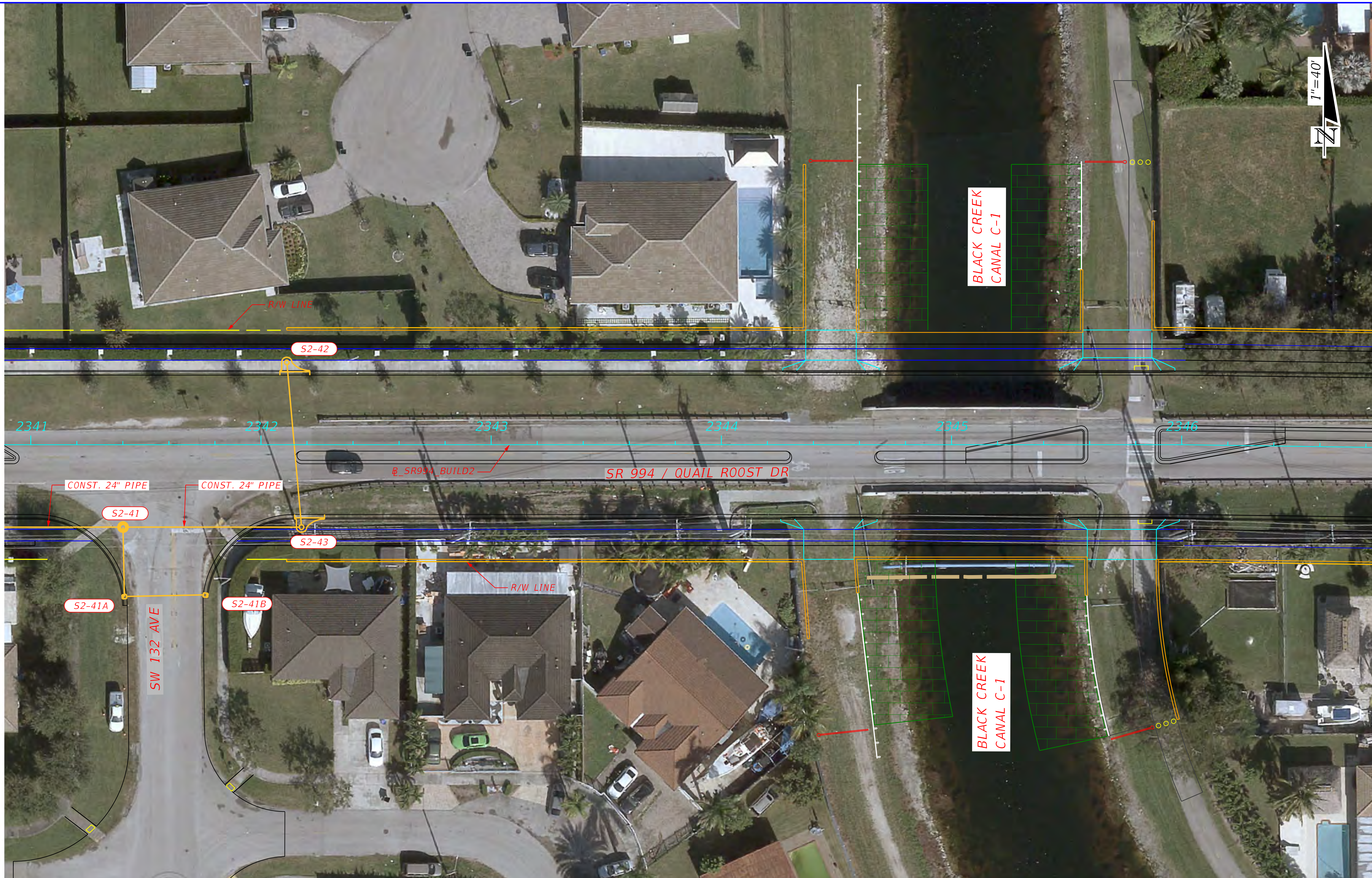

REVISIONS				ENGINEER OF RECORD	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			CONCEPT DRAINAGE PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	CARLOS F. RIBBECK, P.E. LICENSE NUMBER 50543 RIBBECK ENGINEERING, INC. 14335 SW 120 STREET, SUITE 205 MIAMI, FL 33186	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.
10

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.

11

6/14/2024 10:46:41 AM erodriguez
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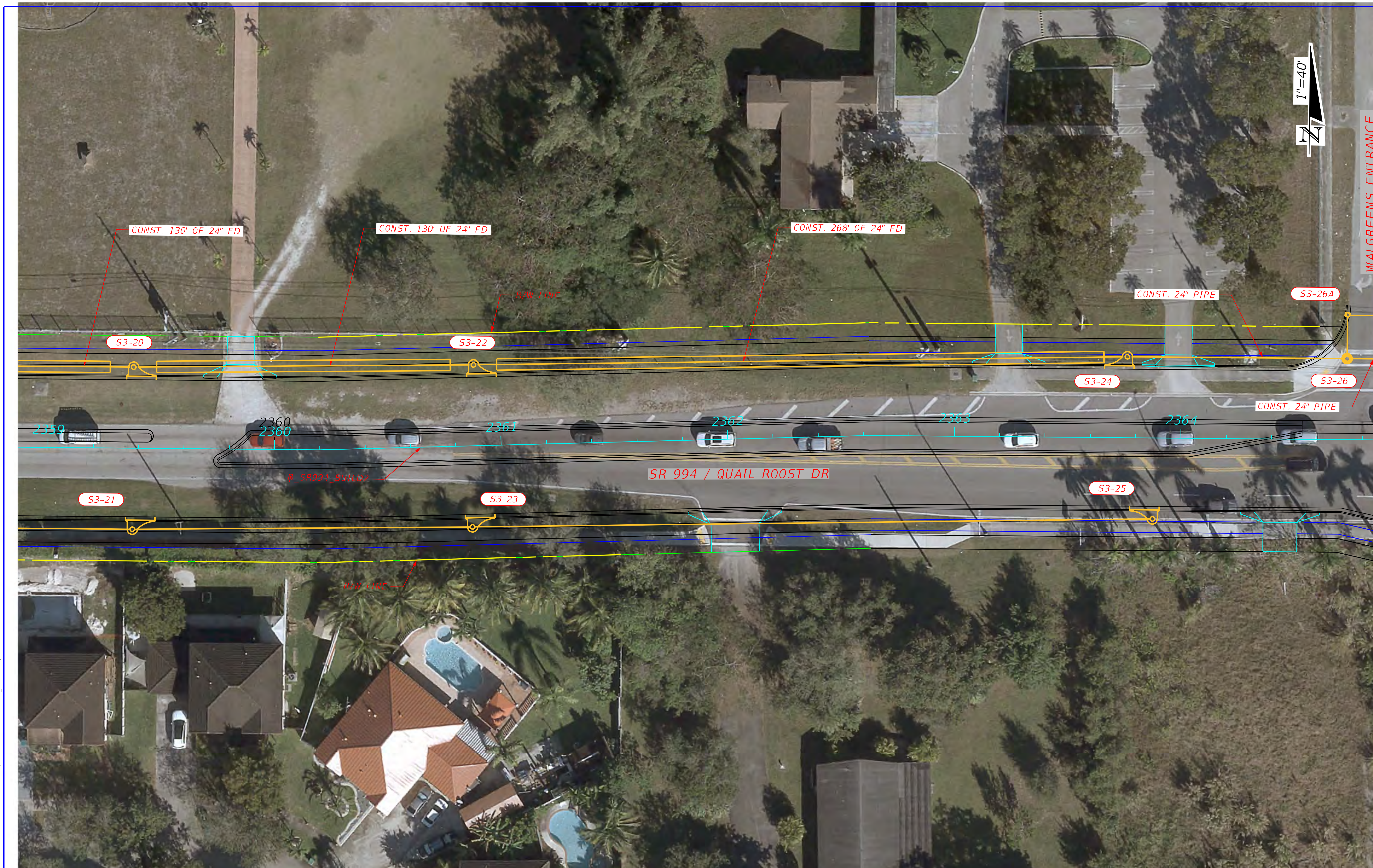

REVISIONS				ENGINEER OF RECORD	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			CONCEPT DRAINAGE PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	CARLOS F. RIBBECK, P.E. LICENSE NUMBER 50543 RIBBECK ENGINEERING, INC. 14335 SW 120 STREET, SUITE 205 MIAMI, FL 33186	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		12
					SR 994	MIAMI-DADE	445804-1-22-01		

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

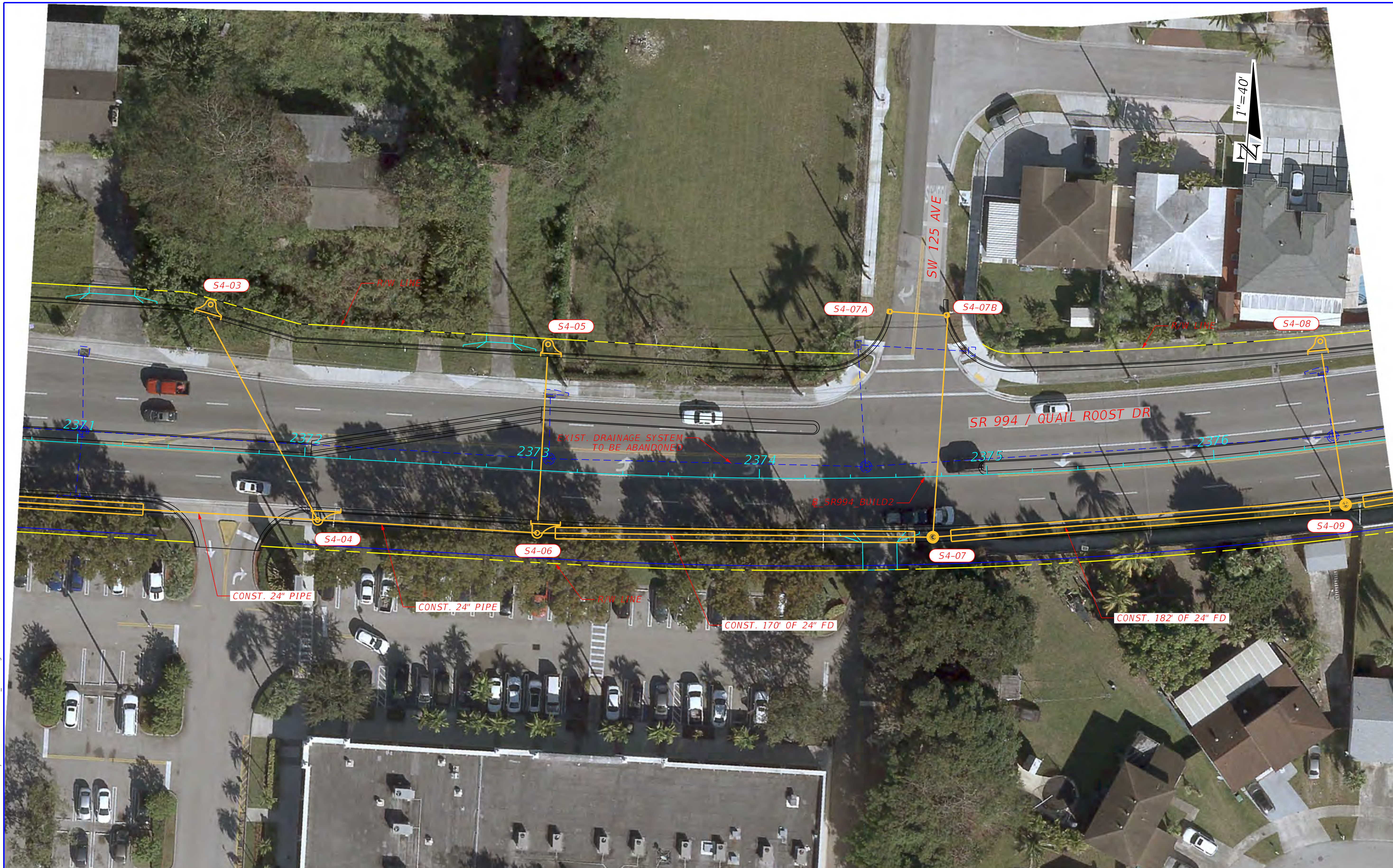
CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.
13



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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD
CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO.
14

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REVISIONS				ENGINEER OF RECORD	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			CONCEPT DRAINAGE PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	CARLOS F. RIBBECK, P.E. LICENSE NUMBER 50543 RIBBECK ENGINEERING, INC. 14335 SW 120 STREET, SUITE 205 MIAMI, FL 33186	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 994	MIAMI-DADE	445804-1-22-01		15

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD

CARLOS F. RIBBECK, P.E.
LICENSE NUMBER 50543
RIBBECK ENGINEERING, INC.
14335 SW 120 STREET, SUITE 205
MIAMI, FL 33186

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

CONCEPT DRAINAGE PLAN

SHEET NO. 16

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APPENDIX C
CONCEPT DRAINAGE CALCULATIONS

SR994/Quail Rosst Drive from W. of SW 137th Avenue to E. of SW 127th Avenue
Post-Development Drainage Conditions
Computation of Total Length of Self-Contained French Drain Required per Basin

Calc. by: E. Rodriguez
Chkd. By: C. Ribbeck
Date: 6/14/2024

BASIN I.D.	PERVIOUS acres	IMPERVIOUS acres	TOTAL acres	$C_{WEIGHTED}$	Roadway Min. EOP. Elev ft-NAVD	Top of FD Trench Elev. ft-NAVD	DERM Oct. Avg. GW Elev. ft-NAVD	$E_{FD\ EXF.}$ cfs/ft	$S_{FD\ STORAGE}$ ft^3/ft	COMPUTED L_{-FD} ft.	L_{-FD} (SF>=2) MIN. REQUIRED ft.	$L_{-FD\ PROVIDED}$ ft.	ACTUAL SF
BASIN 1	0.75	2.12	2.87	0.77	10.0	8.0	3.3	0.1	12.15	144	288	625	4.3
BASIN 2	0.93	6.54	7.47	0.86	9.0	7.0	3.1	0.1	10.35	434	868	1910	4.4
BASIN 3	0.82	4.69	5.51	0.85	8.0	6.0	2.9	0.1	8.55	330	660	1210	3.7
BASIN 4	0.26	3.78	4.04	0.90	8.0	6.0	2.8	0.1	8.77	255	510	1159	4.5

Project's Total Length of 24" FD= 4904

$C_{IMPERVIOUS}$= 0.95
$C_{PERVIOUS}$= 0.25

BASIN 1: Begin of Project to SW 137th avenue
BASIN 2: SW 137th Avenue to C-1 Canal Bridge
BASIN 3: C-1 Canal Bridge to SW 127th Avenue
BASIN 4: SW 127th Avenue to End of Project

LENGTH OF A SELF-CONTAINED FRENCH DRAIN FOR FDOT RAINFALL - SR 994 PD&E - BASIN B-1

A,B,C,D = FDOT IDF coefficients.
A_r = Area, in acres.
C_r = Runoff coefficient of Rational Equation.
E = F.D. exfiltration rate, in cfs/ft.
S = F.D. storage, in cf/ft.
t and T = time, in minutes.
l and L = length of F.D., in ft.

Zone no. = 10 Frequency, years = 10

$A := 10.84265$ $B := -0.18976$

$C := -0.69575$ $D := 0.07495$

$A_r := 2.87$ $C_r := 0.77$ $E := 0.10$ $S := 12.15$

---

trial values: $t := 10$ $l := 10$

F.D. retention volume and runoff volume curves have equal tangents

Guess Values / Constraints

$$E \cdot l = C_r \cdot A_r \cdot (A + B \cdot (ln(t) + 1) + C \cdot ln(t) \cdot (ln(t) + 2) + D \cdot (ln(t))^2 \cdot (ln(t) + 3))$$

F.D. retention volume and runoff volumes are equal

$$l \cdot S + 60 \cdot E \cdot l \cdot t = 60 \cdot C_r \cdot A_r \cdot t \cdot (A + B \cdot ln(t) + C \cdot (ln(t))^2 + D \cdot (ln(t))^3)$$

Solver

$$\begin{bmatrix} L \\ T \end{bmatrix} := \textbf{Find}(l, t)$$

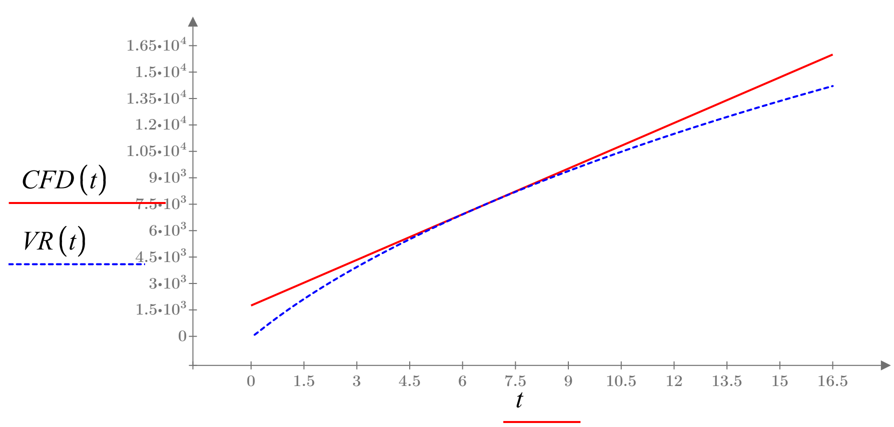
$L = 143.92$ $T = 6.557$

$t := 0., 0.1 .. T + 10$

CFD = Capacity of F.D., in cf.
VR = Volume of runoff, in cf.

$$CFD(t) := L \cdot S + 60 \cdot E \cdot L \cdot t$$

$$VR(t) := 60 \cdot C_r \cdot A_r \cdot (A + B \cdot \ln(t) + C \cdot (\ln(t))^2 + D \cdot (\ln(t))^3) \cdot t$$



LENGTH OF A SELF-CONTAINED FRENCH DRAIN FOR FDOT RAINFALL - SR 994 PD&E - BASIN B-2

A,B,C,D = FDOT IDF coefficients.
A_r = Area, in acres.
C_r = Runoff coefficient of Rational Equation.
E = F.D. exfiltration rate, in cfs/ft.
S = F.D. storage, in cf/ft.
t and T = time, in minutes.
l and L = length of F.D., in ft.

Zone no. = 10 Frequency, years = 10

$A := 10.84265$ $B := -0.18976$

$C := -0.69575$ $D := 0.07495$

$A_r := 7.47$ $C_r := 0.86$ $E := 0.10$ $S := 10.35$

---

trial values: $t := 10$ $l := 10$

F.D. retention volume and runoff volume curves have equal tangents

Guess Values / Constraints

$$E \cdot l = C_r \cdot A_r \cdot \left(A + B \cdot (ln(t)+1) + C \cdot ln(t) \cdot (ln(t)+2) + D \cdot (ln(t))^2 \cdot (ln(t)+3)\right)$$

F.D. retention volume and runoff volumes are equal

$$l \cdot S + 60 \cdot E \cdot l \cdot t = 60 \cdot C_r \cdot A_r \cdot t \cdot \left(A + B \cdot ln(t) + C \cdot (ln(t))^2 + D \cdot (ln(t))^3\right)$$

Solver

$$\begin{bmatrix} L \\ T \end{bmatrix} := \mathbf{Find}(l, t)$$

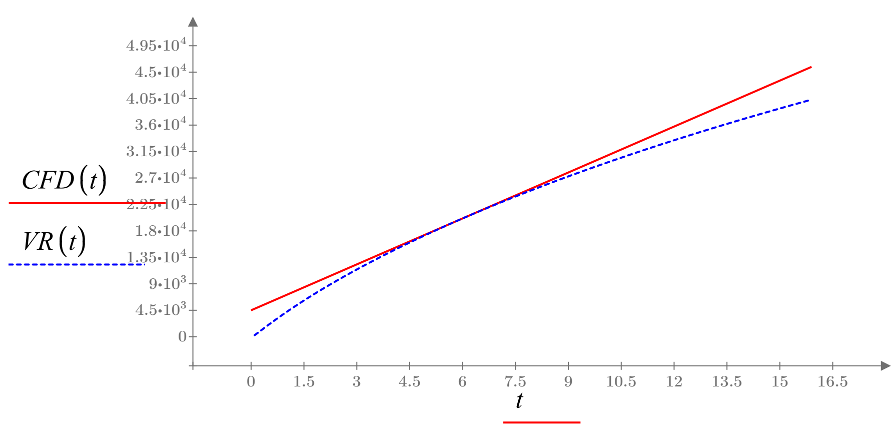
$L = 434.112$ $T = 5.957$

$t := 0., 0.1 .. T + 10$

CFD = Capacity of F.D., in cf.
VR = Volume of runoff, in cf.

$$CFD(t) := L \cdot S + 60 \cdot E \cdot L \cdot t$$

$$VR(t) := 60 \cdot C_r \cdot A_r \cdot \left(A + B \cdot \ln(t) + C \cdot (\ln(t))^2 + D \cdot (\ln(t))^3\right) \cdot t$$



LENGTH OF A SELF-CONTAINED FRENCH DRAIN FOR FDOT RAINFALL - SR 994 PD&E - BASIN B-3

A,B,C,D = FDOT IDF coefficients.
A_r = Area, in acres.
C_r = Runoff coefficient of Rational Equation.
E = F.D. exfiltration rate, in cfs/ft.
S = F.D. storage, in cf/ft.
t and T = time, in minutes.
l and L = length of F.D., in ft.

Zone no. = 10   Frequency, years = 10

$A := 10.84265$ $B := -0.18976$

$C := -0.69575$ $D := 0.07495$

$A_r := 5.51$ $C_r := 0.85$ $E := 0.10$ $S := 8.55$

---

trial values: $t := 10$ $l := 10$

Guess Values / Constraints

F.D. retention volume and runoff volume curves have equal tangents

$$E \cdot l = C_r \cdot A_r \cdot (A + B \cdot (ln(t) + 1) + C \cdot ln(t) \cdot (ln(t) + 2) + D \cdot (ln(t))^2 \cdot (ln(t) + 3))$$

F.D. retention volume and runoff volumes are equal

$$l \cdot S + 60 \cdot E \cdot l \cdot t = 60 \cdot C_r \cdot A_r \cdot t \cdot (A + B \cdot ln(t) + C \cdot (ln(t))^2 + D \cdot (ln(t))^3)$$

Solver

$$\begin{bmatrix} L \\ T \end{bmatrix} := \mathbf{Find}(l, t)$$

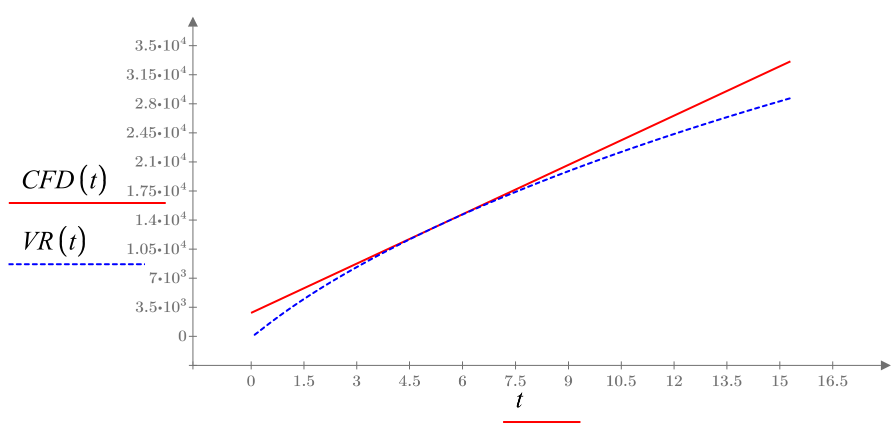
$L = 329.938$ $T = 5.319$

$t := 0., 0.1 .. T + 10$

CFD = Capacity of F.D., in cf.
VR = Volume of runoff, in cf.

$$CFD(t) := L \cdot S + 60 \cdot E \cdot L \cdot t$$

$$VR(t) := 60 \cdot C_r \cdot A_r \cdot (A + B \cdot \ln(t) + C \cdot (\ln(t))^2 + D \cdot (\ln(t))^3) \cdot t$$



LENGTH OF A SELF-CONTAINED FRENCH DRAIN FOR FDOT RAINFALL - SR 994 PD&E - BASIN B-4

A,B,C,D = FDOT IDF coefficients.
A_r = Area, in acres.
C_r = Runoff coefficient of Rational Equation.
E = F.D. exfiltration rate, in cfs/ft.
S = F.D. storage, in cf/ft.
t and T = time, in minutes.
l and L = length of F.D., in ft.

Zone no. = 10 Frequency, years = 10

$A := 10.84265$ $B := -0.18976$

$C := -0.69575$ $D := 0.07495$

$A_r := 4.04$ $C_r := 0.90$ $E := 0.10$ $S := 8.77$

---

trial values: $t := 10$ $l := 10$

F.D. retention volume and runoff volume curves have equal tangents

Guess Values

Constraints

$$E \cdot l = C_r \cdot A_r \cdot (A + B \cdot (ln(t) + 1) + C \cdot ln(t) \cdot (ln(t) + 2) + D \cdot (ln(t))^2 \cdot (ln(t) + 3))$$

F.D. retention volume and runoff volumes are equal

$$l \cdot S + 60 \cdot E \cdot l \cdot t = 60 \cdot C_r \cdot A_r \cdot t \cdot (A + B \cdot ln(t) + C \cdot (ln(t))^2 + D \cdot (ln(t))^3)$$

Solver

$$\begin{bmatrix} L \\ T \end{bmatrix} := \mathbf{Find}(l, t)$$

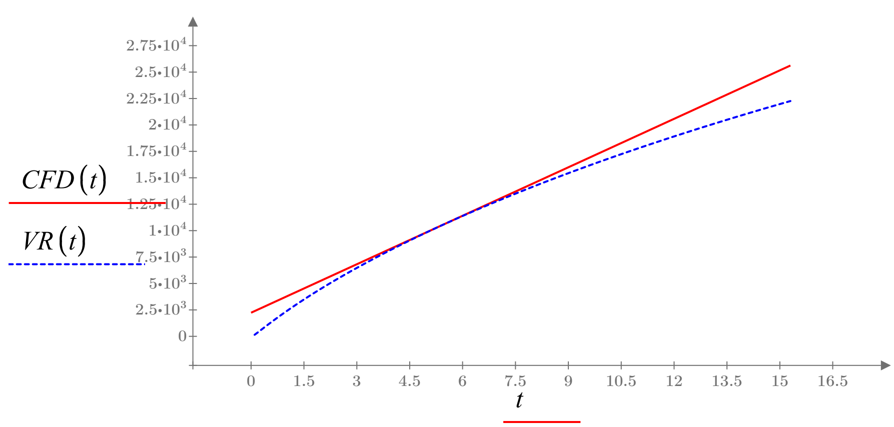
$L = 254.768$ $T = 5.399$

$t := 0., 0.1 .. T + 10$

CFD = Capacity of F.D., in cf.
VR = Volume of runoff, in cf.

$$CFD(t) := L \cdot S + 60 \cdot E \cdot L \cdot t$$

$$VR(t) := 60 \cdot C_r \cdot A_r \cdot (A + B \cdot \ln(t) + C \cdot (\ln(t))^2 + D \cdot (\ln(t))^3) \cdot t$$



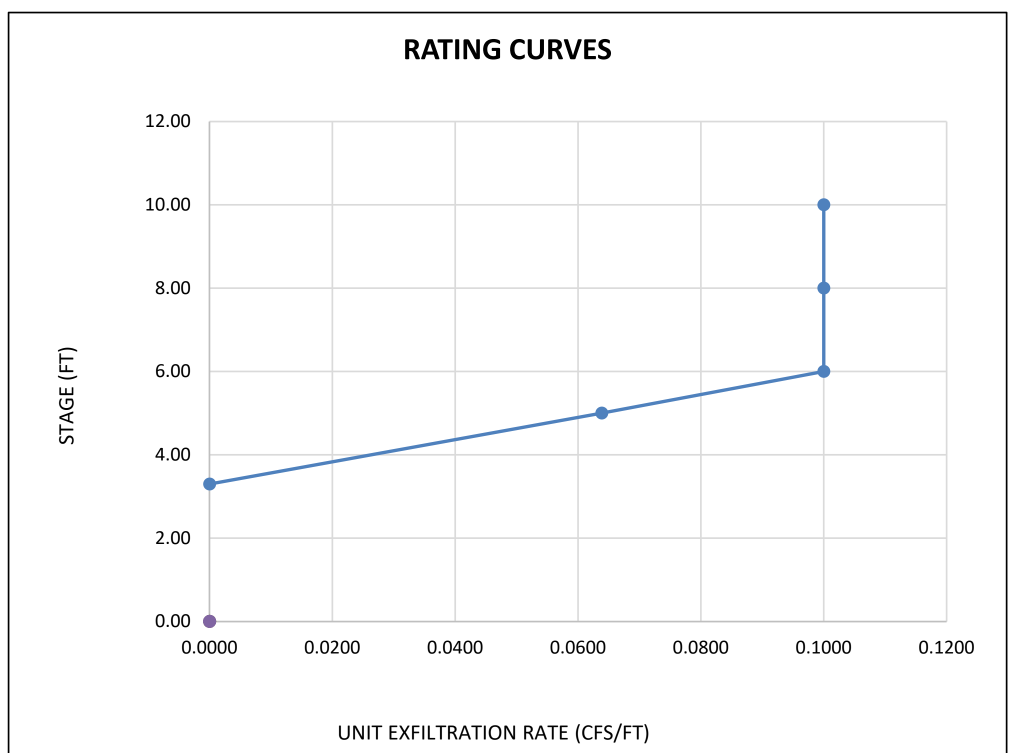
SR 994/QUAIL ROOST DR. PD&E - BASIN B-1 - FD EXFILTRATION RATING CURVES

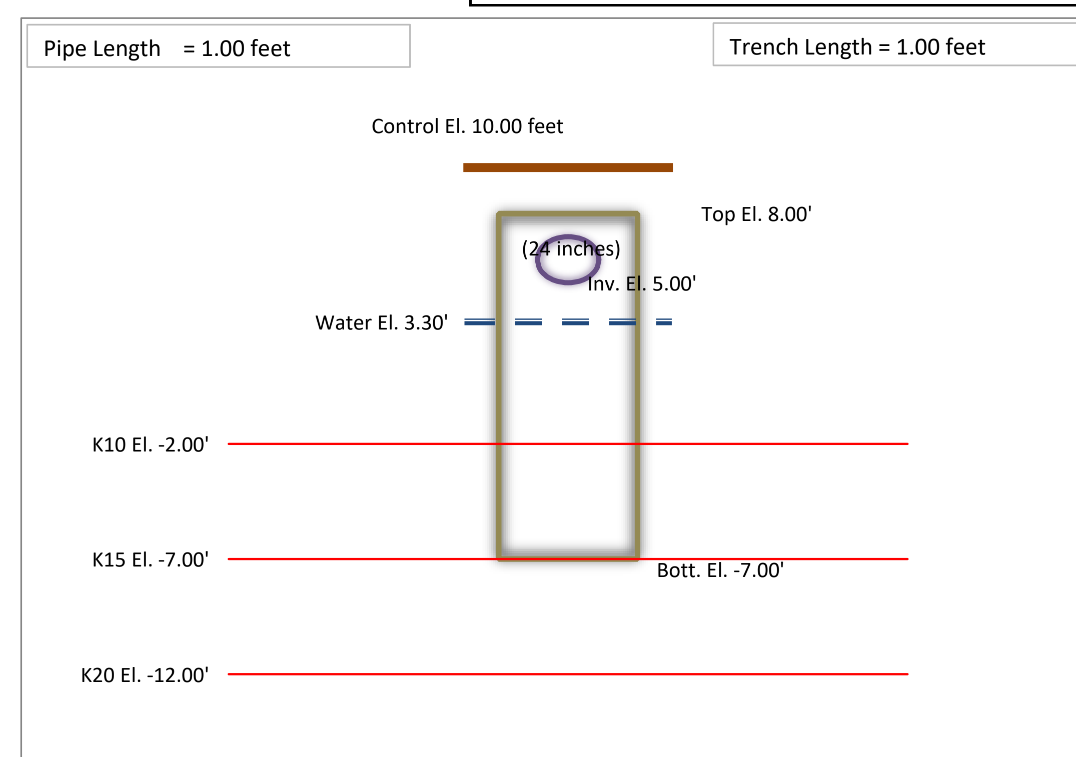
TE	8.00	ft-NGVD	TRENCH TOP ELEVATION	TW	4.50	ft	TRENCH TOP WIDTH
BE	-7.00	ft-NGVD	TRENCH BOTTOM ELEVATION	BW	4.50	ft	TRENCH BOTTOM WIDTH
BE10	-2.00	ft-NGVD	K10 TEST ELEVATION				
BE15	-7.00	ft-NGVD	K15 TEST ELEVATION	PIPE			
BE20	-12.00	ft-NGVD	K20 TEST ELEVATION	DIAMETER	2.00	ft	
K10	2.24E-04	cfs/ft^2-ft	K10 EXFILTRATION RATE	INVERT	5.00	ft-NGVD	
K15	3.48E-03	cfs/ft^2-ft	K15 EXFILTRATION RATE	LENGTH	1.00	ft	
K20	4.05E-03	cfs/ft^2-ft	K20 EXFILTRATION RATE				

Headwater - HW	3.30	5.00	6.00	8.00	10.00															
Tailwater - TW			3.30																	
Do	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Du	0.00	1.70	2.70	4.70	4.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ds	5.30	5.30	5.30	5.30	5.30	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
D15	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
D20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E10	0.0000	0.0047	0.0080	0.0161	0.0251	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E15	0.0000	0.0592	0.0940	0.1636	0.2332	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ET	0.0000	0.0638	0.1020	0.1797	0.2582	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Et_{adj}	0.0000	0.0638	0.1000	0.1000	0.1000															

DRAINAGE STRUCTURE I.D.	FD RUN ALONG SR 994 BASIN 1
LENGTH OF FD (ft.)	1.00

EXFILTRATION OPERATING TABLE			
TW	HW	UNIT Q	TOTAL Q
(ft)	(ft)	(cfs/ft)	(cfs)
3.30	3.30	0.0000	0.00000
3.30	5.00	0.0638	0.06384
3.30	6.00	0.1000	0.10000
3.30	8.00	0.1000	0.10000
3.30	10.00	0.1000	0.10000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000





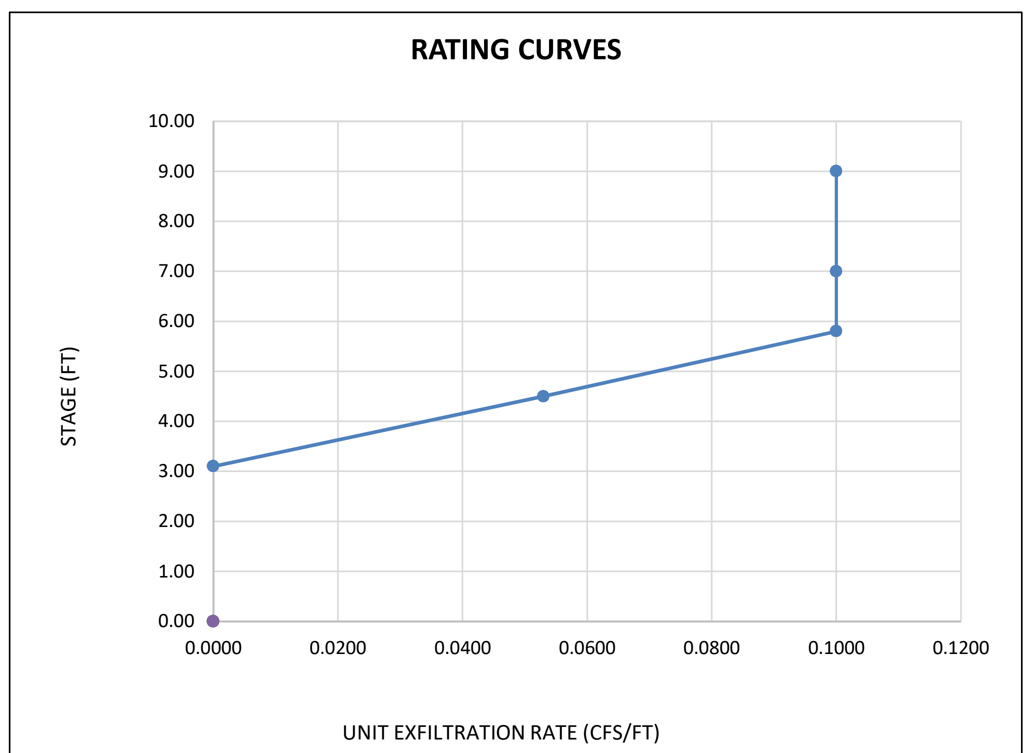
SR 994/QUAIL ROOST DR. PD&E - BASIN B-2 - FD EXFILTRATION RATING CURVE

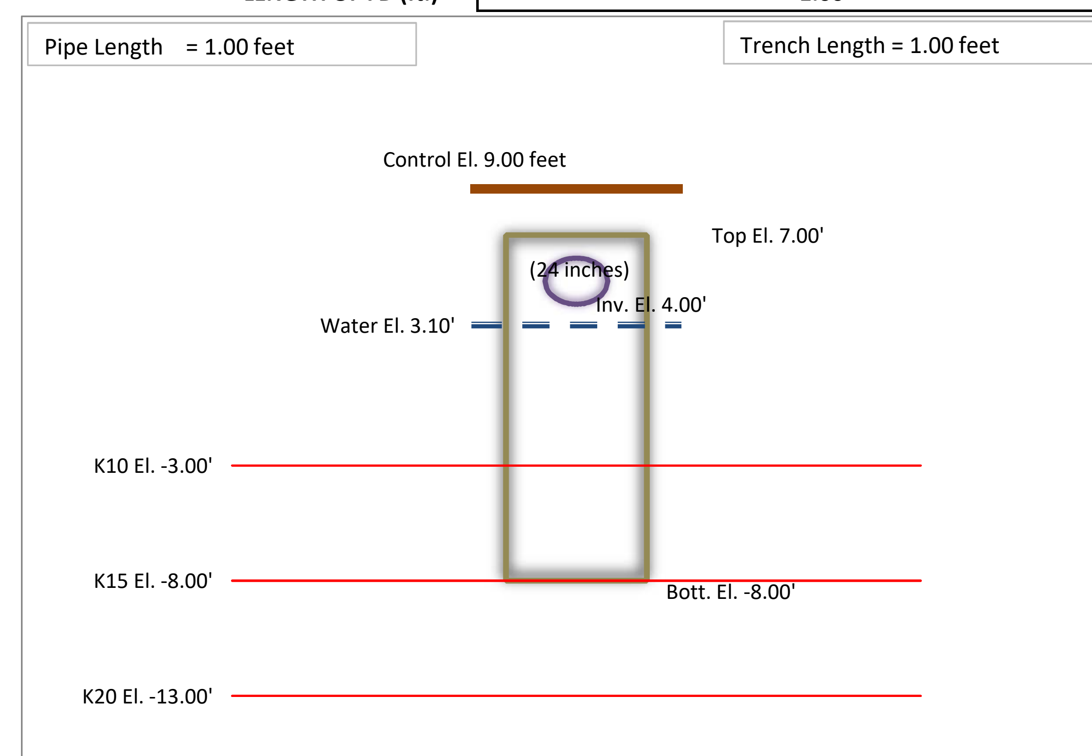
TE	7.00	ft-NGVD	TRENCH TOP ELEVATION	TW	4.50	ft	TRENCH TOP WIDTH
BE	-8.00	ft-NGVD	TRENCH BOTTOM ELEVATION	BW	4.50	ft	TRENCH BOTTOM WIDTH
BE10	-3.00	ft-NGVD	K10 TEST ELEVATION				
BE15	-8.00	ft-NGVD	K15 TEST ELEVATION	PIPE			
BE20	-13.00	ft-NGVD	K20 TEST ELEVATION	DIAMETER	2.00	ft	
K10	2.24E-04	cfs/ft^2-ft	K10 EXFILTRATION RATE	INVERT	4.00	ft-NGVD	
K15	3.48E-03	cfs/ft^2-ft	K15 EXFILTRATION RATE	LENGTH	1.00	ft	
K20	4.05E-03	cfs/ft^2-ft	K20 EXFILTRATION RATE				

Headwater - HW	3.10	4.50	5.80	7.00	9.00															
Tailwater - TW			3.10																	
Do	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Du	0.00	1.40	2.70	3.90	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ds	6.10	6.10	6.10	6.10	6.10	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
D15	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
D20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E10	0.0000	0.0043	0.0090	0.0141	0.0230	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E15	0.0000	0.0487	0.0940	0.1357	0.2053	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ET	0.0000	0.0530	0.1030	0.1498	0.2283	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Et_{adj}	0.0000	0.0530	0.1000	0.1000	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DRAINAGE STRUCTURE I.D.	FD RUN ALONG SR 994 BASIN 2
LENGTH OF FD (ft.)	1.00

EXFILTRATION OPERATING TABLE			
TW	HW	UNIT Q	TOTAL Q
(ft)	(ft)	(cfs/ft)	(cfs)
3.10	3.10	0.0000	0.00000
3.10	4.50	0.0530	0.05298
3.10	5.80	0.1000	0.10000
3.10	7.00	0.1000	0.10000
3.10	9.00	0.1000	0.10000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000





SR 994/QUAIL ROOST DR. PD&E - BASIN B-3 - FD EXFILTRATION RATING CURVE

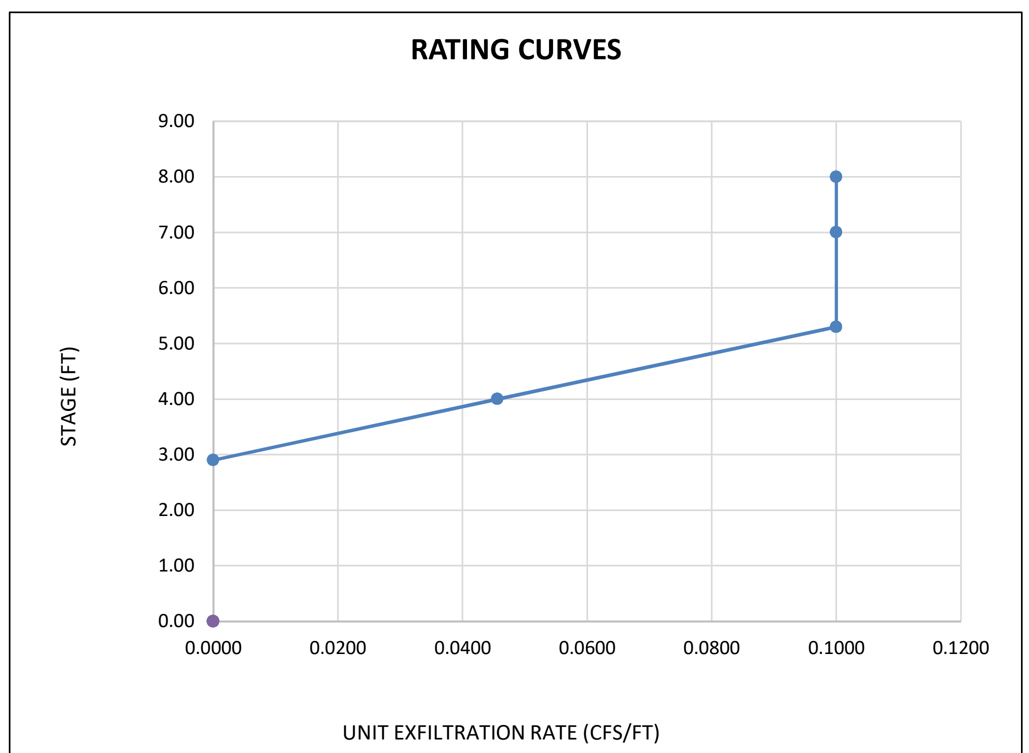
TE	6.00	ft-NGVD	TRENCH TOP ELEVATION	TW	4.50	ft	TRENCH TOP WIDTH
BE	-9.00	ft-NGVD	TRENCH BOTTOM ELEVATION	BW	4.50	ft	TRENCH BOTTOM WIDTH
BE10	-3.00	ft-NGVD	K10 TEST ELEVATION				
BE15	-8.00	ft-NGVD	K15 TEST ELEVATION	PIPE			
BE20	-13.00	ft-NGVD	K20 TEST ELEVATION	DIAMETER	2.00	ft	
K10	1.66E-04	cfs/ft^2-ft	K10 EXFILTRATION RATE	INVERT	3.00	ft-NGVD	
K15	3.12E-03	cfs/ft^2-ft	K15 EXFILTRATION RATE	LENGTH	1.00	ft	
K20	4.06E-03	cfs/ft^2-ft	K20 EXFILTRATION RATE				

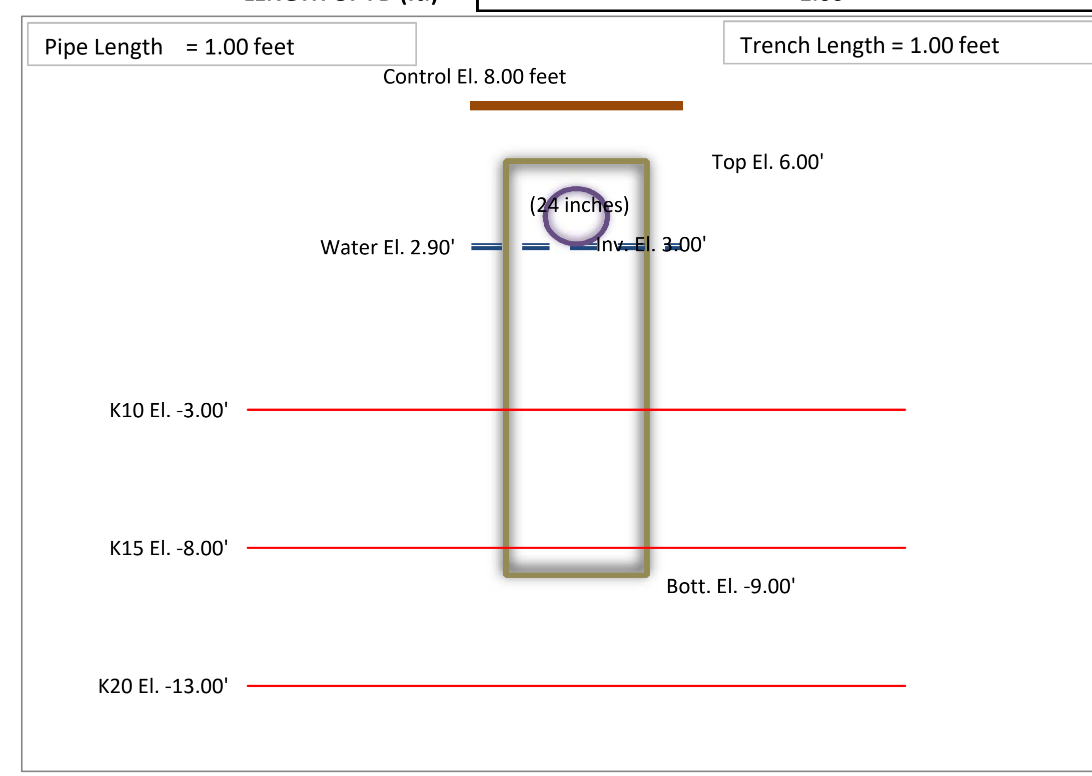
Headwater - HW	2.90	4.00	5.30	7.00	8.00															
Tailwater - TW			2.90																	
Do	0.00	0.00	0.00	1.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Du	0.00	1.10	2.40	3.10	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ds	5.90	5.90	5.90	5.90	5.90	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
D15	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
D20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E10	0.0000	0.0024	0.0057	0.0107	0.0136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E15	0.0000	0.0343	0.0749	0.1279	0.1591	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E20	0.0000	0.0089	0.0195	0.0333	0.0414	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ET	0.0000	0.0456	0.1000	0.1719	0.2142	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Et_{adj}	0.0000	0.0456	0.1000	0.1000	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DRAINAGE STRUCTURE I.D.	FD RUN ALONG SR 994 BASIN 3
LENGTH OF FD (ft.)	1.00

EXFILTRATION OPERATING TABLE

TW	HW	UNIT Q	TOTAL Q
(ft)	(ft)	(cfs/ft)	(cfs)
2.90	2.90	0.0000	0.00000
2.90	4.00	0.0456	0.04561
2.90	5.30	0.1000	0.10000
2.90	7.00	0.1000	0.10000
2.90	8.00	0.1000	0.10000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000





SR 994/QUAIL ROOST DR. PD&E - BASIN B-4 - FD EXFILTRATION RATING CURVE

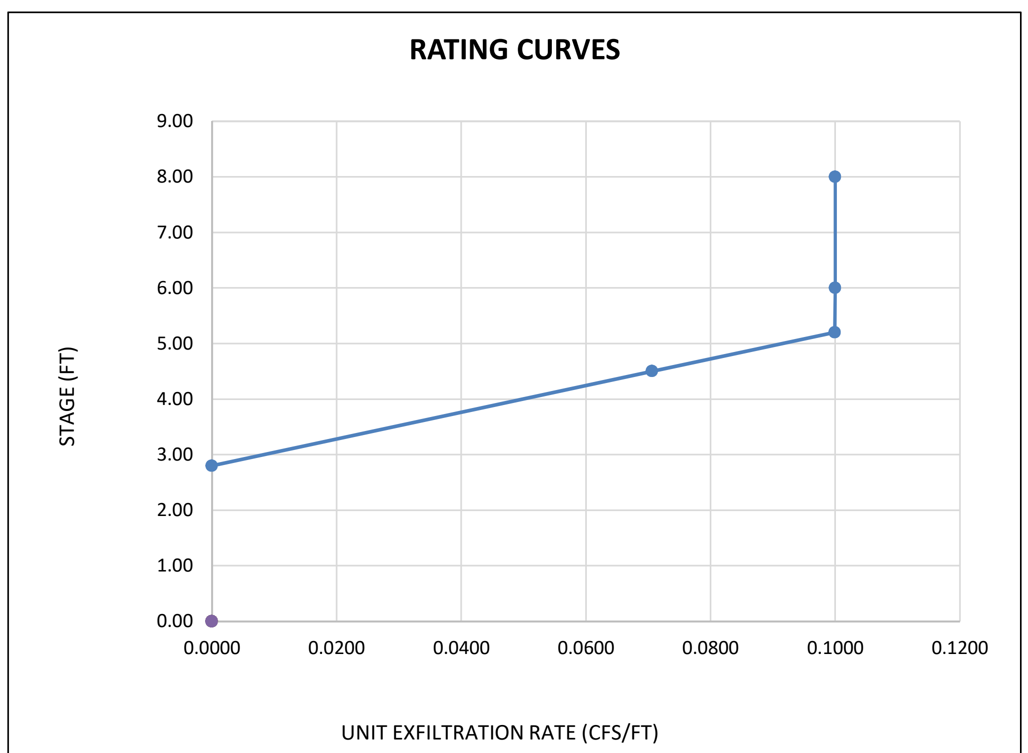
TE	6.00	ft-NGVD	TRENCH TOP ELEVATION	TW	4.50	ft	TRENCH TOP WIDTH
BE	-9.00	ft-NGVD	TRENCH BOTTOM ELEVATION	BW	4.50	ft	TRENCH BOTTOM WIDTH
BE10	-3.00	ft-NGVD	K10 TEST ELEVATION				
BE15	-8.00	ft-NGVD	K15 TEST ELEVATION	PIPE			
BE20	-13.00	ft-NGVD	K20 TEST ELEVATION	DIAMETER	2.00	ft	
K10	1.66E-04	cfs/ft^2-ft	K10 EXFILTRATION RATE	INVERT	3.00	ft-NGVD	
K15	3.12E-03	cfs/ft^2-ft	K15 EXFILTRATION RATE	LENGTH	1.00	ft	
K20	4.06E-03	cfs/ft^2-ft	K20 EXFILTRATION RATE				

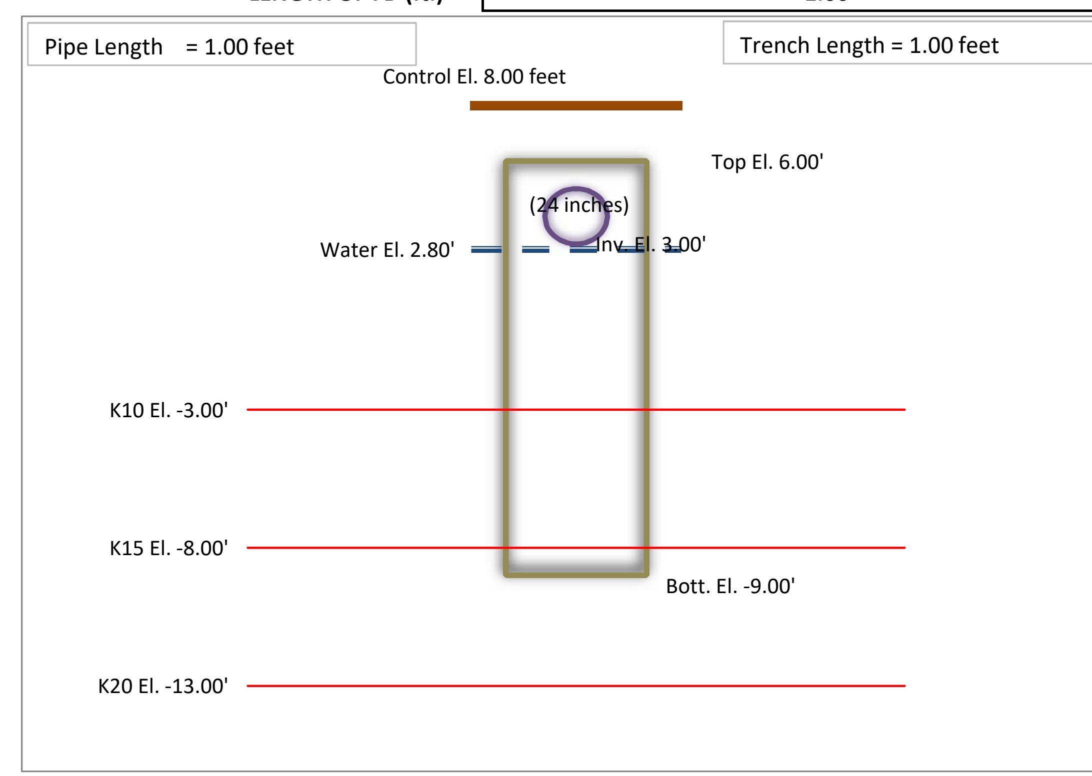
Headwater - HW	2.80	4.50	5.20	6.00	8.00															
Tailwater - TW			2.80																	
Do	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Du	0.00	1.70	2.40	3.20	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ds	5.80	5.80	5.80	5.80	5.80	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
D15	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
D20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E10	0.0000	0.0038	0.0056	0.0079	0.0138	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E15	0.0000	0.0530	0.0749	0.0998	0.1622	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E20	0.0000	0.0138	0.0195	0.0260	0.0422	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ET	0.0000	0.0706	0.0999	0.1337	0.2183	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Et_{adj}	0.0000	0.0706	0.0999	0.1000	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DRAINAGE STRUCTURE I.D.	**FD RUN ALONG SR 994 BASIN 4**
LENGTH OF FD (ft.)	**1.00**

EXFILTRATION OPERATING TABLE

TW	HW	UNIT Q	TOTAL Q
(ft)	(ft)	(cfs/ft)	(cfs)
2.80	2.80	0.0000	0.00000
2.80	4.50	0.0706	0.07060
2.80	5.20	0.0999	0.09995
2.80	6.00	0.1000	0.10000
2.80	8.00	0.1000	0.10000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000
0.00	0.00	0.0000	0.00000





APPENDIX "D"

Table 4 – Summary of Constant Head Exfiltration Test Results
Schematics of Constant Head Borehole Exfiltration Testing

GEOSOL, Inc.

TABLE 4 - SUMMARY OF CONSTANT HEAD BOREHOLE EXFILTRATION TEST RESULTS

SR 994/SW 200th Street/Quail Roost Drive
From West of SW 137th Avenue to East of SW 127th Avenue
Miami-Dade County, Florida
GEOSOL Project No. 221126

Test No.	Date Performed	Diameter		Depth of Hole (Feet)	Screen Interval (Feet)	Depth to Groundwater Level Below Ground Surface (Feet)		SATURATED HOLE DEPTH Ds (Feet)	Corrected Depth of Hole (Feet)	Average Flow Rate (gpm)	Average Flow Rate (cfs)	K, Hydraulic Conductivity (cfs/ft^2-Ft Head)
		Casing (Inches)	Hole (Inches)			Prior to Test	During Test					
EX-1	08/16/21	6.00	6.75	10	0-10	6.3	0.00	3.70	10.00	7.7	1.7E-02	2.24E-04
		6.00	6.75	15	10-15	6.3	5.30	8.70	9.70	13.8	3.1E-02	3.48E-03
		6.00	6.75	20	15-20	6.3	5.30	13.70	14.70	16.1	3.6E-02	4.05E-03
EX-2	08/17/21	6.00	6.75	10	0-10	7.9	0.00	2.10	10.00	6.3	1.4E-02	1.66E-04
		6.00	6.75	15	10-15	7.9	6.90	7.10	8.10	12.4	2.8E-02	3.12E-03
		6.00	6.75	20	15-20	7.9	6.90	12.10	13.10	16.1	3.6E-02	4.06E-03

NOTES:

(1) The above hydraulic conductivity values are for a French drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should decide on the required factor of safety.

(2) The hydraulic conductivity values were calculated based on the procedure shown in the Florida Department of Transportation District 6 Exfiltration Trench Reference Manual.

(3) The diameter of the CASING was used in the computation of the hydraulic conductivity values presented in the above table.

(4) Loss of circulation was NOT encountered during the performance of the borehole exfiltration test.

(5) A Standard Penetration Test (SPT) boring was performed at the borehole exfiltration test location. Refer to the Report of Core Borings for subsurface stratification information.

TEST No.	TEST LOCATION (FEET)		DEPTH (FEET)		GENERAL MATERIAL DESCRIPTION
	LATITUDE	LONGITUDE	FROM	TO	
EX-1	25.580878	-80.406311	0.00	0.50	Dark Brown Organic Silty Fine Sand with Grass (TOPSOIL)
			0.50	1.50	Brown Slightly Silty Fine to Medium SAND with Some Limerock Fragments
			1.50	6.00	Brown Sandy Limestone
			1.50	10.00	Brown Fine to Medium SAND with Some Limestone Fragments
			10.00	20.00	Brown Sandy Limestone
EX-2	25.580738	-80.398037	0.00	0.50	Dark Brown Organic Silty Fine Sand with Grass (TOPSOIL)
			0.50	1.50	Brown Slightly Silty Fine to Medium SAND with Some Limerock Fragments
			1.50	20.00	Brown Sandy Limestone

12. Auger a hole from 15 feet to 20 feet deep to accommodate a 3 and 3/16 – inch perforated casing.
13. Lower a 10 feet long, 3 and 3/16 - inch casing, with the lower 5 feet perforated.
14. Pump test water into the hole with the same method as the one used in the determination of the percolation rate for the 10-foot section of the test-hole (Item 5 above).

The hydraulic conductivity at the different stratums can then be determined using the results from the percolation tests performed at the defined stratums and the equations in **Sections 2.3.1** through **2.3.3**. <u>The application of the procedures and equations in **Sections 2.3** and **2.3.1** through **2.3.3** for determining hydraulic conductivity in which the water table is more than 10 feet deep does not yield accurate results and should not be used.</u>

2.3.1 Hydraulic Conductivity Equations – 0- to 10-foot Stratum

The hydraulic conductivity for the 0- to 10-foot stratum (K_{10}) is determined by **Equation 2.3-1** and correlates to the percolation test parameters for a 10-foot test depicted in **Figure 2.3-1**.

$$K_{10} = \frac{P_{10}}{\sum S\,h}$$ **Equation 2.3-1**

Where
P_{10} = Percolation test pump discharge for 0 to 10-casing, in cfs
S = Surface area perpendicular to the direction of flow, in ft^2
h = Average hydraulic head inducing exfiltration through S, in ft

In **Figure 2.3-1**, D_s represents the saturated depth which is the vertical distance from the observed groundwater surface to the bottom of the test hole (10-feet below the existing ground elevation for K_{10}) and D_u represents the unsaturated depth which is the vertical distance from the stabilized water surface during the test to the observed groundwater surface.

It should be noted that **Equations 2.2-1**, **2.2-2** and **2.3-1** imply a linear relationship between flow and hydraulic head, even though the flow is directly proportional to the head elevated to a power less than 1. However, as depicted in **Figure 2.3-2**, the error, e, and Δ are relatively small and thus acceptable in assuming a linear relation.

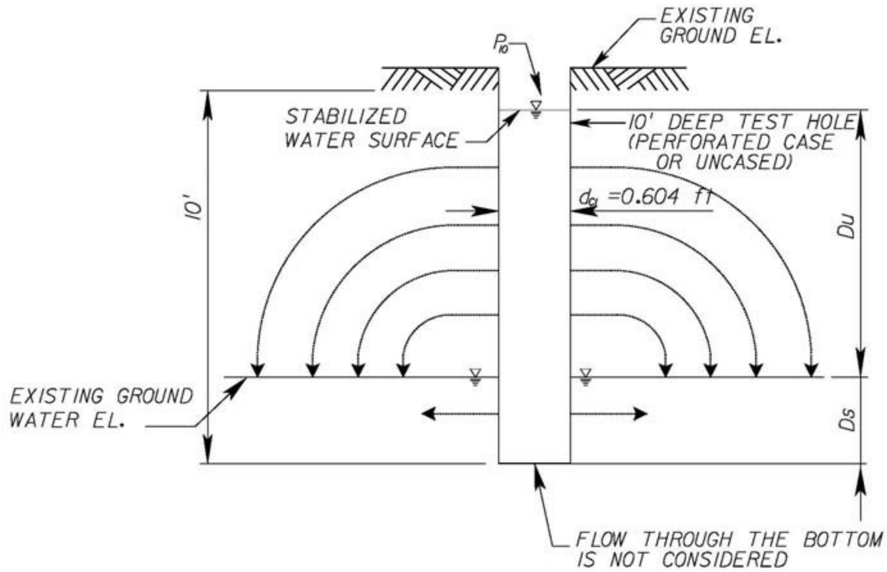


Figure 2.3-1 - Schematic of the key percolation test parameters for a 10-foot test hole

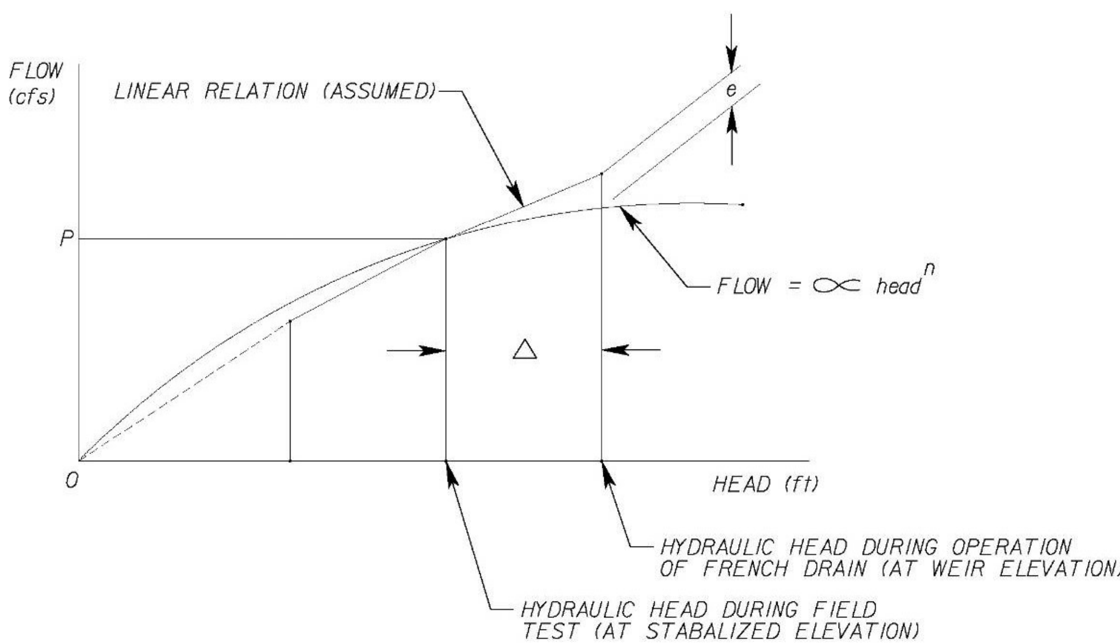


Figure 2.3-2 - Schematic of Percolation Flow versus Head Relationship

Under this assumption, the hydraulic conductivity for the 10-foot stratum can be expressed by **Equation 2.3-2**.

$$K_{10} = \frac{P_{10}}{(S_u h_u + S_s h_s)}$$ **Equation 2.3-2**

Where S_u = Unsaturated area, in $ft^2 = \pi d_1 D_u$

h_u = Average head for the unsaturated area, in ft = D_u / 2
S_s = Saturated area, in ft^2 = $\pi\, d_{C1}\, D_s$
h_s = Average head for the saturated area, in ft = D_u
d_{C1}, D_s, and D_u, in ft, from **Figure 2.3.1**

Equation 2.3-2 can then be transformed into **Equation 2.3-3**.

$$K_{10} = \frac{P_{10}}{[(\pi\, d_{C1}\, D_u\, \{D_u/2\}) + (\pi\, d_{C1}\, D_s\, D_u)]}$$ **Equation 2.3-3**

Equation 2.3-3 can be further reduced to **Equation 2.3-4**, which is the equation used to determine the hydraulic conductivity for the 10-foot stratum of the percolation test hole.

$$K_{10} = \frac{P_{10}}{\pi\, d_{C1}\, D_u\, [D_u/2 + D_s]}$$ **Equation 2.3-4**

As noted in **Section 2.3**, **Equation 2.3-4** implies that the groundwater table at the percolation test location is less than 10 feet deep and within the 0- to 10-foot stratum.

2.3.2 Hydraulic Conductivity Equations – 10- to 15-foot Stratum

Figure 2.3-3 shows a schematic of the key percolation test parameters for a 15-foot test hole to determine the hydraulic conductivity for the 10- to 15-foot stratum (K_{15}).

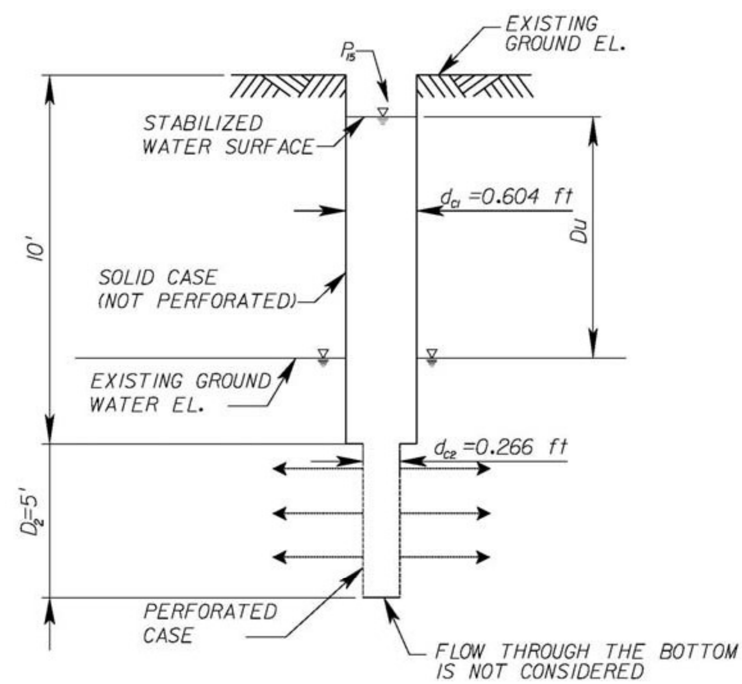


Figure 2.3-3 - Schematic of the key percolation test parameters for a 15-foot test hole

In **Figure 2.3-3**, D_u is the vertical distance from existing groundwater elevation to the stabilized water surface inside the test hole.

The hydraulic conductivity for the 10- to 15-foot stratum (K_{15}) can be expressed by **Equation 2.3-5**.

$$K_{15} = \frac{P_{15}}{\sum S\,h} \qquad \textbf{Equation 2.3-5}$$

Where P_{15} = Percolation test pump discharge for 10 to 15 foot casing, in cfs

S = Area of any vertical surface perpendicular to the direction of flow, in $ft^2 = \pi\, d_{C2}\, D_2$

h = Average hydraulic head affecting the movement of water through S, in $ft = D_u$

d_{C2}, D_2, and D_u, in ft, from **Figure 2.3.3**

Equation 2.3-5 can be further refined into **Equation 2.3-6**.

$$K_{15} = \frac{P_{15}}{\pi\, d_{C2}\, D_2\, D_u} \qquad \textbf{Equation 2.3-6}$$

2.3.3 Hydraulic Conductivity Equations – 15 to 20 foot Stratum

Similarly, **Figure 2.3-4** shows a schematic of the key percolation test parameters for a 20-foot test hole to determine the hydraulic conductivity for the 15- to 20-foot stratum (K_{20}).

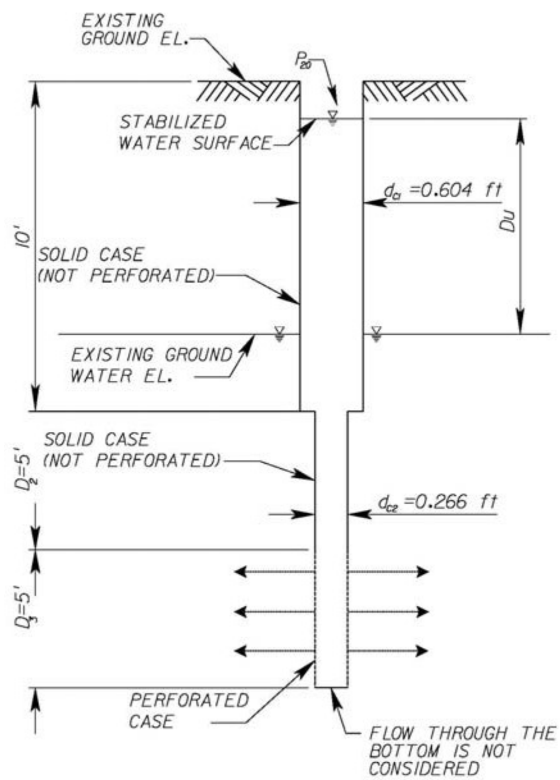


Figure 2.3-4 - Schematic of the key percolation test parameters for a 20-foot test hole

The hydraulic conductivity for the 15- to 20-foot stratum can be expressed by **Equation 2.3-7**.

$$K_{20} = \frac{P_{20}}{\sum S\,h}$$ **Equation 2.3-7**

Where
P_{20} = Percolation test pump discharge for 15 to 20 foot casing, in cfs
S = Area of any vertical surface perpendicular to the direction of flow, in $ft^2 = \pi\, d_{C2}\, D_3$
h = Average hydraulic head affecting the movement of water through S, in ft = D_u

Equation 2.3-7 can be further refined into **Equation 2.3-8**.

$$K_{20} = \frac{P_{20}}{\pi\, d_{C2}\, D_3\, D_u}$$ **Equation 2.3-8**

2.4 Exfiltration Rate Equations

The exfiltration capacity of exfiltration trenches depends on where the DHW and control elevations are in relation to the exfiltration trench aggregate media. There are typically three scenarios:

- Scenario 1: Design High Water and Control Elevations are within the Aggregate Media
- Scenario 2: Design High Water and Control Elevations are Above the Aggregate Media
- Scenario 3: Design High Water is within the Aggregate Media and Control Elevation is Above the Aggregate Media

The following sections summarize the approach for determining the exfiltration rate for exfiltration trenches for each of these scenarios.

2.4.1 Scenario 1: Design High Water and Control Elevations are within the Aggregate Media

This section applies when the DHW elevation and the control or weir elevations are within the exfiltration trench aggregate media as depicted on **Figure 2.4-1**. The total exfiltration rate per foot of trench out of an exfiltration trench can be calculated using **Figure 2.4-1**, **Equations 2.4-5** through **2.4-7,** and the supporting equations in this section, depending on the depth and geometry of the exfiltration trench.

Equation 2.4-1 is the basic equation used in order to calculate total exfiltration out of an exfiltration trench per foot of trench.

$$E_t = E_{10} + E_{15} + E_{20}$$ **Equation 2.4-1**

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ENGINEER OF RECORD:
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DESIGNED BY: O.R. 09-21
CHECKED BY: O.R. 09-21

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 994	MIAMI-DADE	445804-1-22-01

SHEET TITLE: TEST LOCATION PLANS

PROJECT NAME: PROJECT DEVELOPMENT AND ENVIRONMENTAL (PD&E) STUDY
SR 994/ SW 200TH STREET/QUAIL ROOST DRIVE
FROM WEST OF SW 137TH AVENUE TO EAST OF SW 127TH AVENUE

REF. DWG. NO.

SHEET NO. 9

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SR 994/ SW 200TH STREET/QUAIL ROOST DRIVE
FROM WEST OF SW 137TH AVENUE TO EAST OF SW 127TH AVENUE

REF. DWG. NO.

SHEET NO. 14

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