DRC

PZ22-12000041
07/03/2024

EA3 CIVIL ENGINEERING

Drainage Calculations
for
2233 E Atlantic Blvd

EA3 Project Number: 224804

May 2024

Prepared For:

MTTRMGMT XK LLC
212 NW 73rd Street,
Miami, FL 33150

ERIC ARENCIBIA LICENSE No 82291 STATE OF FLORIDA PROFESSIONAL ENGINEER

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Permit Criteria:

The proposed stormwater drainage system was analyzed following the standard methods of SFWMD and Broward County Surface Water Management (BCSWM). The most stringent design requirements were followed in the design of the stormwater improvements. The design criteria are as follows:

WATER QUANTITY CRITERIA:

Various rainfall events were modeled to verify maximum stage compliance with applicable requirements. The storm events and their respective rainfall depths are listed in the Rainfall Data section of this report.

PARKING LOT FLOOD PROTECTION: 5-YEAR, 24-HOUR RAINFALL (SFWMD)

A storm event with a duration of 24-hour and a 5-year return period is required to be maintained below the lowest inlet.

OFF-SITE DISCHARGE: 25-YEAR, 72-HOUR RAINFALL (SFWMD)

A storm event with duration of 72 hours and a 25-year return period determines the need for a perimeter berm. The proposed conditions must provide a lower peak stage compared to the existing conditions, or a perimeter berm shall be constructed to prevent discharge to any neighboring property during this storm event.

BUILDING FLOOD PROTECTION (SFWMD/BROWARD)

A minimum finished floor elevation for future development of all buildings within the permitted limits is to be established to provide flood protection for all buildings.

For sites located within a FEMA flood hazard area, the finished floor elevations will be determined by the greater of the Base Flood Elevation (BFE) + 1 and the Design Flood Elevation (DFE).

- BFE – The base flood elevation is specified by the FEMA flood data. For this property, the FEMA flood zone is X, corresponding to a BFE of N/A.
- DFE – The design flood elevation is the maximum of (1) Broward County Flood Criteria and (2) the maximum stage calculated for a 100-year/72-hour storm event with no offsite discharge, shown in the following sections.

FEMA FLOOD ZONE

The project is located within COMMUNITY-PANEL NUMBER 0376H (Map Number 12011C0376H) of the Flood Insurance Rate Map (FIRM), revised August 18, 2014. According to the National Flood Insurance Program the Site is located within Zone X.

FEMA Flood Elevation = N/A (Zone X)

100-YEAR/72-HOUR RAINFALL

DFE was calculated by the maximum flood stage for the 100-year, 72-hour storm event.

100-Year, 72-Hour Stage = 7.09 NAVD

WATER QUALITY CRITERIA:

South Florida Water Management District (SFWMD) water criteria and procedures were followed during this analysis. The total volumes for water quality are provided for the greater of the first inch of storm runoff from the entire site, or the amount of 2.5 inches times the percentage of impervious area. Volumetric calculations for the required and provided amounts can be found on Sheet C-3 of the civil plans.

For water quality that is provided with dry detention and retention, a reduction in required volume is allowed as per SFWMD. The credits include the following:

- Dry Detention – the provided volume shall be equal to or greater than 75 percent of the required volume.
- Retention – the provided volume shall be equal to or greater than 50 percent of the required volume.

On-site Volume Required for Water Quality = 3,403 CF = 0.07812 acre-feet

½" PRE-TREATMENT:

0.5 in x 0.501 acres x 1-ft/12-in = 0.0209 ac-ft dry pre-treatment required

Required volume provided by Exfiltration Trench = 0.0653 ac-ft > 0.0209 ac-ft

Proposed Design Parameters:

The proposed stormwater management system consists of catch basins connected via pipes and exfiltration trenches. Water quality treatment will be provided by the 200 linear feet of exfiltration trench. All underground piping, catch basins, exfiltration trench, concrete, and asphalt pavement are designed to conform to the applicable standards.

WATER TABLE ELEVATION:

The design water table elevation was obtained from the Broward County Future Conditional Groundwater Elevations Map. The groundwater elevation for the purposes of these calculations was taken to be 2.50' NAVD88 for the entire site.

RAINFALL DATA:

Rainfall Frequency	Rainfall Depth (inches)
5-year/24-hour	7.50
25-year/72-hour	15.00
100-year/72-hour	20.00

SOIL STORAGE:

Soil storage is calculated based on soil type and the average depth to the water table across the project site, in accordance with the Environmental Resource Permit Applicant's Handbook Volume II.

Proposed Site Soil Storage Capacity = 0.87 inches

FLOOD ROUTING MODEL:

A Cascade stormwater model has been developed for the proposed conditions. See the proceeding pages for flood routing stage-storage model results and output.

Conclusion and Recommendations:

The drainage analysis indicates that the proposed drainage system can protect the proposed building during a 100-year, 72-hour storm event as well as satisfy applicable water quality, water quantity, and discharge requirements. 200 linear feet of exfiltration trench has been proposed to meet water quality and quantity requirements. All water quality for the site is proposed to be provided through exfiltration trench, satisfying both pre-treatment and water quality volume requirements.

Design elevations on site have been designed to maintain the existing stormwater conveyance and prohibit any additional discharge onto the adjacent private properties. Minimum finished floor elevation is proposed above the highest stage of the 100-year, 72-hour design storm event.

Storm Event	Proposed Conditions Maximum Stage (NAVD)	Design Elevations, Existing Elevations (NAVD)
5-year, 24-hour	7.70’	7.71’
25-year, 72-hour	7.00’	7.47’(existing)
100-year. 72-hour	7.09’	7.77’

2233 E Atalntic Blvd., Pompano Beach, FL

DRAINAGE CALCULATIONS - FRENCH DRAIN & SWALE RETENTION SYSTEM
as per SFWMD Environmental Resource Permit Information Manual, Volume IV

Flood Routing Calculations (see calculations below for 5-year/1-hour)

Rainfall Frequency	Rainfall Depth (inches)
5-year/24-hour	7.50
25-year/72-hour	15.00
100-year/72-hour	20.00

As per SFWMD Isohyetal Maps, ERP Handbook Volume II

Exfiltration Trench Storage Provided has been converted to an amount of rainfall in inches to be subtracted from the design storm events in the Proposed condition:

Volume used: 0.0658 ac-ft / 0.501 acres = 1.58 in

SOIL STORAGE (PROPOSED CONDITIONS)

Average Elevation of Site:	7.42' NAVD
Average Water Table Elevation	2.50' NAVD
Average Depth to Water Table	4.92 ft
Available Storage (S.p)	5.10 in
Percent Pervious	16.9%
SOIL STORAGE = S x Percent Pervious	0.87 in

MAXIMUM FLOOD STAGES

Storm Event	Proposed Conditions Maximum Stage (NAVD)	Design Elevations, Existing Elevations (NAVD)
5-year/24-hour	7.70'	7.71'
25-year/72-hour	7.00'	7.47' (existing)
100-year/72-hour	7.09'	7.77'

See below for inputs.

STAGE-STORAGE CALCULATIONS (PROPOSED CONDITIONS)

Area Type	Green	Pavement	Building	Exfiltration Trench	Total
Area (ac)	0.085	0.260	0.156	0.0653 ac-ft	0.501
Low Elevation	6.42	6.62		-7.88	
High Elevation	7.42	7.72		5.12	

Stage (ft NAVD)	Volume (ac-ft)	Volume (ac-ft)	Volume	Volume	Total Storage
0.00	0.000	0.000	0.000	0.0000	0.000
0.50	0.000	0.000	0.000	0.0000	0.000
1.00	0.000	0.000	0.000	0.0000	0.000
1.50	0.000	0.000	0.000	0.0000	0.000
2.00	0.000	0.000	0.000	0.0000	0.000
2.50	0.000	0.000	0.000	0.0000	0.000
3.00	0.000	0.000	0.000	0.0000	0.000
3.50	0.000	0.000	0.000	0.0000	0.000
4.00	0.000	0.000	0.000	0.0000	0.000
4.50	0.000	0.000	0.000	0.0000	0.000
5.00	0.000	0.000	0.000	0.0000	0.000
5.50	0.000	0.000	0.000	0.0000	0.000
6.00	0.000	0.000	0.000	0.0000	0.000
6.50	0.000	0.000	0.000	0.0000	0.000
7.00	0.010	0.020	0.000	0.0000	0.030
7.50	0.050	0.090	0.000	0.0000	0.140
8.00	0.090	0.220	0.000	0.0000	0.310
8.50	0.130	0.350	0.000	0.0000	0.480
9.00	0.170	0.480	0.000	0.0000	0.650
9.50	0.220	0.610	0.000	0.0000	0.830
10.00	0.260	0.740	0.000	0.0000	1.000
10.50	0.300	0.870	0.000	0.0000	1.170
11.00	0.340	1.000	0.000	0.0000	1.340

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SOIL STORAGE (EXISTING CONDITIONS)

Average Elevation of Site:	6.92' NAVD
Average Water Table Elevation	2.50' NAVD
Average Depth to Water Table	4.42 ft
Available Storage (S.p)	5.10 in
Percent Pervious	14.3%
SOIL STORAGE = S x Percent Pervious	0.73 in

MAXIMUM FLOOD STAGES

Storm Event	Existing Conditions Maximum Stage (NAVD)
5-year/24-hour	7.71'
25-year/72-hour	8.52'
100-year/72-hour	9.04'

See below for inputs.

STAGE-STORAGE CALCULATIONS (EXISTING CONDITIONS)

Area Type	Green	Pavement	Building	Total
Area (ac)	0.072	0.325	0.104	0.501
Low Elevation	7.00	6.05		
High Elevation	7.42	7.94		

Stage (ft NAVD)	Volume (ac-ft)	Volume (ac-ft)	Volume (ac-ft)	Total Storage (ac-ft)
0.00	0.000	0.000	0.000	0.000
0.50	0.000	0.000	0.000	0.000
1.00	0.000	0.000	0.000	0.000
1.50	0.000	0.000	0.000	0.000
2.00	0.000	0.000	0.000	0.000
2.50	0.000	0.000	0.000	0.000
3.00	0.000	0.000	0.000	0.000
3.50	0.000	0.000	0.000	0.000
4.00	0.000	0.000	0.000	0.000
4.50	0.000	0.000	0.000	0.000
5.00	0.000	0.000	0.000	0.000
5.50	0.000	0.000	0.000	0.000
6.00	0.000	0.000	0.000	0.000
6.50	0.000	0.020	0.000	0.020
7.00	0.000	0.080	0.000	0.080
7.50	0.020	0.180	0.000	0.200
8.00	0.050	0.330	0.000	0.380
8.50	0.090	0.490	0.000	0.580
9.00	0.130	0.650	0.000	0.780
9.50	0.170	0.810	0.000	0.980
10.00	0.200	0.980	0.000	1.180
10.50	0.240	1.140	0.000	1.380
11.00	0.270	1.300	0.000	1.570

EA3 CIVIL ENGINEERING

Flood Routing for (5-yr/1-hr)

DRAINAGE CALCULATIONS -SWALE RETENTION SYSTEM 5/21/2024
as per SFWMD Environmental Resource Permit Information Manual, Volume IV

DESIGN CRITERIA

Rainfall Frequency	Rainfall Depth (inches)	*As per SFWMD Isohyetal Maps, ERP Handbook Volume II*
5-year/1-hour(P)	3.20	

SITE DISTRIBUTION (EXISTING CONDITIONS)		
Site Area	21,839 SF	100%
Pervious Area	3,117 SF	14.3%
Impervious Area	18,722 SF	85.7%

SOIL STORAGE (EXISTING CONDITIONS)

Compacted Soil Storage (inches)	5.10	*As per SFWMD*
Soil Storage(S)(inches)	0.73	S=(PERVIOUS/SITE)*(COMPACTED SOIL STORAGE)
Runoff(R)(inches)	2.46	R=(P-0.2S)^2/(P+0.8S)
Volume of Runoff(V)(CF)	4,477	V=(SITE AREA*R)/12

SITE DISTRIBUTION (PROPOSED CONDITIONS)		
Site Area	21,839 SF	100%
Pervious Area	3,706 SF	16.9%
Impervious Area	18,133 SF	83.1%

SOIL STORAGE (PROPOSED CONDITIONS)

Compacted Soil Storage (inches)	5.10	*As per SFWMD*
Soil Storage(S)(inches)	0.87	S=(PERVIOUS/SITE)*(COMPACTED SOIL STORAGE)
Runoff(R)(inches)	2.35	R=(P-0.2S)^2/(P+0.8S)
Volume of Runoff(V)(CF)	4,277	V=(SITE AREA*R)/12

PRE VS POST ANALYSIS (WATER QUANTITY)

4,277 CF - 4,477 CF = (-)200 CF

WATER QUALITY ANALYSIS

1.0 IN. x 21,839 SF / 12in/ft = 1,820 CF
SITE AREA FOR WQ: 21,839 SF-7,158 SF(roof)=14,681 SF
IMPERVIOUS AREA WQ: 14,681 SF - 3,706 SF= 10,975 SF
2.5 IN. x 74.8% (PERCENT IMPERVIOUS WQ) = 1.87 IN.
1.87 IN. x 21,839 SF / 12in/ft = 3,403 CF

Project Name: Proposed 2233 E Atlantic Blvd.
Reviewer: RR
Project Number: 224804
  Period Begin: Jan 01, 2000;0000 hr End: Jan 02, 2000;0000 hr Duration: 24 hr
  Time Step: 0.2 hr,   Iterations: 10

Basin 1: On-Site

  Method: Santa Barbara Unit Hydrograph
  Rainfall Distribution: SFWMD - 24 hr
  Design Frequency: 5 year
  1 Day Rainfall: 5.92 inches
  Area: 0.501 acres
  Ground Storage: 0.87 inches
  Time of Concentration: 0.1 hours
  Initial Stage: 2.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
0.00	0.00
0.50	0.00
1.00	0.00
1.50	0.00
2.00	0.00
2.50	0.00
3.00	0.00
3.50	0.00
4.00	0.00
4.50	0.00
5.00	0.00
5.50	0.00
6.00	0.00
6.50	0.00
7.00	0.03
7.50	0.14
8.00	0.31
8.50	0.48
9.00	0.65
9.50	0.83
10.00	1.00
10.50	1.17
11.00	1.34

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
On-Site	7.70	24.00	0.00	0.20

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
On-Site	0.21	0.00	0.00	0.00	0.21	0.00

Project Name: Proposed 2233 E Atlantic Blvd.
Reviewer: RR
Project Number: 224804
  Period Begin: Jan 01, 2000;0000 hr End: Jan 02, 2000;0000 hr Duration: 24 hr
  Time Step: 0.2 hr,   Iterations: 10

Basin 1: On-Site

  Method: Santa Barbara Unit Hydrograph
  Rainfall Distribution: SFWMD - 3day
  Design Frequency: 25 year
  3 Day Rainfall: 13.42 inches
  Area: 0.501 acres
  Ground Storage: 0.87 inches
  Time of Concentration: 0.1 hours
  Initial Stage: 2.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
0.00	0.00
0.50	0.00
1.00	0.00
1.50	0.00
2.00	0.00
2.50	0.00
3.00	0.00
3.50	0.00
4.00	0.00
4.50	0.00
5.00	0.00
5.50	0.00
6.00	0.00
6.50	0.00
7.00	0.03
7.50	0.14
8.00	0.31
8.50	0.48
9.00	0.65
9.50	0.83
10.00	1.00
10.50	1.17
11.00	1.34

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
On-Site	7.00	24.00	0.00	0.20

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
On-Site	0.03	0.00	0.00	0.00	0.03	0.00

Note: All elevations noted and shown are in NAVD (not NGVD)

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Project Name: Proposed 2233 E Atlantic Blvd.
Reviewer: RR
Project Number: 224804
Period Begin: Jan 01, 2000;0000 hr End: Jan 02, 2000;0000 hr Duration: 24 hr
Time Step: 0.2 hr, Iterations: 10

Basin 1: On-Site

Method: Santa Barbara Unit Hydrograph
Rainfall Distribution: SFWMD - 3day
Design Frequency: 100 year
3 Day Rainfall: 18.42 inches
Area: 0.501 acres
Ground Storage: 0.87 inches
Time of Concentration: 0.1 hours
Initial Stage: 2.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
0.00	0.00
0.50	0.00
1.00	0.00
1.50	0.00
2.00	0.00
2.50	0.00
3.00	0.00
3.50	0.00
4.00	0.00
4.50	0.00
5.00	0.00
5.50	0.00
6.00	0.00
6.50	0.00
7.00	0.03
7.50	0.14
8.00	0.31
8.50	0.48
9.00	0.65
9.50	0.83
10.00	1.00
10.50	1.17
11.00	1.34

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
On-Site	7.09	24.00	0.00	0.20

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
On-Site	0.05	0.00	0.00	0.00	0.05	0.00

Note: All elevations noted and shown are in NAVD (not NGVD)

Project Name: Ex. 2233 E Atlantic Blvd.
Reviewer: RR
Project Number: 224804
  Period Begin: Jan 01, 2000;0000 hr End: Jan 02, 2000;0000 hr Duration: 24 hr
  Time Step: 0.2 hr,   Iterations: 10

Basin 1: On-Site

  Method: Santa Barbara Unit Hydrograph
  Rainfall Distribution: SFWMD - 24 hr
  Design Frequency: 5 year
  1 Day Rainfall: 7.5 inches
  Area: 0.501 acres
  Ground Storage: 0.73 inches
  Time of Concentration: 0.1 hours
  Initial Stage: 2.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
0.00	0.00
0.50	0.00
1.00	0.00
1.50	0.00
2.00	0.00
2.50	0.00
3.00	0.00
3.50	0.00
4.00	0.00
4.50	0.00
5.00	0.00
5.50	0.00
6.00	0.00
6.50	0.02
7.00	0.08
7.50	0.20
8.00	0.38
8.50	0.58
9.00	0.78
9.50	0.98
10.00	1.18
10.50	1.38
11.00	1.57

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
On-Site	7.71	24.00	0.00	0.20

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
On-Site	0.28	0.00	0.00	0.00	0.28	0.00

Note: All elevations noted and shown are in NAVD (not NGVD)

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Project Name: Ex. 2233 E Atlantic Blvd.
Reviewer: RR
Project Number: 224804
  Period Begin: Jan 01, 2000;0000 hr End: Jan 04, 2000;0000 hr Duration: 72 hr
  Time Step: 0.2 hr,   Iterations: 10

Basin 1: On-Site

  Method: Santa Barbara Unit Hydrograph
  Rainfall Distribution: SFWMD - 3day
  Design Frequency: 25 year
  3 Day Rainfall: 15 inches
  Area: 0.501 acres
  Ground Storage: 0.73 inches
  Time of Concentration: 0.1 hours
  Initial Stage: 2.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
0.00	0.00
0.50	0.00
1.00	0.00
1.50	0.00
2.00	0.00
2.50	0.00
3.00	0.00
3.50	0.00
4.00	0.00
4.50	0.00
5.00	0.00
5.50	0.00
6.00	0.00
6.50	0.02
7.00	0.08
7.50	0.20
8.00	0.38
8.50	0.58
9.00	0.78
9.50	0.98
10.00	1.18
10.50	1.38
11.00	1.57

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
On-Site	8.52	72.00	0.00	0.20

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
On-Site	0.59	0.00	0.00	0.00	0.59	0.00

Note: All elevations noted and shown are in NAVD (not NGVD)

Project Name: Ex. 2233 E Atlantic Blvd.
Reviewer: RR
Project Number: 224804
  Period Begin: Jan 01, 2000;0000 hr End: Jan 04, 2000;0000 hr Duration: 72 hr
  Time Step: 0.2 hr,   Iterations: 10

Basin 1: On-Site

  Method: Santa Barbara Unit Hydrograph
  Rainfall Distribution: SFWMD - 3day
  Design Frequency: 100 year
  3 Day Rainfall: 20 inches
  Area: 0.501 acres
  Ground Storage: 0.73 inches
  Time of Concentration: 0.1 hours
  Initial Stage: 2.5 ft NGVD

Stage (ft NGVD)	Storage (acre-ft)
0.00	0.00
0.50	0.00
1.00	0.00
1.50	0.00
2.00	0.00
2.50	0.00
3.00	0.00
3.50	0.00
4.00	0.00
4.50	0.00
5.00	0.00
5.50	0.00
6.00	0.00
6.50	0.02
7.00	0.08
7.50	0.20
8.00	0.38
8.50	0.58
9.00	0.78
9.50	0.98
10.00	1.18
10.50	1.38
11.00	1.57

STRUCTURE MAXIMUM AND MINIMUM DISCHARGES

Struc	Max (cfs)	Time (hr)	Min (cfs)	Time (hr)

BASIN MAXIMUM AND MINIMUM STAGES

Basin	Max (ft)	Time (hr)	Min (ft)	Time (hr)
On-Site	9.04	72.00	0.00	0.20

BASIN WATER BUDGETS (all units in acre-ft)

Basin	Total Runoff	Structure Inflow	Structure Outflow	Initial Storage	Final Storage	Residual
On-Site	0.80	0.00	0.00	0.00	0.80	0.00

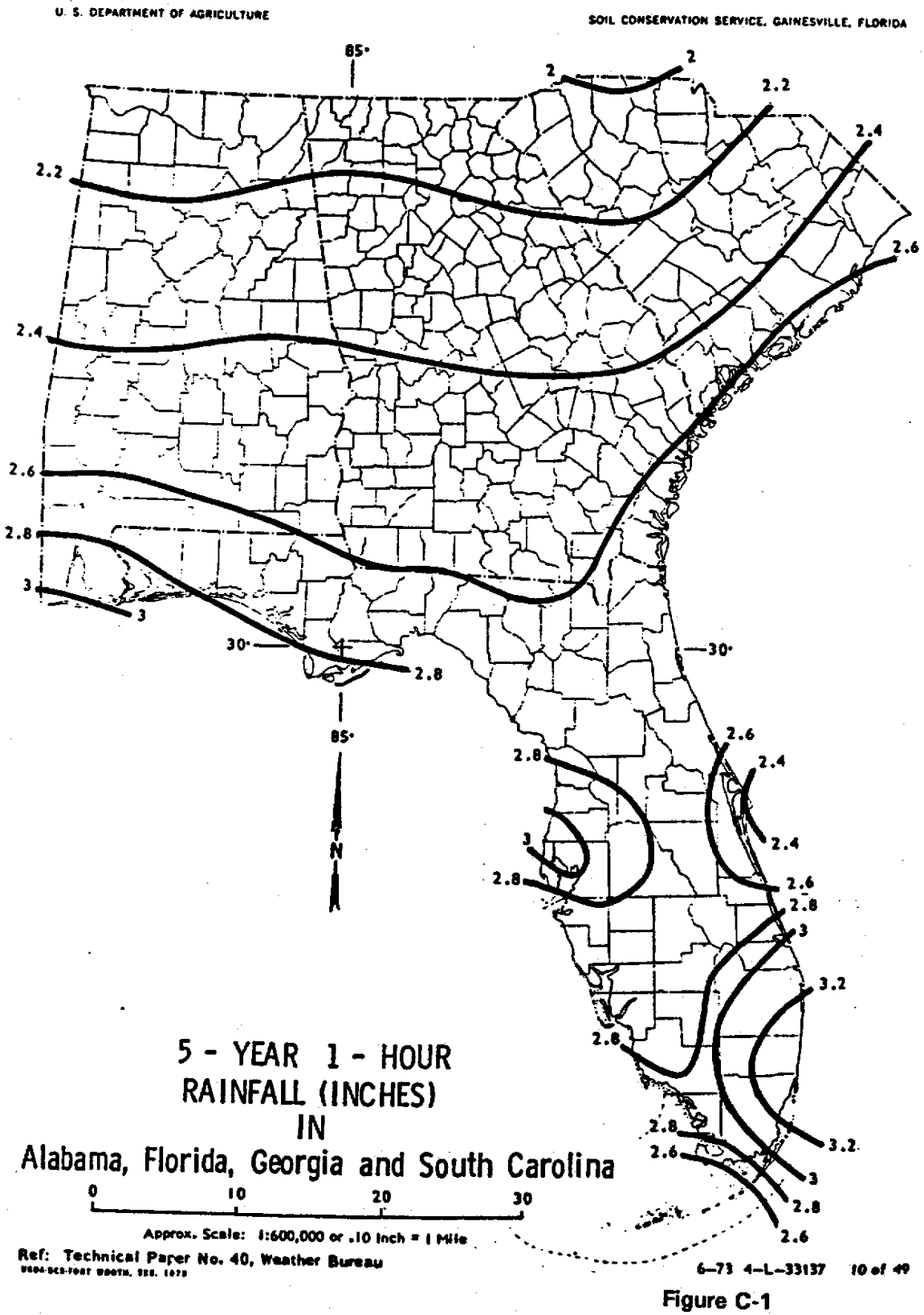

Figure C-1

Figure C-1

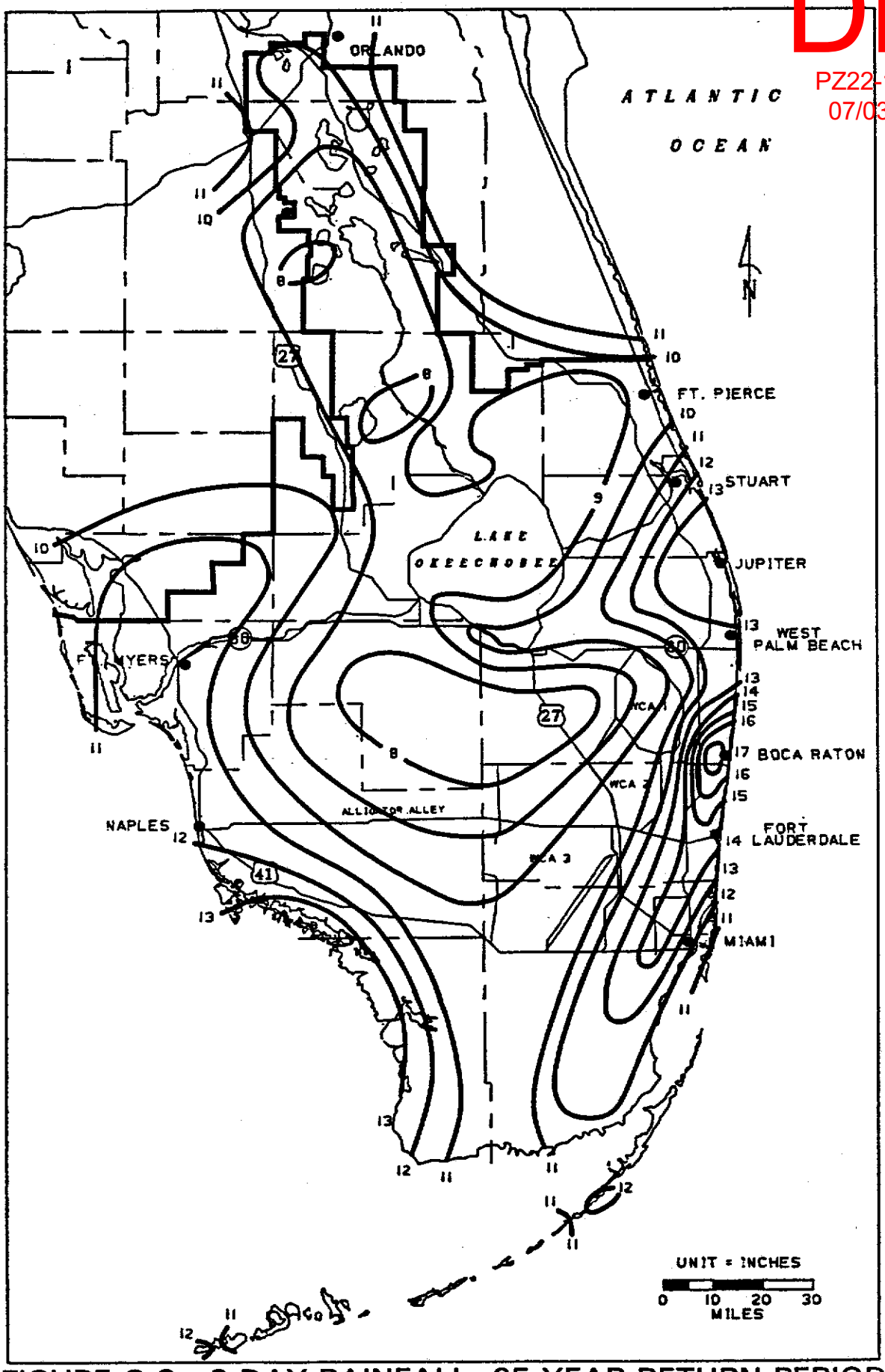

FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD

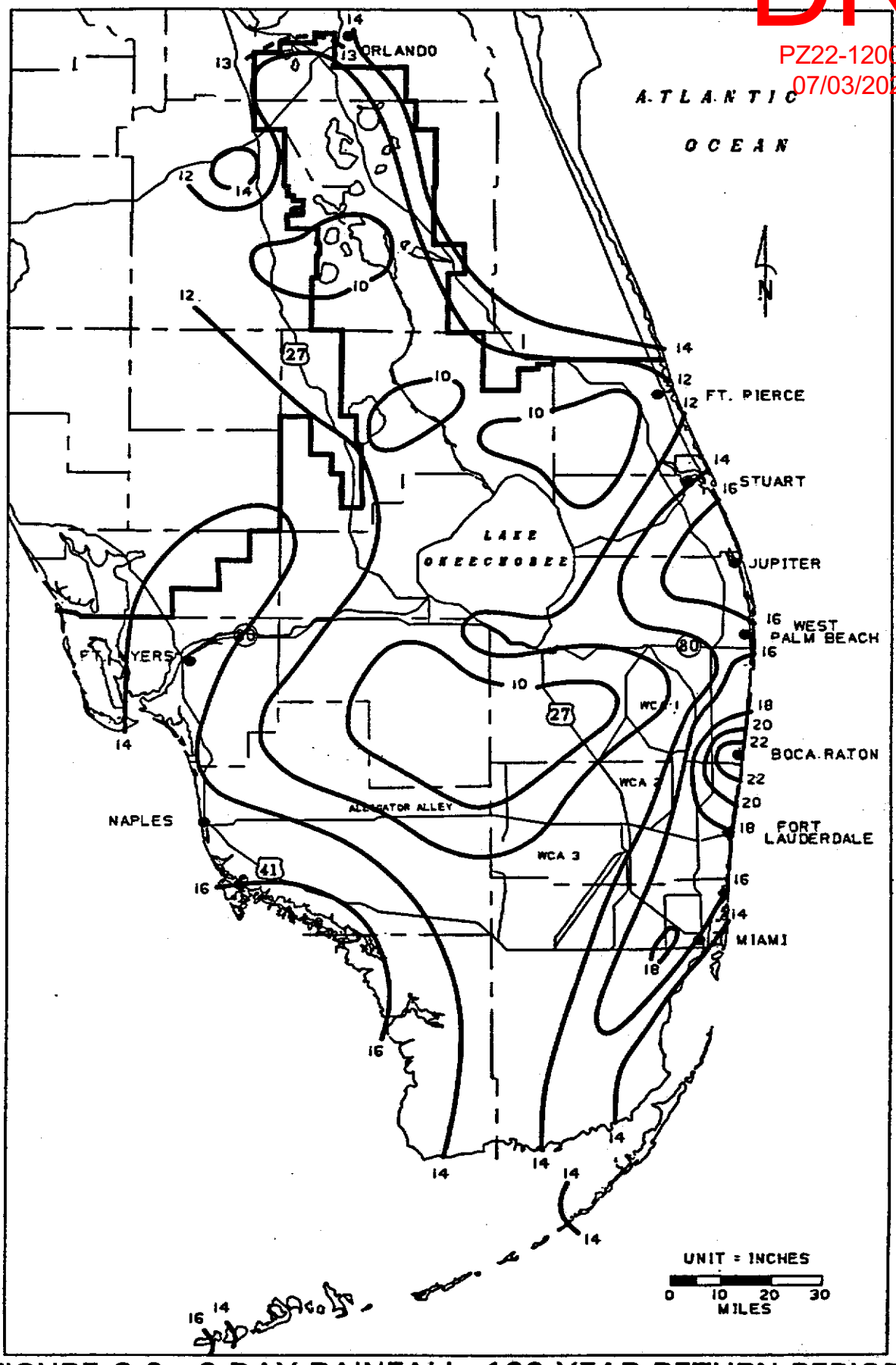

FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

Figure C-9