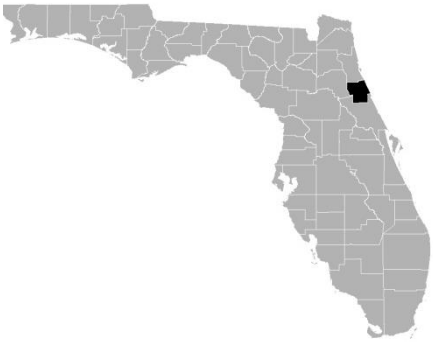
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 2 OF 3



FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
BEVERLY BEACH, TOWN OF	120569
BUNNELL, CITY OF	120086
FLAGLER BEACH, CITY OF	120087
FLAGLER COUNTY UNINCORPORATED AREAS	120085
MARINELAND, TOWN OF	120570
PALM COAST, CITY OF	120684

FEMA

PRELIMINARY
03/15/2016

REVISED:

FLOOD INSURANCE STUDY NUMBER
12035CV002B

Version Number 2.3.3.2

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Bull Creek	07-09 P
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Graham Swamp	17-19 P
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Exhibits

Coastal Transect Profiles	Panel
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Exhibits, continued

Coastal Transect Profiles	Panel
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Published Separately

Flood Insurance Rate Map (FIRM)

Figure 9: Transect Location Map

St. Johns County

Town of Marineland

Town of Marineland

Flagler County

Atlantic Ocean

City of Palm Coast

38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22

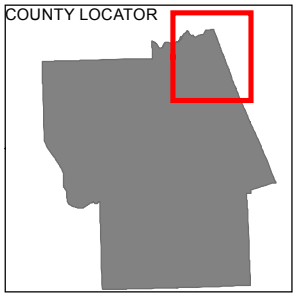
Elevation (Feet, NAVD88)

1 inch = 6,000 feet 1:72,000

0 1,200 2,400 4,800 7,200 9,600 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

PANELS WITH TRANSECTS

0017E, 0019E, 0028E, 0036E, 0037E, 0038E, 0039E, 0126E, 0127E, 0129E, 0131E, 0133E, 0141E

FEMA

Figure 9: Transect Location Map, continued

City of Palm Coast

Town of Beverly Beach

Atlantic Ocean

Flagler County

City of Flagler Beach

21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Elevation (Feet, NAVD88)

1 inch = 6,000 feet 1:72,000

0 1,200 2,400 4,800 7,200 9,600 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

PANELS WITH TRANSECTS

0141E, 0142E, 0143E, 0144E, 0232E, 0234E, 0242E, 0251E, 0253E, 0261E

FEMA

5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

Table 18: Summary of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

Table 19: Results of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey (NGS) at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Flagler County are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Beverly Beach	SE	29.625	-81.25	-1.047
Bunnell	SE	29.375	-81.25	-1.056
Codys Corner	SE	29.25	-81.25	-1.060
Crescent City	SE	29.5	-81.125	-1.050
Dinner Island	SE	29.5	-81.375	-1.033
Dinner Island NE	SE	29.375	-81.5	-0.978
Espanola	SE	29.625	-81.375	-1.033
Favoretta	SE	29.25	-81.125	-1.109
Flagler Beach West	SE	29.375	-81.125	-1.089
Hastings	SE	29.625	-81.5	-0.991
Saint Johns Park	SE	29.5	-81.25	-1.053
San Mateo	SE	29.375	-81.375	-1.020
Seville	SE	29.25	-81.375	-1.014
Spuds	SE	29.5	-81.5	-0.991
Average Conversion from NGVD29 to NAVD88 = -1.037 feet				

Table 21: Stream-Based Vertical Datum Conversion

[Not Applicable to this Flood Risk Project]

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping*, www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Digital Orthophoto	U.S Department of Agriculture – Farm Service Agency	2013	*	Raster imagery
Political boundaries	Flagler County GIS Department	2014	*	Municipal boundaries
Political boundaries	FEMA	2006	*	County boundaries
Public Land Survey System (PLSS)	Florida Resources and Environmental Analysis Center	2003	1:24,000	PLSS data
Transportation Features	U.S. Census Bureau, Geography Division	2010	*	All transportation features within the study area
Surface Water Features	FEMA	2006	*	Streams, rivers, and lakes were supplied from Flood Insurance Study, Flagler County and Incorporated Areas 2006
Coastal Barrier Resources	U.S. Fish and Wildlife Service	1991	*	Coastal Barrier Resources polygon

*Data not available

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. All topographic data used for modeling or mapping has been converted as necessary to NAVD88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 25, "Flood Hazard and Non-Encroachment Data for Selected Streams."

Table 23: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data					
		Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
Flagler County	Atlantic Ocean	LiDAR	N/A	N/A	18 cm	35.28 cm	Merrick & Co., 2004

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.

Table 24: Floodway Data

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	16	113	467	3.09	6.9[2]	5.5[3]	6.2	0.7
B	1,618	135	681	2.12	6.9[2]	5.5[3]	6.3	0.8
C	3,156	133	274	4.3	8.9[2]	8.9	9.5	0.6
D	5,460	265	742	1.59	12.9	12.8	13.5	0.7
E	7,892	170	558	2.12	17.8	17.8	17.9	0.1
F	9,779	56	272	3.87	21.4	21.4	22.0	0.6
G	11,662	100	1,066	0.38	21.8	21.8	22.3	0.5
H	13,150	117	693	0.59	21.8	21.8	22.4	0.6
I	15,083	76	486	0.84	22.9	22.9	23.5	0.6
J	16,145	76	488	0.58	23.0	23.0	23.5	0.5
K	17,334	76	489	0.29	23.0	23.0	23.5	0.5
L	17,923	76	489	0.15	23.0	23.0	23.5	0.5
M	18,423	72	489	0.03	23.0	23.0	23.5	0.5
N	18,523	76	489	0.03	23.0	23.0	23.5	0.5

[1]Feet above confluence of Intracoastal Waterway
[2]Combined coastal and riverine effects from Atlantic Ocean and Big Mulberry Branch
[3]Elevation computed without consideration of backwater effects from Intracoastal Waterway

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	1,718	10,517	0.47	10.9	10.9	11.9	1.0
B	3,500	1,366	6,559	0.76	11.1	11.1	12.1	1.0
C	6,109	1,204	6,962	0.62	11.3	11.3	12.3	1.0
D	9,478	1,707	8,815	0.39	11.3	11.7	12.7	1.0
E	11,708	300	1,555	2.24	11.7	11.7	12.7	1.0
F	14,046	67	403	3.38	11.9	11.9	12.9	1.0
G	16,123	900	3,417	0.36	12.4	12.4	13.2	0.8
H	18,444	894	301	3.66	13.7	13.7	13.8	0.1
I	21,031	353	576	1.65	14.6	14.6	14.8	0.2
J	22,494	589	1,469	0.59	14.7	14.7	15.2	0.5

[1]Feet above confluence with Haw Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BLACK BRANCH

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,150	4,408	25,950	0.06	10.9	10.9	11.8	0.9
B	2,317	2,084	9,685	0.13	10.9	10.9	11.8	0.9
C	5,078	1,592	7,686	0.14	10.9	10.9	11.8	0.9
D	7,923	2,341	11,943	0.07	11.0	11.0	11.8	0.8
E	9,897	2,300	11,156	0.06	11.0	11.0	11.8	0.8
F	11,925	47[2]	111	5.13	12.9	12.9	13.1	0.2

[1]Feet above mouth
[2]Value is inaccurate, as the floodway has been adjusted in this area to match topographic-based floodplain redelineation

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BLACK POINT SWAMP

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	18,555	82	405	6.6	6.3	6.3	6.8	0.5
B	19,756	55	383	6.19	9.1	9.1	9.4	0.3
C	20,898	45	323	6.47	10.8	10.8	10.9	0.1
D	23,480	48	413	3.48	13.0	13.0	13.0	0.0
E	25,369	54	370	3.43	13.7	13.7	13.7	0.0
F	28,599	44	238	4.12	15.5	15.5	15.5	0.0
G	31,195	52	232	3.21	17.2	17.2	17.2	0.0
H	33,775	74	414	1.24	17.8	17.8	17.8	0.0

[1]Feet above confluence with Crescent Lake

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BULL CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	710	39	246	7.55	10.9	10.9	11.0	0.1
B	2,002	68	359	5.17	13.5	13.5	13.6	0.1
C	4,578	878	3,438	0.54	17.8	17.8	18.0	0.2
D	7,184	51	352	5.27	20.0	20.0	20.0	0.0
E	9,833	67	370	5.1	22.0	22.0	22.0	0.0
F	12,476	176	799	2.36	22.8	22.8	22.8	0.0
G	15,141	1,114	4,708	0.05	22.8	22.8	22.8	0.0
H	17,748	657	1,892	0.13	22.8	22.8	23.0	0.2

[1]Feet above confluence with Bull Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BULL CREEK TRIBUTARY

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	800	4,627	0.48	5.2[2]	5.1	6.1	1.0
B	820	1,500	8,073	0.24	5.2[2]	5.1	6.1	1.0
C	7,380	621	3,643	0.53	5.4[2]	5.4	6.4	1.0
D	12,750	341	2,804	0.69	5.5[2]	5.4	6.4	1.0
E	17,010	423	2,878	0.68	5.5[2]	5.5	6.5	1.0
F	21,980	568	3,984	0.49	5.8[2]	5.7	6.7	1.0
G	25,580	620	3,242	0.60	6.7[2]	6.8	7.7	0.9
H	28,780	245	1,032	1.48	10.7	10.7	11.6	0.9
I	30,830	200	672	1.11	13.9	13.9	14.4	0.5
J	32,262	31	156	4.78	20.2	20.2	20.2	0.0

[1]Feet above county boundary
[2]Combined coastal and riverine effects from Atlantic Ocean and Bulow Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BULOW CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	346	1,345	1.14	11.0	11.0	12.0	1.0
B	2,300	103	372	2.06	16.3	16.3	16.8	0.5
C	4,700	226	354	1.5	19.0	19.0	19.0	0.0

[1]Feet above confluence with Bulow Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BULOW CREEK TRIBUTARY

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	5,190	5,590	39,423	0.21	6.3	6.3[2]	7.2	0.9
B	12,056	1,790	15,982	0.71	6.3	6.3[2]	7.2	0.9
C	20,567	1,849	9,443	1.63	6.4	6.4	7.3	0.9
D	23,928	3,215	17,928	0.63	6.8	6.8	7.8	1.0
E	27,809	2,268	14,252	0.79	7.1	7.1	8.1	1.0
F	30,372	550	2,417	3.23	7.3	7.3	8.2	0.9
G	33,009	1,291	4,363	1.79	9.5	9.5	10.5	1.0
H	36,889	7,437	28,965	0.27	10.6	10.6	11.3	0.7
I	41,076	5,716	32,976	0.24	10.7	10.7	11.4	0.7
J	45,311	3,074	20,103	0.39	10.7	10.7	11.5	0.8
K	48,644	5,232	22,521	0.35	10.8	10.6	11.6	1.0
L	51,380	3,661	21,628	0.34	10.9	10.9	11.7	0.8

[1]Feet above confluence with Crescent Lake

[2]Elevation computed without consideration of backwater effects from Crescent Lake

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: HAW CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	269	1,923	2.6	12.1	12.1	13.1	1.0
B	1,478	343	2,182	2.3	12.6	12.6	13.5	0.9
C	4,808	484	2,736	1.8	13.9	13.9	14.9	1.0
D	5,268	270	2,097	2.4	14.0	14.0	15.0	1.0
E	7,617	1,374	7,002	0.7	14.5	14.5	15.5	1.0
F	10,017	2,587	14,352	0.3	14.6	14.6	15.6	1.0
G	13,187	758	3,626	1.2	14.9	14.9	15.9	1.0
H	16,837	1,370	6,858	0.6	15.6	15.6	16.6	1.0
I	20,217	1,526	6,959	0.6	16.1	16.1	17.1	1.0
J	26,617	400	1,264	2.8	19.5	19.5	20.2	0.7
K	27,847	300	1,349	2.6	21.2	21.2	21.8	0.6
L	28,669	241	1,320	2.7	22.2	22.2	22.8	0.6
M	32,539	645	3,130	1.1	23.8	23.8	24.6	0.8
N	37,589	1,218	3,743	0.8	25.1	25.1	26.0	0.9
O	40,289	1,075	4,240	0.7	25.8	25.8	26.7	0.9
P	46,389	1,542	5,281	0.6	28.1	28.1	29.1	1.0

[1]Feet above State Route 11

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: MIDDLE HAW CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2,300	545	1,650	0.8	14.5	12.5[2]	13.5	1.0
B	5,760	627	1,875	0.6	14.5	14.4[2]	15.4	1.0
C	6,360	823	2,351	0.4	14.7	14.7	15.7	1.0

[1]Feet above confluence with Middle Haw Creek
[2]Elevation computed without consideration of backwater effects from Middle Haw Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: MIDDLE HAW CREEK TRIBUTARY NO. 1

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2,500	150	410	1.0	26.6	26.6	27.6	1.0
B	2,980	109	246	1.7	27.6	27.6	28.6	1.0
C	7,054	253	773	0.3	28.8	28.8	29.8	1.0
D	7,454	106	329	0.7	29.2	29.2	30.2	1.0

[1]Feet above confluence with Middle Haw Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: MIDDLE HAW CREEK TRIBUTARY NO.2

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	7,600	120	693	0.8	13.3	13.3	13.6	0.3

[1]Feet above county boundary

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SIXTEENMILE CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	85	718	2,150	1.3	16.3	16.3	16.9	0.6
B	3,879	592	2,797	0.9	18.2	18.2	18.6	0.4
C	6,679	363	1,897	1.3	18.8	18.8	19.3	0.5
D	7,199	503	3,091	0.8	19.0	19.0	19.6	0.6
E	9,761	710	2,988	0.8	19.4	19.4	20.0	0.6
F	15,061	613	1,590	1.4	21.5	21.5	22.5	1.0
G	20,339	1,513	2,634	0.9	23.7	23.7	24.5	0.8
H	25,617	1,253	2,933	0.5	25.7	25.7	26.5	0.8

[1]Feet above State Road 304

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SWEETWATER BRANCH

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	140	59	329	4.01	14.2	14.2	14.2	0.0
B	2,480	37	185	6.39	16.2	16.2	16.2	0.0
C	4,484	59	436	2.71	19.3	19.3	19.3	0.0
D	7,254	57	206	4.46	22.1	22.1	22.1	0.0
E	9,315	52	242	2.97	23.4	23.4	23.4	0.0
F	11,222	63	158	2.05	25.4	25.4	25.4	0.0
G	13,013	735	3,684	0.04	25.5	25.5	25.5	0.0
H	14,599	572	1,196	0.14	25.5	25.5	25.5	0.0
I	16,517	417	894	0.18	25.5	25.5	25.6	0.1

[1]Feet above county boundary

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FLORIDA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WADSWORTH/KORONA CANAL

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

[Not Applicable for this Flood Risk Project]

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either “V” zones or “A” zones.

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
1		VE 11	VE 11 AE 3-5	Runup	SWEL
2		VE 11	VE 11 AE 3-5	Runup	SWEL
3		VE 11	VE 11 AE 3-5	Runup	SWEL
4		VE 11	VE 11 AE 3-5	Runup	SWEL
5		VE 11	VE 11 AE 4-5	Runup	SWEL
6		VE 11	VE 11 AE 3-4	Runup	SWEL
7		VE 11	VE 11 AE 4-5	Runup	SWEL
8		VE 11	VE 11 AE 3-5	Runup	SWEL
9		VE 11	VE 11 AE 3-4	Runup	SWEL
10		VE 11	VE 11 AE 3-4	Runup	SWEL
11		VE 12	VE 11 AE 3-4	Runup	SWEL
12		VE 11	VE 11 AE 3-5	Runup	SWEL
13		VE 11	VE 11 AE 3-5	Runup	SWEL
14		VE 11	VE 11 AE 4-5	Runup	SWEL
15		VE 11	VE 11 AE 3-5	Runup	SWEL
16	✓	VE 11	VE 11 AE 4-5	PFD	SWEL
17		VE 12	VE 12 AE 4-5	Runup	SWEL

Table 26: Summary of Coastal Transect Mapping Considerations, continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
18	✓	VE 11	VE 11 AE 4-5	PFD	SWEL
19	✓	VE 11	VE 11 AE 4-5	PFD	SWEL
20	✓	VE 12	VE 12 AE 4-5	PFD	SWEL
21	✓	VE 10	VE 10-11 AE 4-5	PFD	SWEL
22	✓	VE 11	VE 11 AE 4-5	PFD	SWEL
23	✓	VE 11	VE 11 AE 4-5	PFD	SWEL
24	✓	VE 11	VE 11	PFD	PFD
25	✓	VE 11	VE 11 AE 5-6	PFD	SWEL
26	✓	VE 11 AO 2	VE 11	PFD	Overtopping
27	✓	VE 10 AO 1	VE 10-11	PFD	Overtopping
28	✓	VE 11	VE 11 AE 6	PFD	SWEL
29	✓	VE 10 AO 1	VE 10-11 AE 6-8	PFD	Overtopping
30	✓	VE 10 AO 1	VE 10-11 AE 6-8	PFD	Overtopping
31	✓	VE 10 AO 2	VE 10-11 AE 6-8	PFD	Overtopping
32	✓	VE 11	VE 11 AE 6-8	PFD	SWEL
33	✓	VE 11 AO 1	VE 11 AE 5-8	PFD	Overtopping
34	✓	VE 11 AO 1	VE 11 AE 5-8	PFD	Overtopping
35	✓	VE 10 AO 2	VE 11-12 AE 6-8	PFD	Overtopping

Table 26: Summary of Coastal Transect Mapping Considerations, continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
36	✓	VE 15 AO 1	VE 15 AE 6-7	PFD	Overtopping
37*		N/A	AE 6-7	N/A	SWEL
38*		N/A	AE 6-7	N/A	SWEL

*Transect originates in St. Johns County, Florida. See St. Johns County FIS Report.

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA. A LOMA cannot be issued for properties located on the PFD (primary frontal dune).

To obtain an application for a LOMA, visit www.fema.gov/floodplain-management/letter-map-amendment-loma and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at www.fema.gov/online-tutorials.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting www.fema.gov/floodplain-management/letter-map-amendment-loma for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at www.fema.gov/online-tutorials.

6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/mt-2-application-forms-and-instructions and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the Flagler County FIRM are listed in Table 27.

Table 27: Incorporated Letters of Map Change

Case Number	Effective Date	Flooding Source	FIRM Panel(s)
06-04-BW09P	11-30-2006	Bulow Creek	12035C0231E, 12035C0232E, 12035C0233E, 12035C0234E
07-04-1034P	03-30-2007	Bulow Creek	12035C0234E, 12035C0242E
07-04-1820P	03-30-2007	Graham Swamp	N/A

6.5.4 Physical Map Revisions

Physical Map Revisions (PMRs) are an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or

improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of Flagler County. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first Flood Hazard Boundary Map (FHBM). This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as Physical Map Revisions (PMR) of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Flagler County FIRMs in countywide format was 07/17/2006.

Table 28: Community Map History

Community Name	Initial Identification Date	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Beverly Beach, Town of	06/24/1977	06/24/1977	N/A	01/03/1986	07/17/2006
Bunnell, City of	07/11/1975	07/11/1975	N/A	01/03/1986	07/17/2006
Flagler Beach, City of	02/01/1974	02/01/1974	02/06/1976	05/15/1985	07/17/2006
Flagler County, Unincorporated Areas	01/10/1975	01/10/1975	02/25/1977	02/05/1986	07/17/2006 07/15/1992
Marineland, Town of	07/08/1977	07/08/1977	N/A	02/19/1986	07/17/2006
Palm Coast, City of[1]	01/10/1975	01/10/1975	02/25/1977	02/05/1986	07/17/2006 07/15/1992

[1] This community did not have its own FIRM prior to the 2006 countywide FIS. The land area for this community was previously shown on the FIRM for the unincorporated areas of Flagler County, but was not identified as a separate NFIP community. Therefore, the dates for this community were taken from the FIRM for Flagler County.

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Atlantic Ocean		BakerAECOM	HSFEHQ-09-D-0368	July 2015	Beverly Beach, Town of; Bunnell, city of; Flagler Beach, City of; Flagler County, Unincorporated Areas; Marineland, Town of; Palm Coast, City of
All Sources within Town of Beverly Beach	01/03/1986	*	*	*	Beverly Beach, Town of
All Sources within City of Bunnel	01/03/1986	*	*	*	Bunnell, City of
All Sources within City of Flagler Beach	05/15/1985	Tetra Tech	EMW-C-0724	July 1983	Flagler Beach, City of
All Sources within Flagler County, Unincorporated Areas	02/05/1986	Tetra Tech	EMW-C-0724	August 1983	Flagler County, Unincorporated Areas
All Sources within Flagler County Incorporated Areas	07/17/2006	Taylor Engineering	EMA-97-CO-0137 M-002	October 2001	Flagler County and Incorporated Areas
All Sources within Town of Marineland	02/19/1986	*	*	*	Marineland, Town of

*Data not available

7.2 Community Meetings

The dates of the community meetings held for this Flood Risk Project and previous Flood Risk Projects are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Beverly Beach, Town of		*	Initial CCO	*
		01/21/1985	Final CCO	FEMA, the community, and the study contractor
	07/17/2006	09/02/1997	Initial CCO	Representatives of the county, municipalities and the study contractor
		06/30/1998	Final CCO	Representatives of the county, municipalities and the study contractor
Bunnell, City of		*	Initial CCO	*
		06/18/1985	Final CCO	FEMA, the community, and the study contractor
	07/17/2006	09/02/1997	Initial CCO	Representatives of the county, municipalities and the study contractor
		06/30/1998	Final CCO	Representatives of the county, municipalities and the study contractor
Flagler Beach, City of	05/15/1985	08/05/1981	Initial CCO	FEMA, the community, and the study contractor
		11/01/1984	Final CCO	FEMA, the community, and the study contractor
	07/17/2006	09/02/1997	Initial CCO	Representatives of the county, municipalities and the study contractor
		06/30/1998	Final CCO	Representatives of the county, municipalities and the study contractor
Flagler County, Unincorporated Areas	05/15/1985	08/05/1981	Initial CCO	FEMA, the community, and the study contractor
		10/31/1984	Final CCO	FEMA, the community, and the study contractor
	07/17/2006	09/02/1997	Initial CCO	Representatives of the county, municipalities and the study contractor
		06/30/1998	Final CCO	Representatives of the county, municipalities and the study contractor

Table 30: Community Meetings, continued

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Flagler County, Unincorporated Areas	<date>	03/01/2011	Scoping	FEMA, the community, and the study contractor
		<date>	Final CCO	
Marineland, Town of		*	Initial CCO	FEMA, the community, and the study contractor
		01/22/1985	Final CCO	FEMA, the community, and the study contractor
	07/17/2006	09/02/1997	Initial CCO	Representatives of the county, municipalities and the study contractor
		06/30/1998	Final CCO	Representatives of the county, municipalities and the study contractor
Palm Coast, City of	07/17/2006	09/02/1997	Initial CCO	Representatives of the county, municipalities and the study contractor
		06/30/1998	Final CCO	Representatives of the county, municipalities and the study contractor

*Data not available

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see www.fema.gov.

Table 31 is a list of the locations where FIRMs for Flagler County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
Beverly Beach, Town of	Beverly Beach Town Hall 2735 North Oceanshore Boulevard	Beverly Beach	FL	32136
Bunnell, City of	Bunnell City Hall 201 West Moody Boulevard	Bunnell	FL	32110
Flagler Beach, City of	Flagler Beach City Hall 105 South Second Street	Flagler Beach	FL	32136
Flagler County, Unincorporated Areas	Flagler County Planning and Zoning Department 1769 East Moody Boulevard, Building 2	Bunnell	FL	32110
Marineland, Town of	Marineland Town Office 9507 Oceanshore Boulevard	St. Augustine	FL	32080
Palm Coast, City of	Palm Coast City Hall 160 Lake Avenue	Palm Coast	FL	32164

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32.

Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the State NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of State and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/engineering-library
NFIP website	www.fema.gov/national-flood-insurance-program
NFHL Dataset	msc.fema.gov
FEMA Region IV	FEMA-R4 (Hollins Building), 3003 Chamblee-Tucker Road, Atlanta, GA 30341 (770) 220-3174
Other Federal Agencies	
USGS website	www.usgs.gov
Hydraulic Engineering Center website	www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	Steve Martin, CFM, State NFIP and Floodplain Manager Florida Division of Emergency Management 2555 Shumard Oak Boulevard Tallahassee, FL 32399 - 2100 850-922-5269 steve.martin@em.myflorida.com
State GIS Coordinator	Richard Butgereit, GIS Administrator Florida Division of Emergency Management 2555 Shumard Oak Boulevard Tallahassee, FL 32399 - 2100 Phone: 850-413-9907 richard.butgereit@em.myflorida.com

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Delft University of Technology	Delft University of Technology, the Netherlands	*SWAN User Manual*, SWAN Cycle III version 40.51	SWAN Team, Delft University of Technology, the Netherlands		2006	
Federal Emergency Management Agency, 2008	Federal Emergency Management Agency	*Tide Gage Analysis for the Atlantic and Gulf Open Coast*			December 2008	
FEMA, 2007	Federal Emergency Management Agency	*Procedure Memorandum No. 47 – Guidance for the Determination of the 0.2-Percent-Annual-Chance Wave Envelope along the Atlantic Ocean and Gulf of Mexico Coasts*			September, 2007	
FEMA, 1986	Federal Emergency Management Agency	*Flood Insurance Study, Flagler County, Florida (Unincorporated Areas)*		Washington, D.C.	February 1986	
Federal Emergency Management Agency, May 1985	Federal Emergency Management Agency	*Flood Insurance Study, City of Flagler Beach, Flagler County, Florida*		Washington, D.C.	May 1985	
FEMA, 1981	Federal Emergency Management Agency	*Flood Insurance Study, Putnam County, Florida (Unincorporated Areas)*			September 1981	

Table 33: Bibliography and References, continued

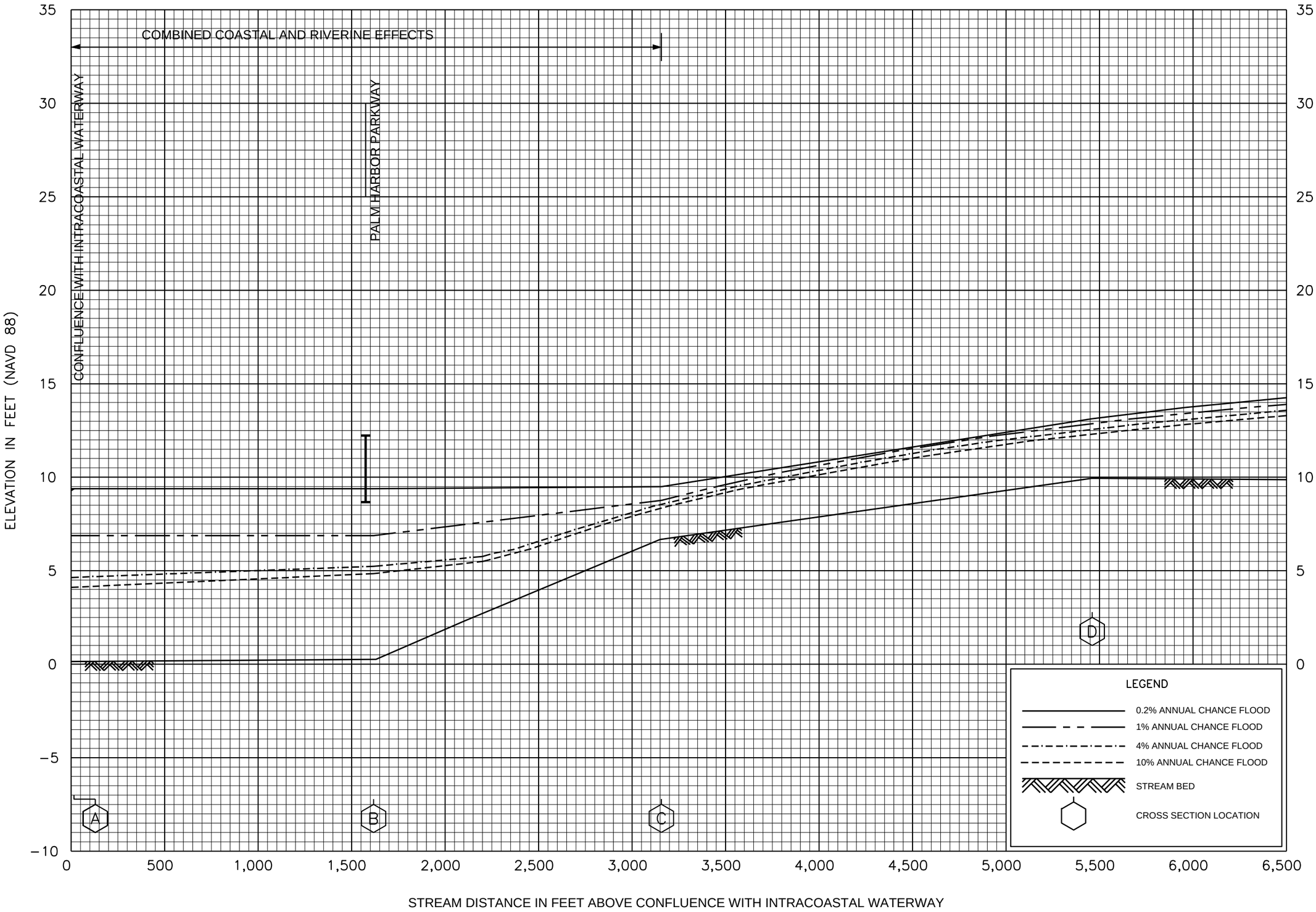
Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Luettich, R.A. and J.J. Westerink		*Formulation and Numerical Implementation of the 2D/3D ADCIRC Finite Element Model*	Luettich, R.A. and J.J. Westerink		2004	http://www.adcirc.org
Merrick & Co., 2004		*Topographic Light Detection and Ranging (LiDAR) data*			2004	
Professional Engineering Consultants, Inc., 1997	Professional Engineering Consultants, Inc.	*Stormwater Structure Inventory, Flagler County*			July 1997	
Resio, 2007		*White Paper on Estimating Hurricane Inundation Probabilities (with contributions from S.J. Boc, L. Borgman, V. Cardone, A. Cox, W.R. Dally, R.G. Dean, D. Divoky, E. Hirsh, J.L. Irish, D. Levinson, A. Niedoroda, M.D. Powell, J.J. Ratcliff, C. Stutts, J.Suhada, G.R. Toro, and P.J. Vickery). Appendix 8-2 (R2007) of USACE (2007), Interagency Performance Evaluation Taskforce (IPET) Final Report.*	Resio, D.T.		2007	
State of Florida, 1978	State of Florida, Department of Natural Resources	*Flagler Coastal Construction Control Line. Aerial Photographs, Scale 1:1,200*			February 1978	

Table 33: Bibliography and References, continued

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Stepp and Upham, Inc.		*Topographic Maps, Scales 1:24,000 and 1:4,800*	Stepp and Upham, Inc.		Undated	
Sverdrup & Parcel and Associates, Inc., Project 5089, 1977	ITT Community Development Corporation	*A Comprehensive Water Management Plan for Community Wide Drainage for Sections 57-65 – Project 5089*	Sverdrup & Parcel and Associates, Inc.		1977	
Sverdrup & Parcel and Associates, Inc., Project 5089A	ITT Community Development Corporation	*A Comprehensive Water Management Plan for Community Wide Drainage for Palm Coast Module One Program – North of S.R. 100, Project 5089A*	Sverdrup & Parcel and Associates, Inc.		1977	
Tetra Tech, Inc., 1983	Tetra Tech, Inc.	*WRE Note 83-5, Flood Insurance Study, St. Johns and Flagler Counties, Florida, Preparation of Hydrology*	Shirly Schluchter		1983	
Tetra Tech, Inc., 1981	Tetra Tech, Inc.	*Aerial Photographs, Scale 1:2,000*			December 1981	
Toro, 2010		"Efficient Joint Probability Methods for Hurricane Surge Frequency Analysis," *Ocean Engineering,* Vol. 37, pp. 125-134.	Toro, G., D.T. Resio, D. Divoky, A.W. Niedoroda, C.W. Reed		2010	
USACE, 1976	U.S. Army Corps of Engineers	*HEC-2 Water-Surface Profiles, User's Manual*			November 1976	

Table 33: Bibliography and References, continued

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USACE, 1974	U.S. Army Corps of Engineers, Hydrologic Engineering Center	*Application of the HEC-2 Bridge Routines*			June 1974	
U.S. Department of the Interior, 1982	U.S. Department of the Interior, Geological Survey	*Technique for Estimating Magnitude and Frequency of Floods on Natural-Flow Streams in Florida, (WRI 82-4012)*		Washington, D.C.	1982	
USGS, 1967	U.S. Geological Survey	*Water-Supply Paper 1849, Roughness Characteristics of Natural Channels*			1967	
U.S. Soil Conservation Service, 1986	Water Resources publications	*Urban Hydrology for Small Watersheds (Technical Release No. 55)*		Littleton, Colorado	1986	
U.S. Water Resources Council, 1976	U.S. Water Resources Council	*Bulletin No. 17A, Guidelines for Determining Flood Flow Frequency*			March 1976, revised 1977	
Zahn and Glinger Engineering, Inc.	Zahn and Glinger Engineering, Inc.	*Drainage Calculations on Smoketalk Ridge Subdivision*			1982	



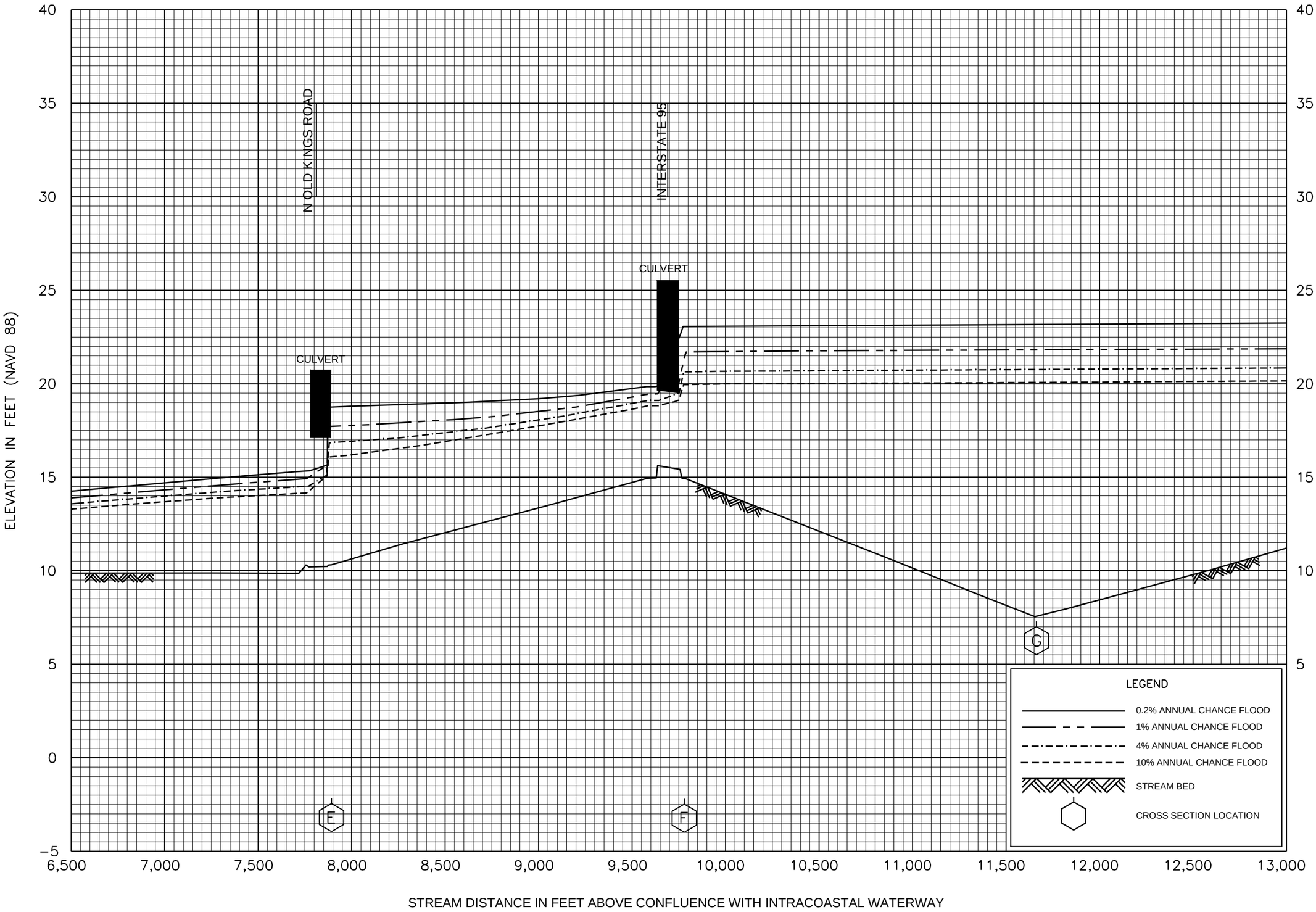
FLOOD PROFILES

BIG MULBERRY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



FLOOD PROFILES

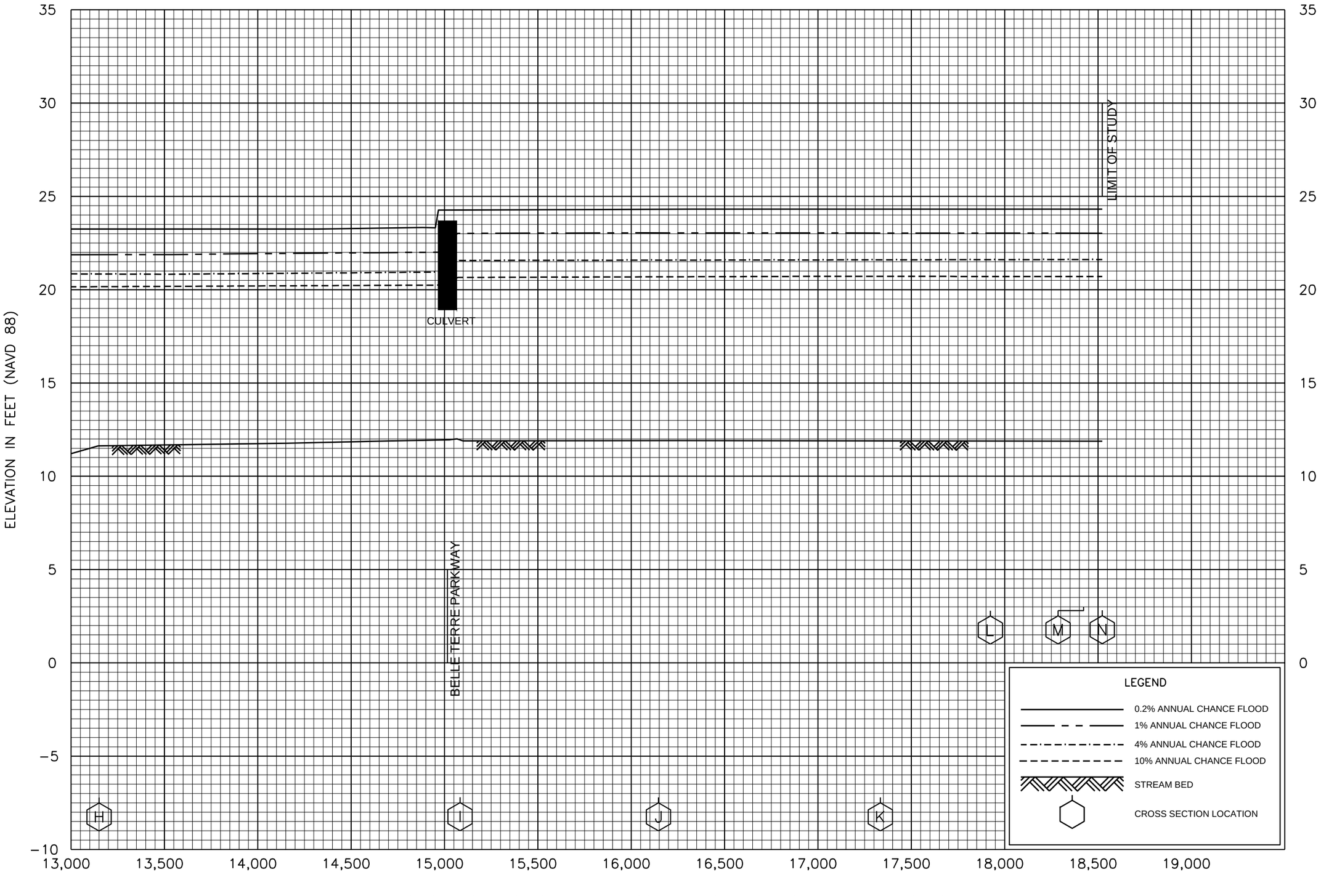
BIG MULBERRY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS

02P



FLOOD PROFILES

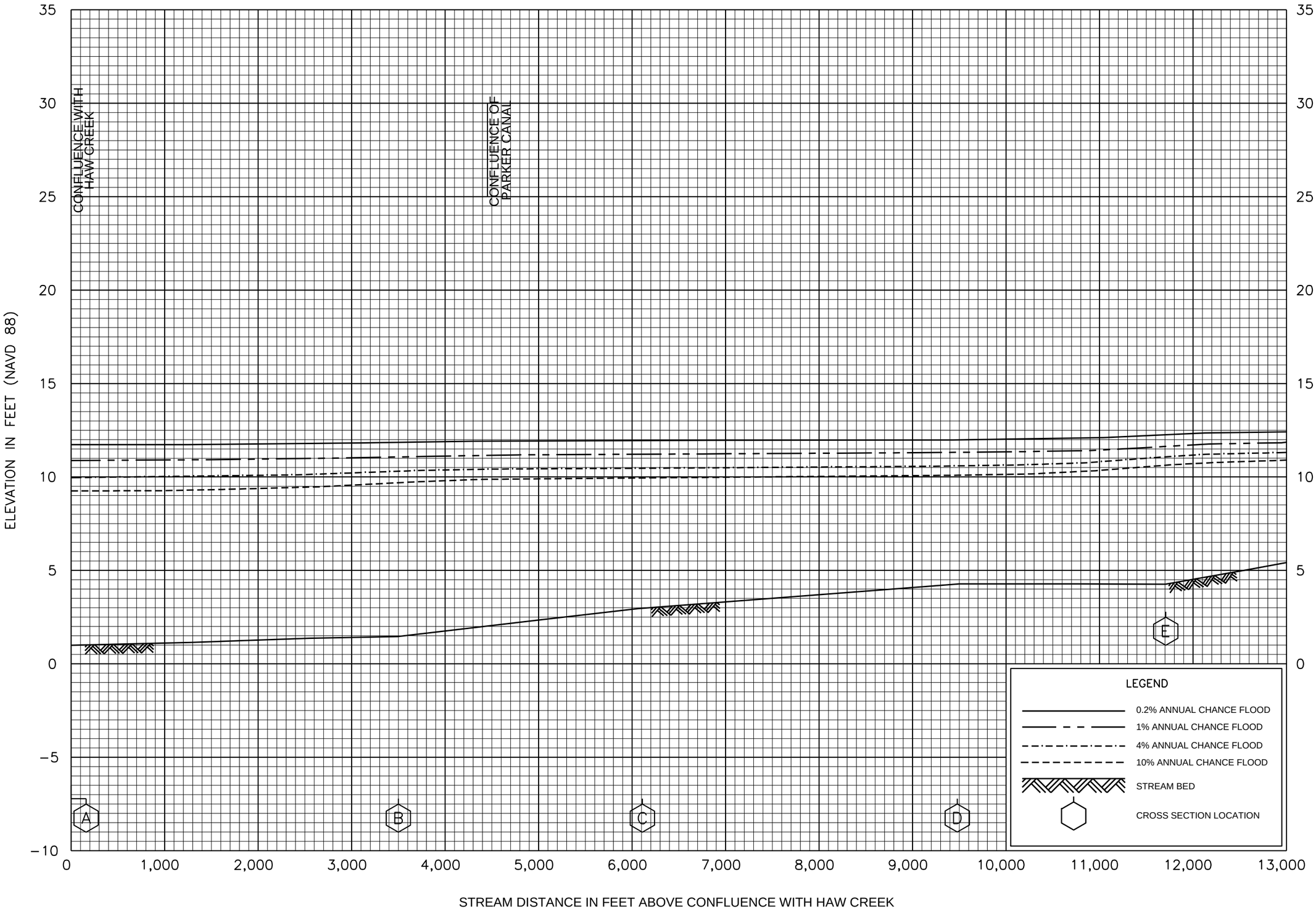
BIG MULBERRY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS

03P



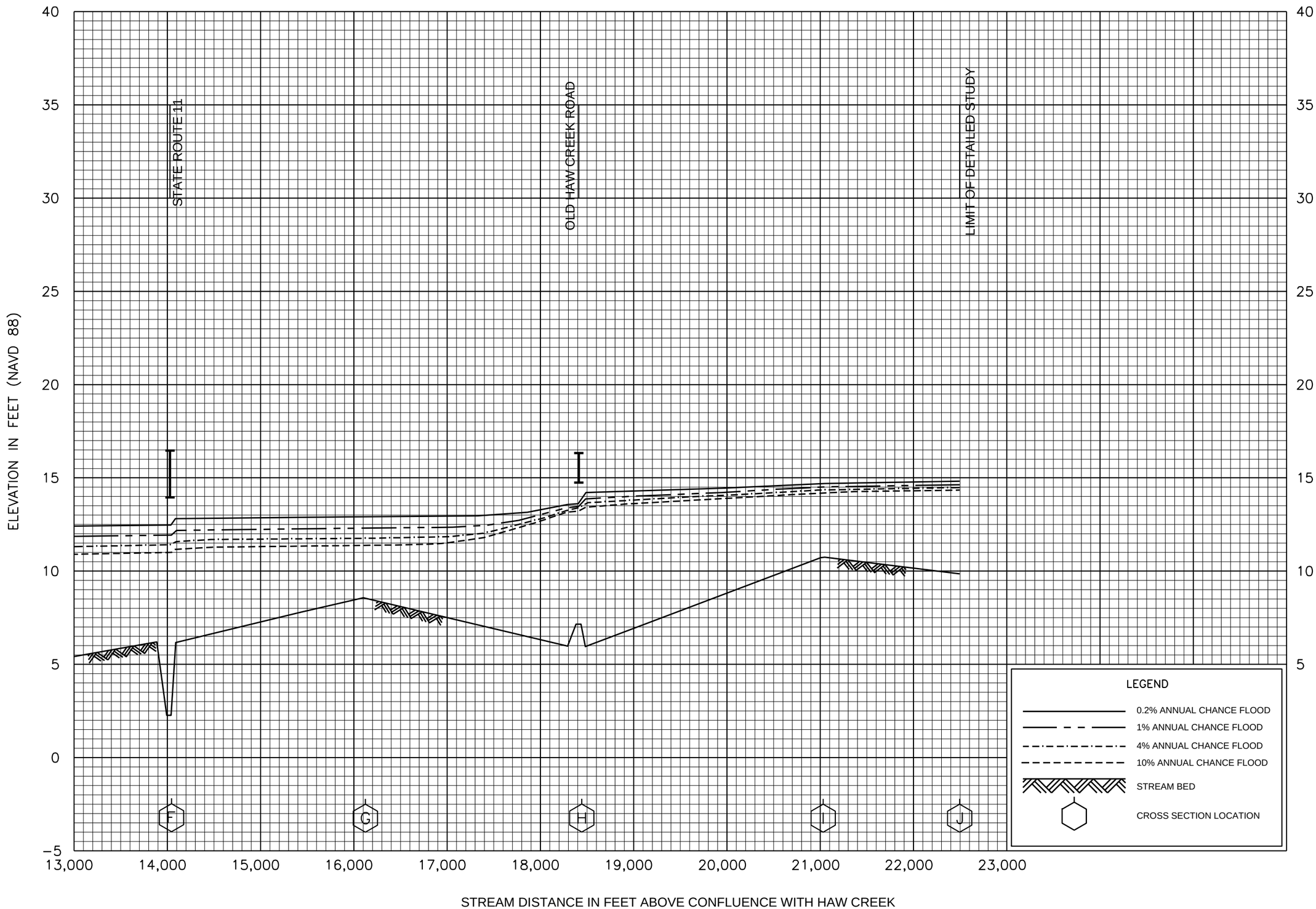
FLOOD PROFILES

BLACK BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



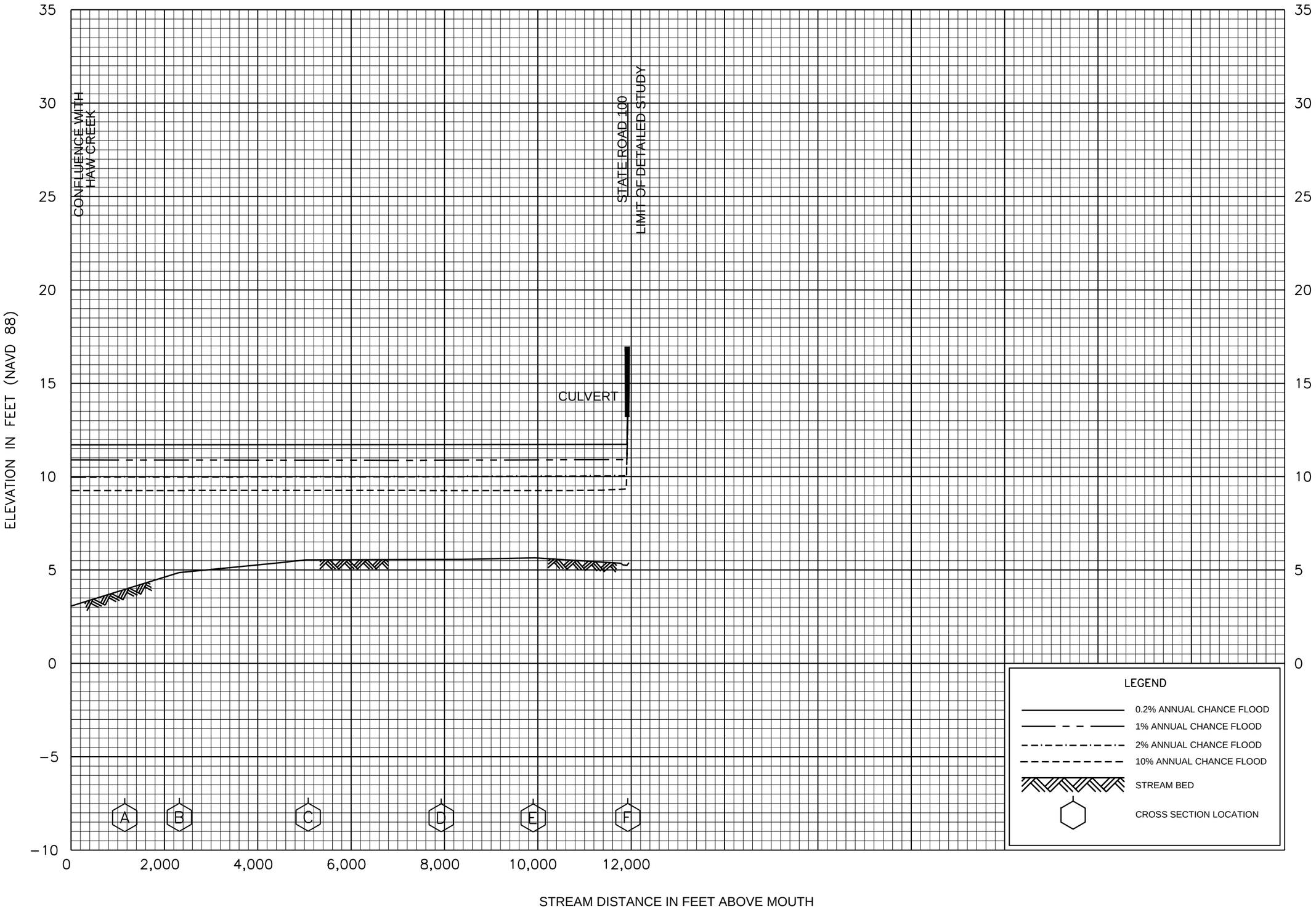
FLOOD PROFILES

BLACK BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



FLOOD PROFILES

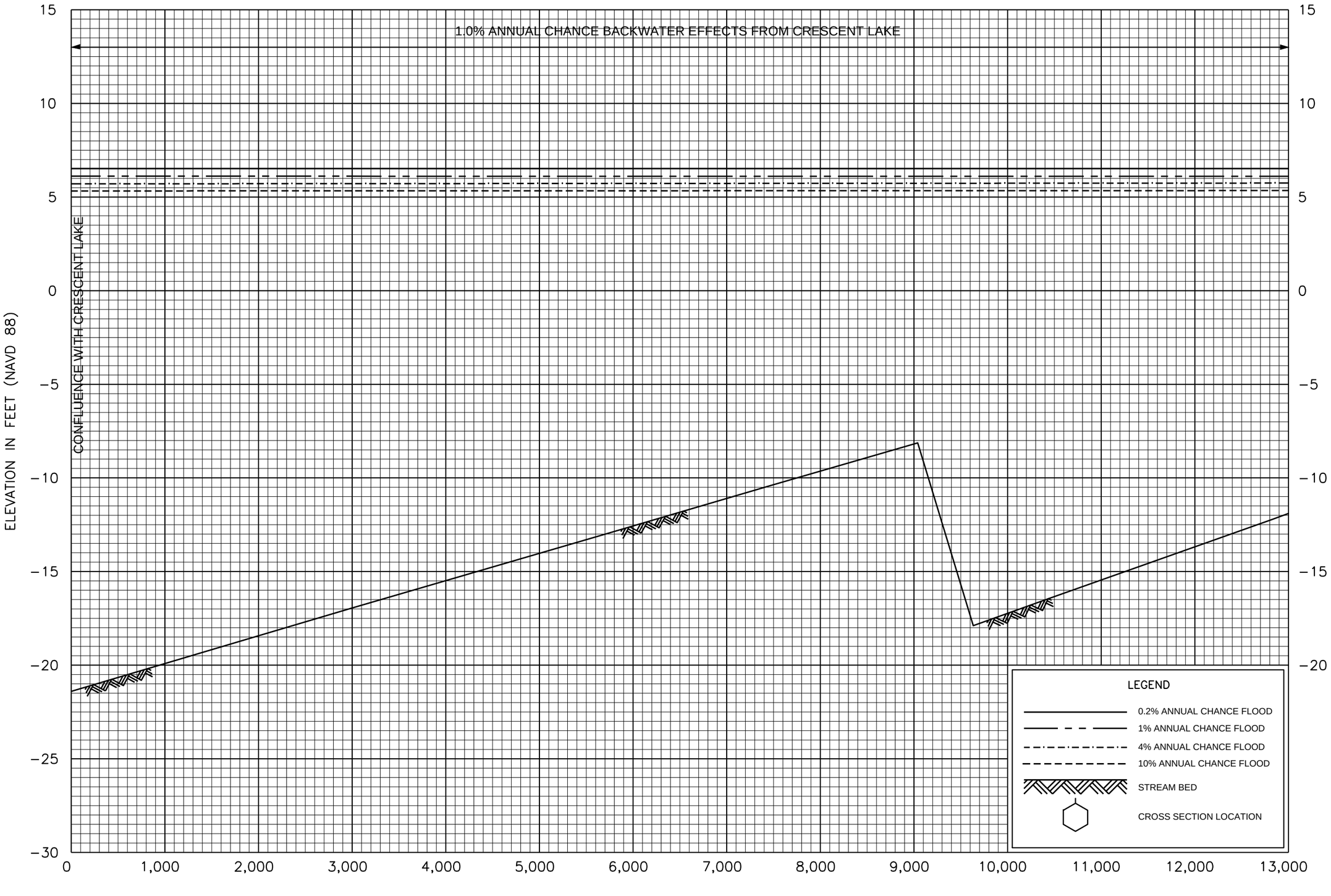
BLACK POINT SWAMP

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY FL

AND INCORPORATED AREAS

06P



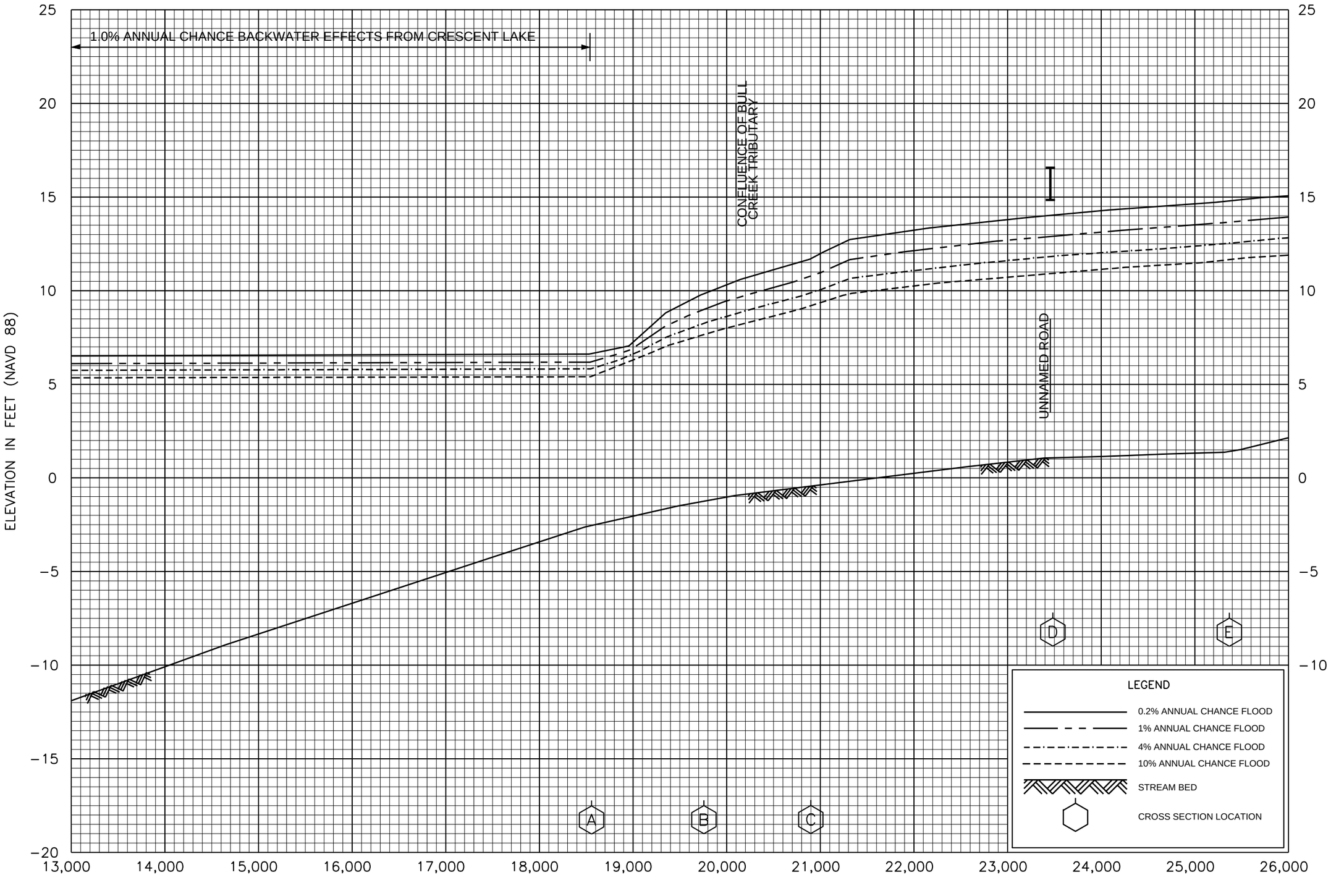
FLOOD PROFILES

BULL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



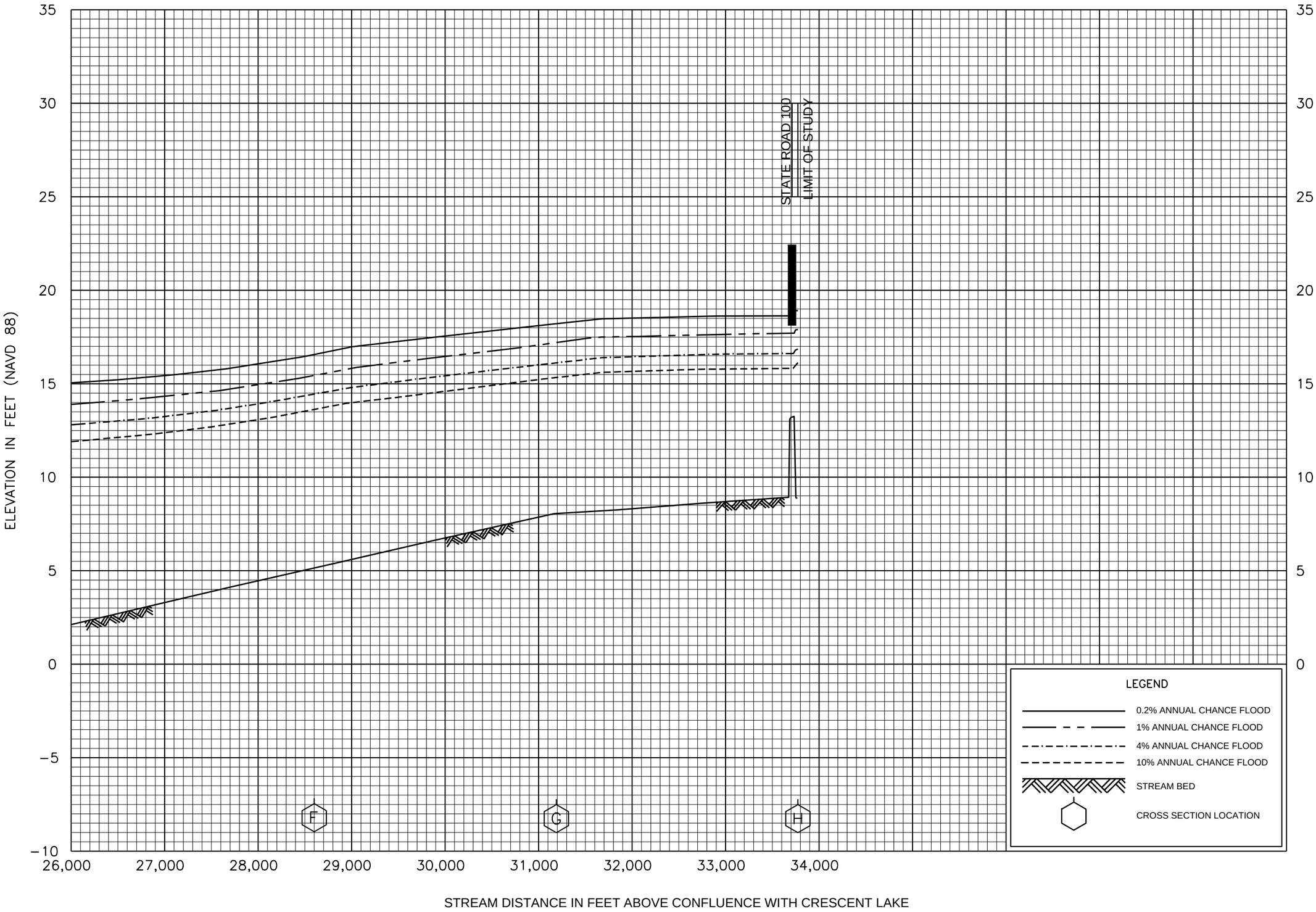
FLOOD PROFILES

BULL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



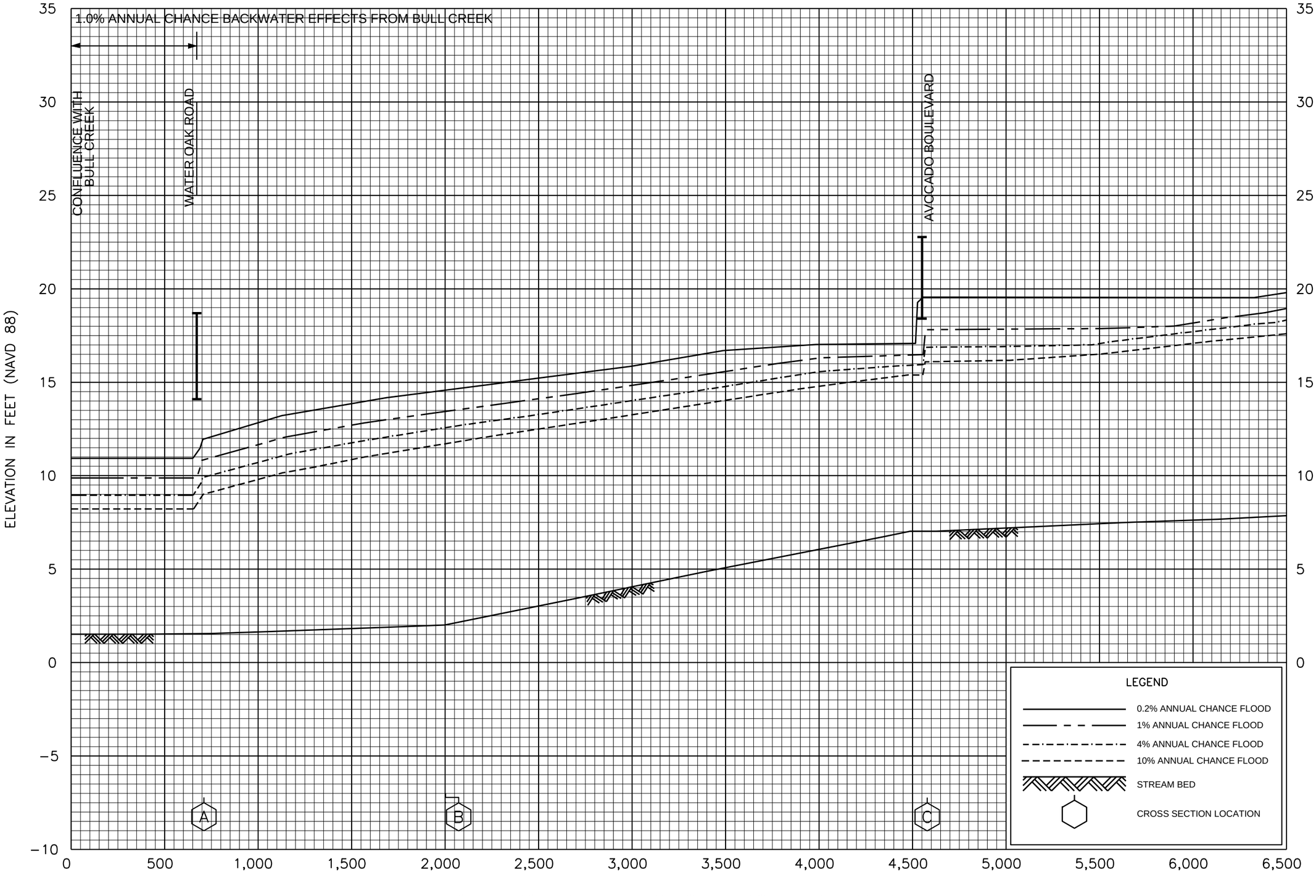
FLOOD PROFILES

BULL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



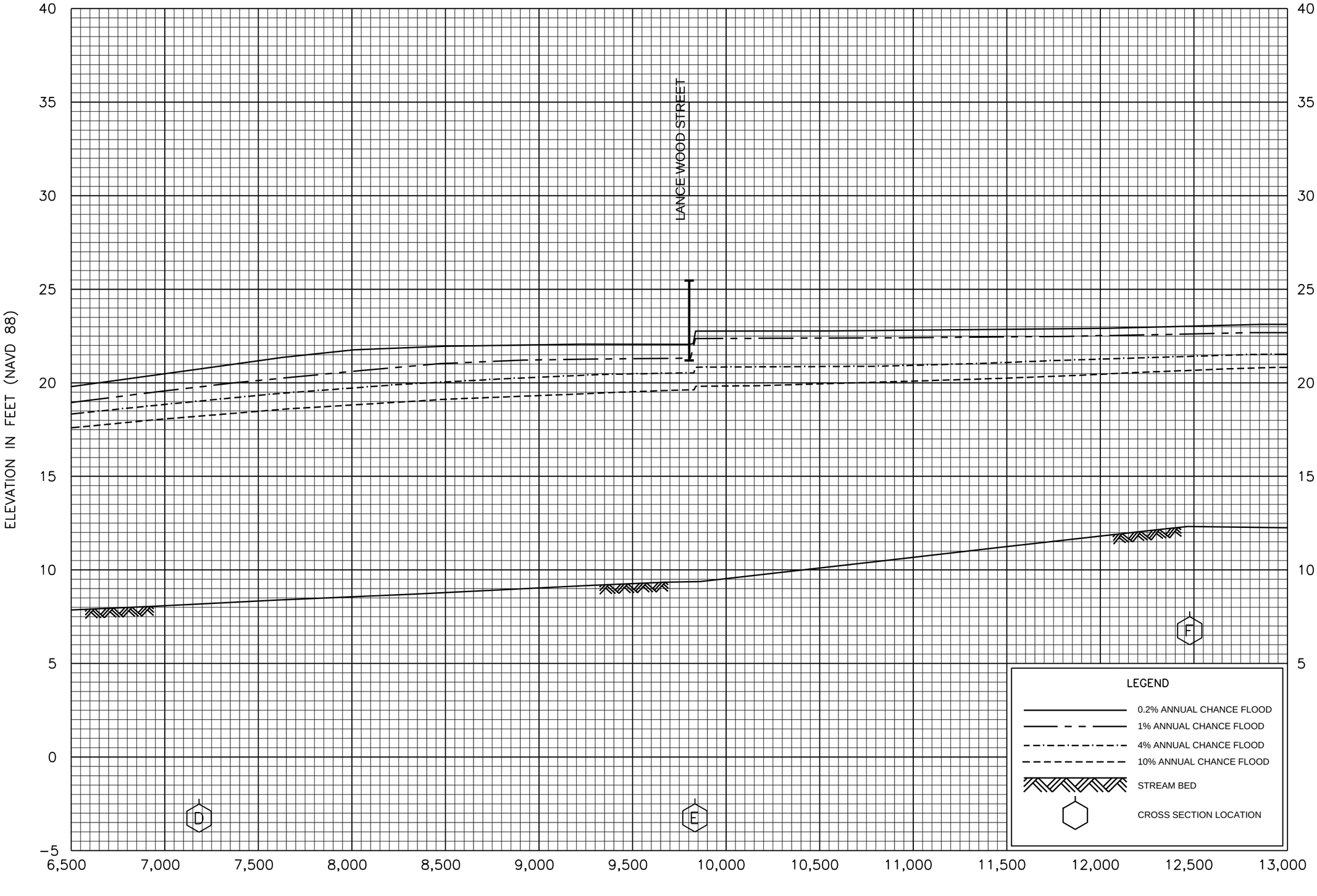
FLOOD PROFILES

BULL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY FL

AND INCORPORATED AREAS



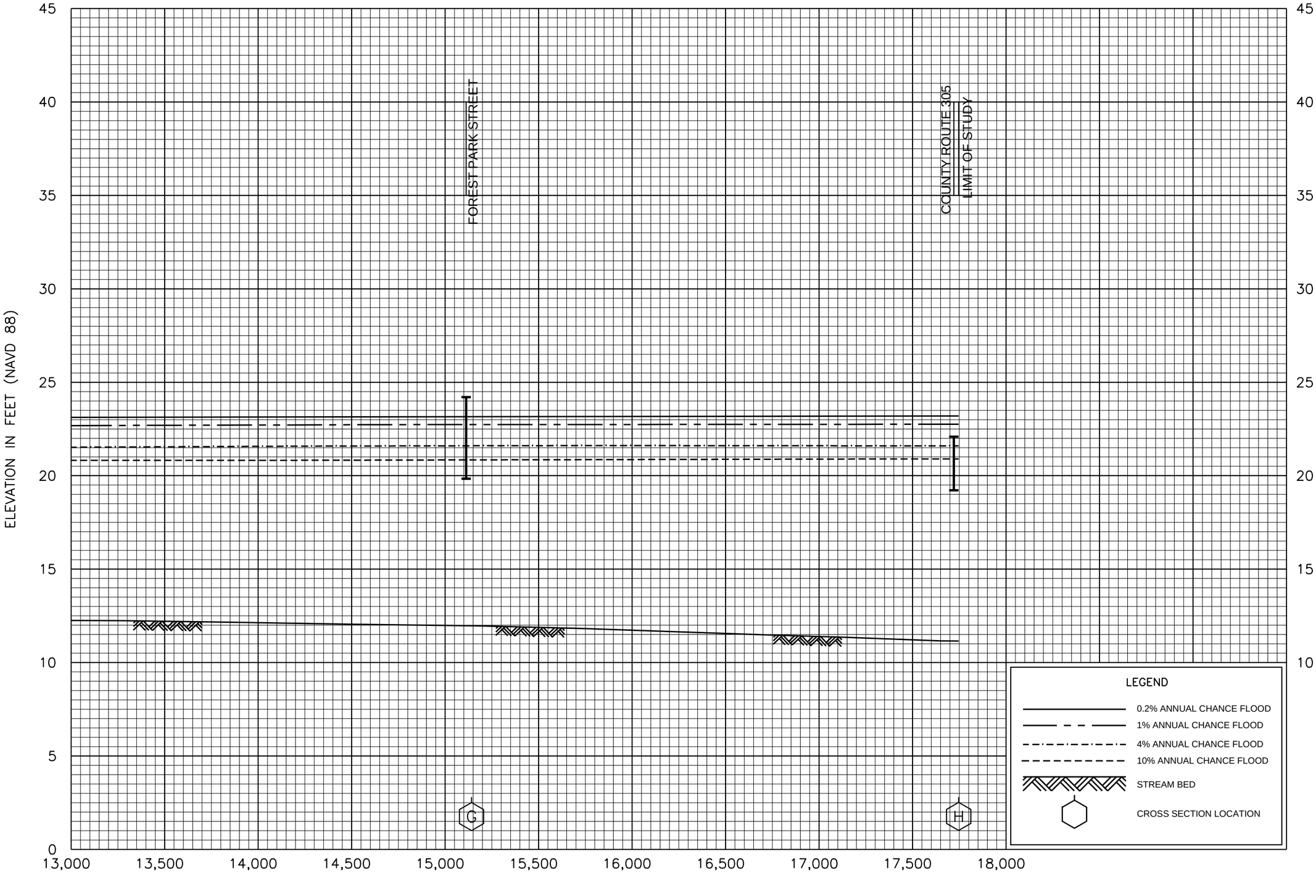
FLOOD PROFILES

BULL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY FL

AND INCORPORATED AREAS



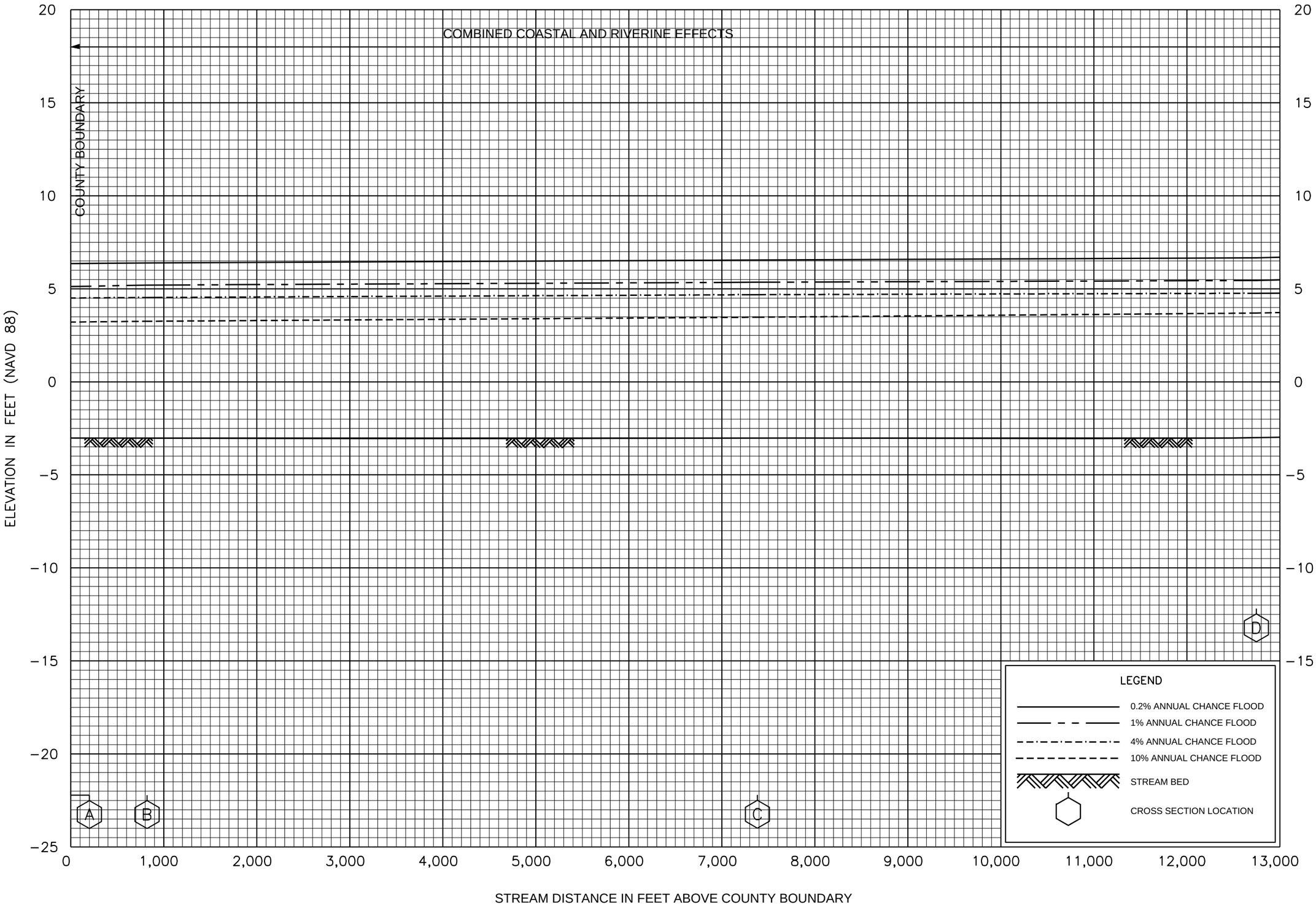
FLOOD PROFILES

BULL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY FL

AND INCORPORATED AREAS



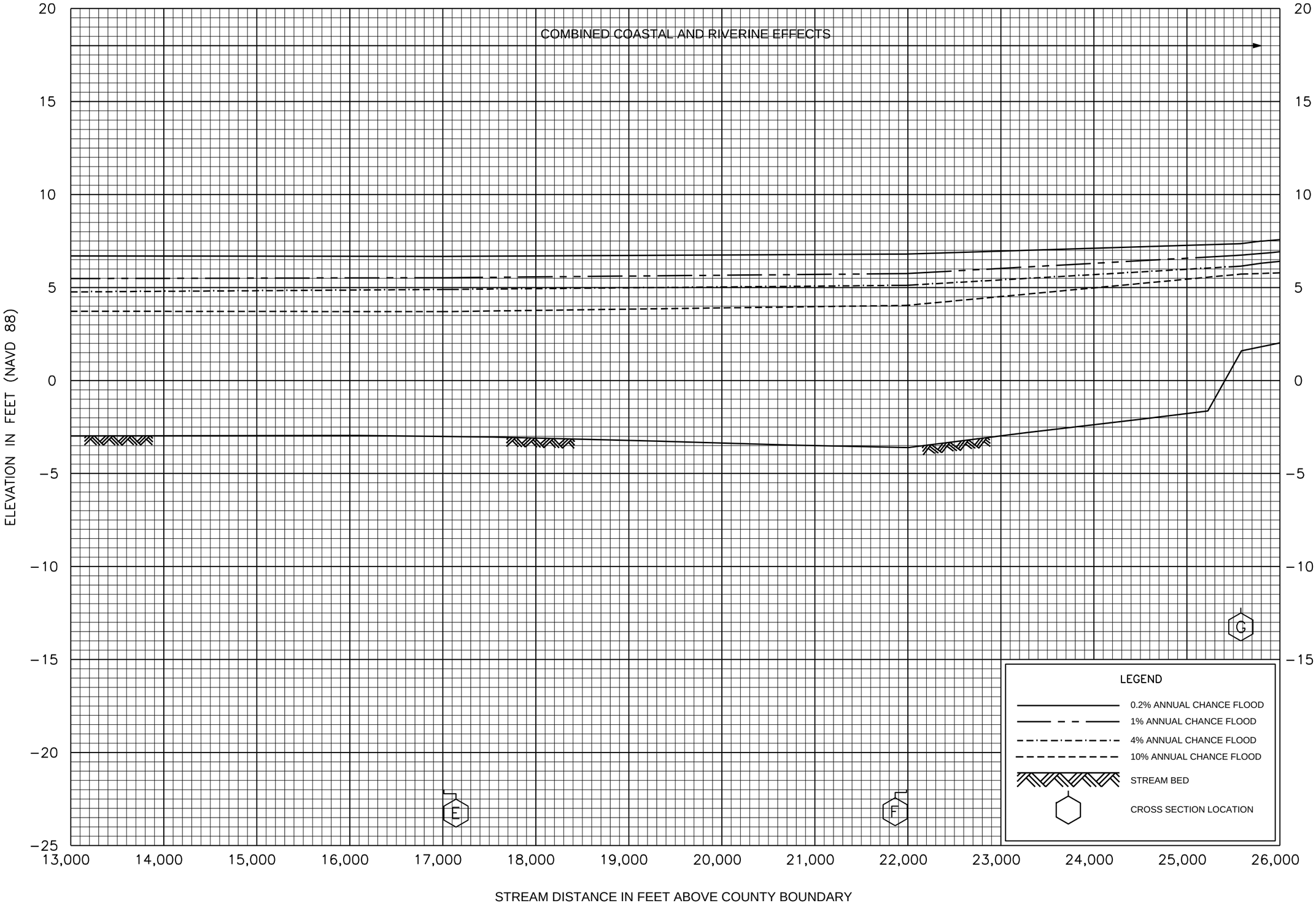
FLOOD PROFILES

BULOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



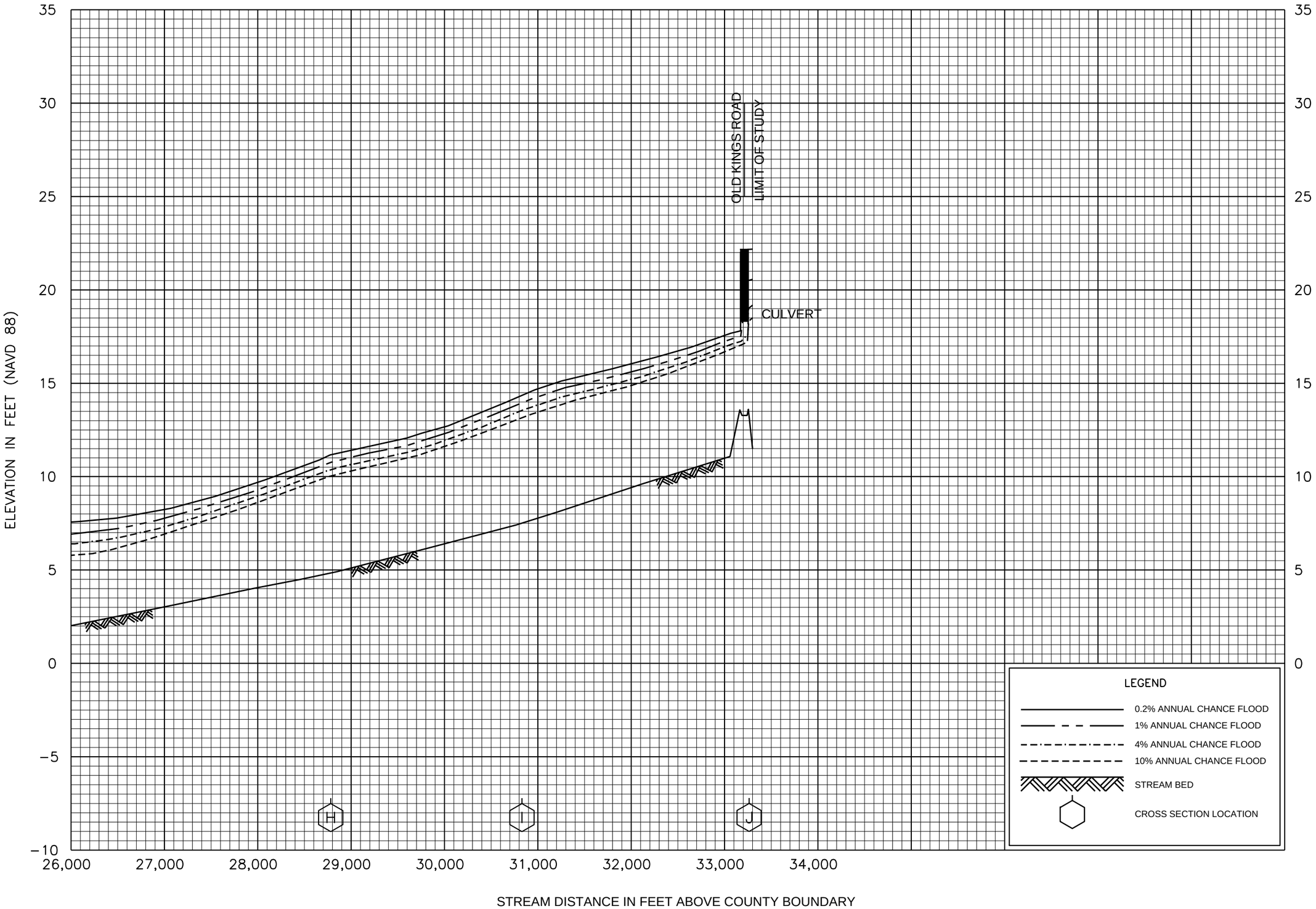
FLOOD PROFILES

BULOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



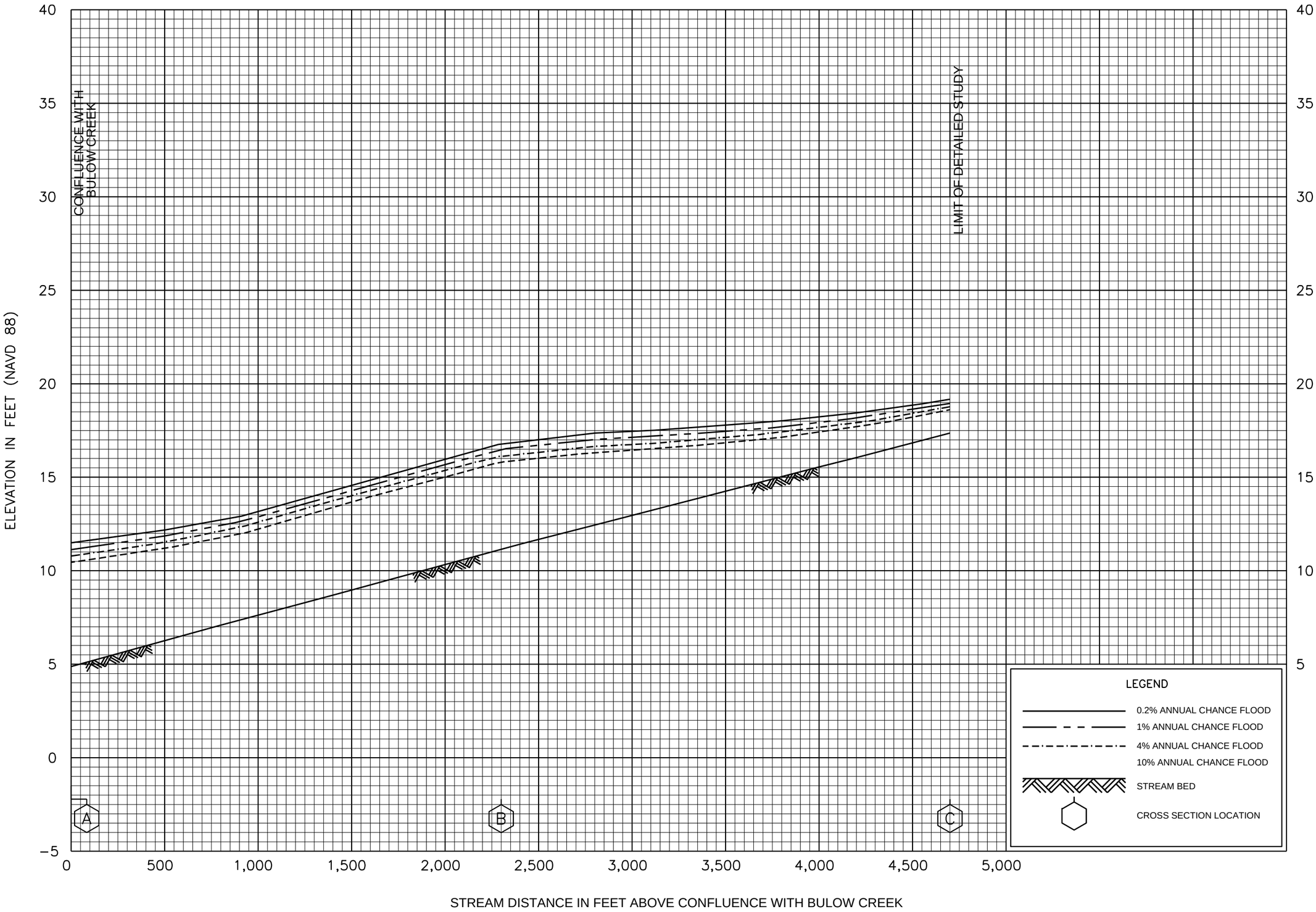
FLOOD PROFILES

BULOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



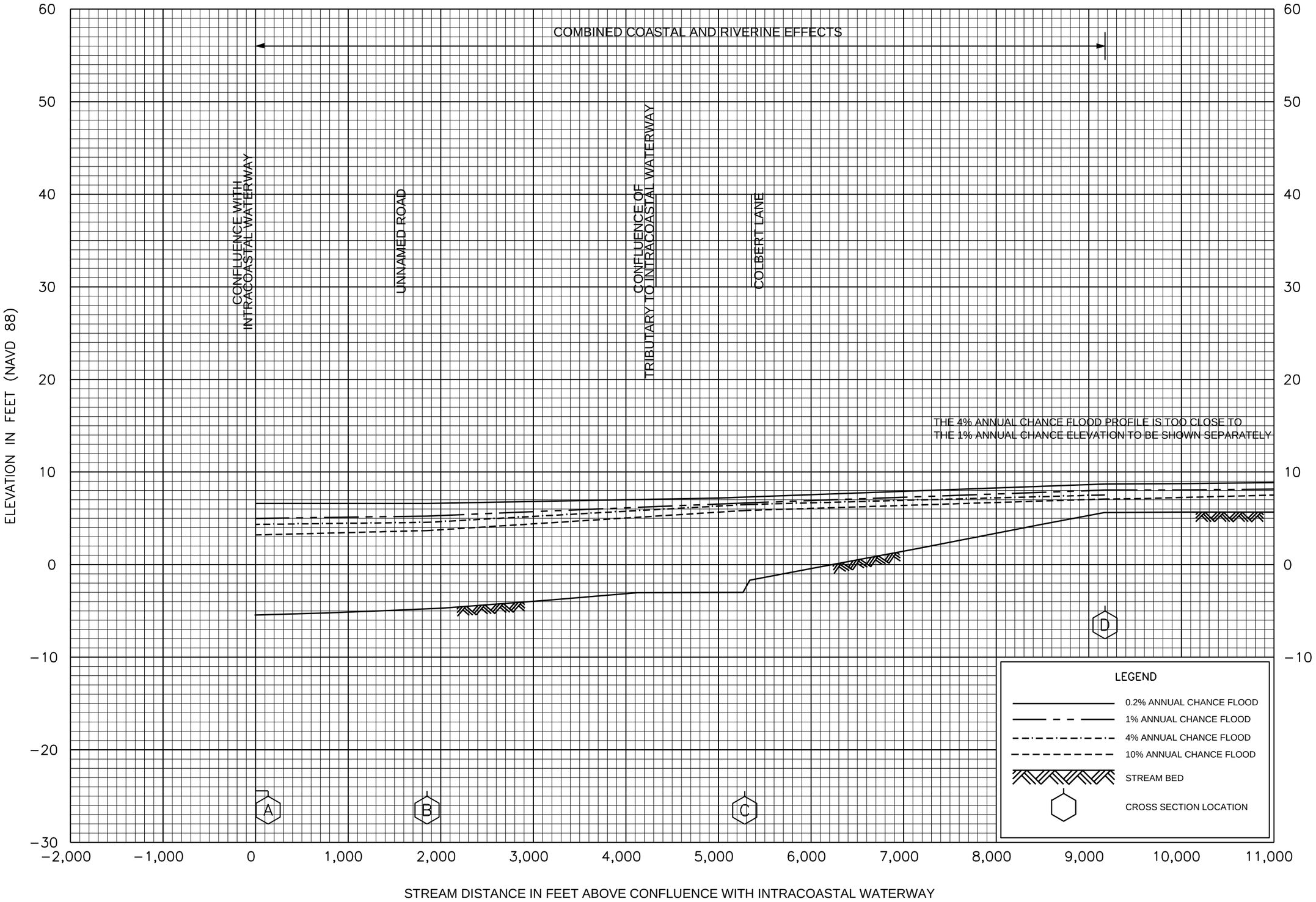
FLOOD PROFILES

BULOW CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



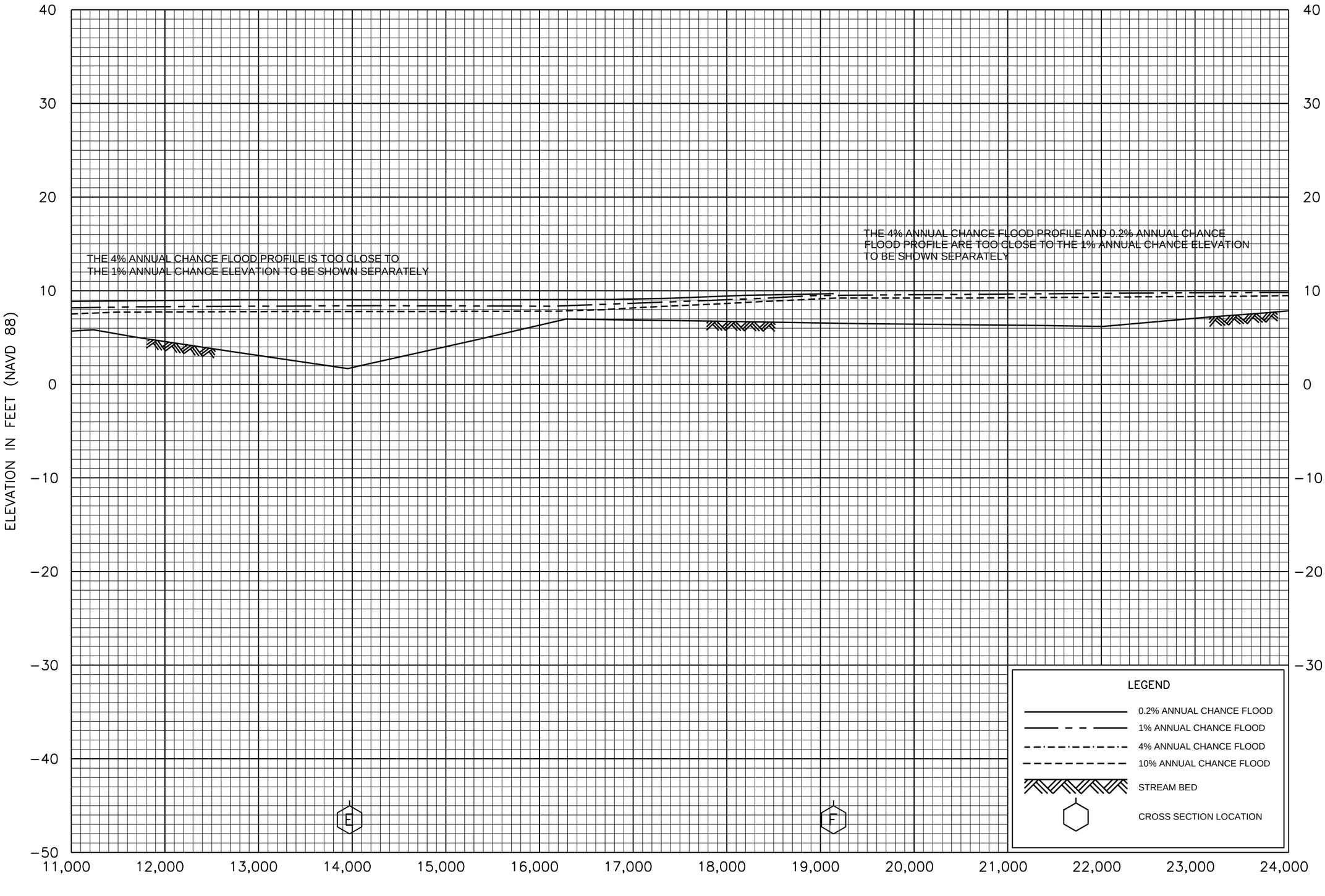
FLOOD PROFILES

GRAHAM SWAMP

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



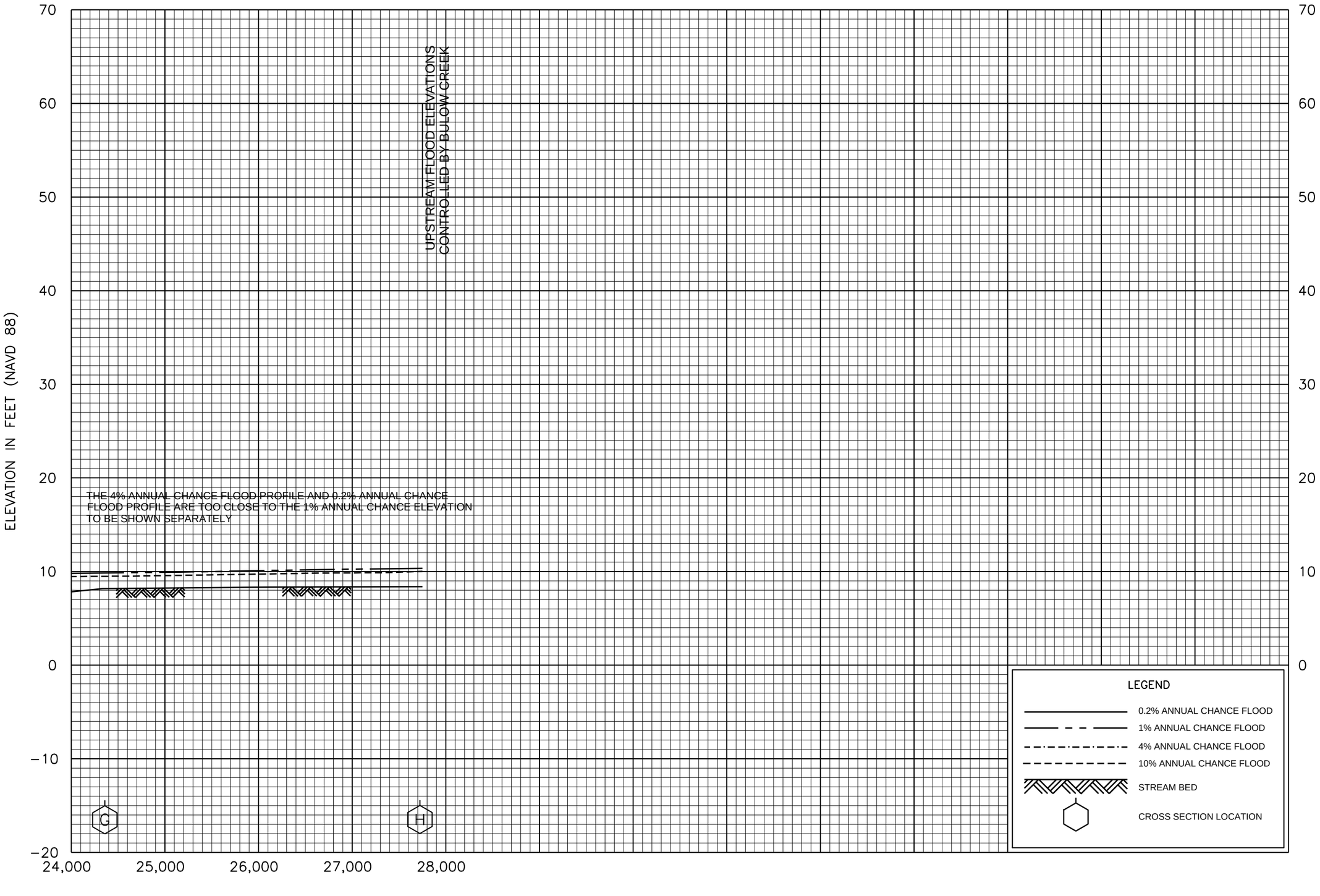
FLOOD PROFILES

GRAHAM SWAMP

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



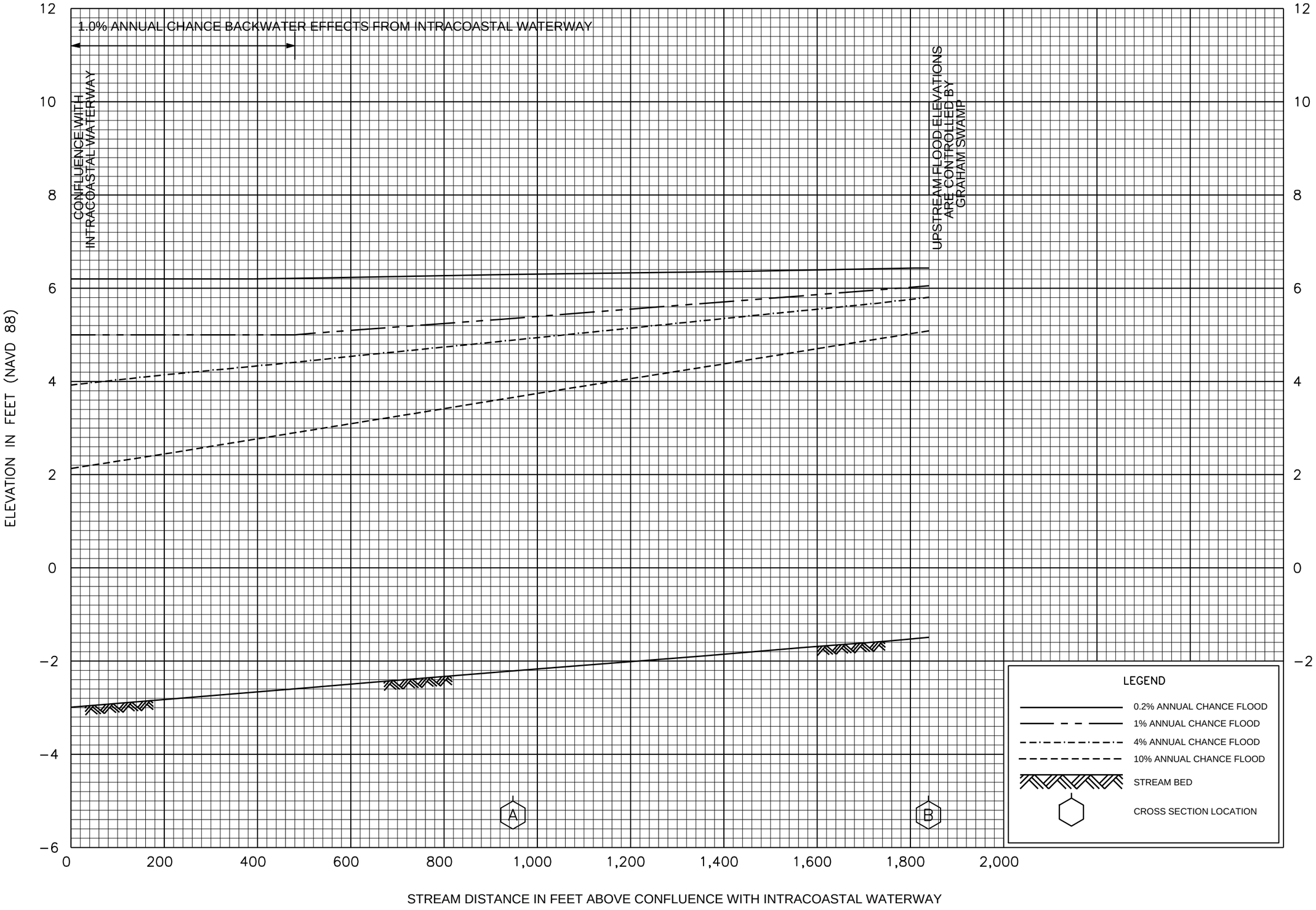
FLOOD PROFILES

GRAHAM SWAMP

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



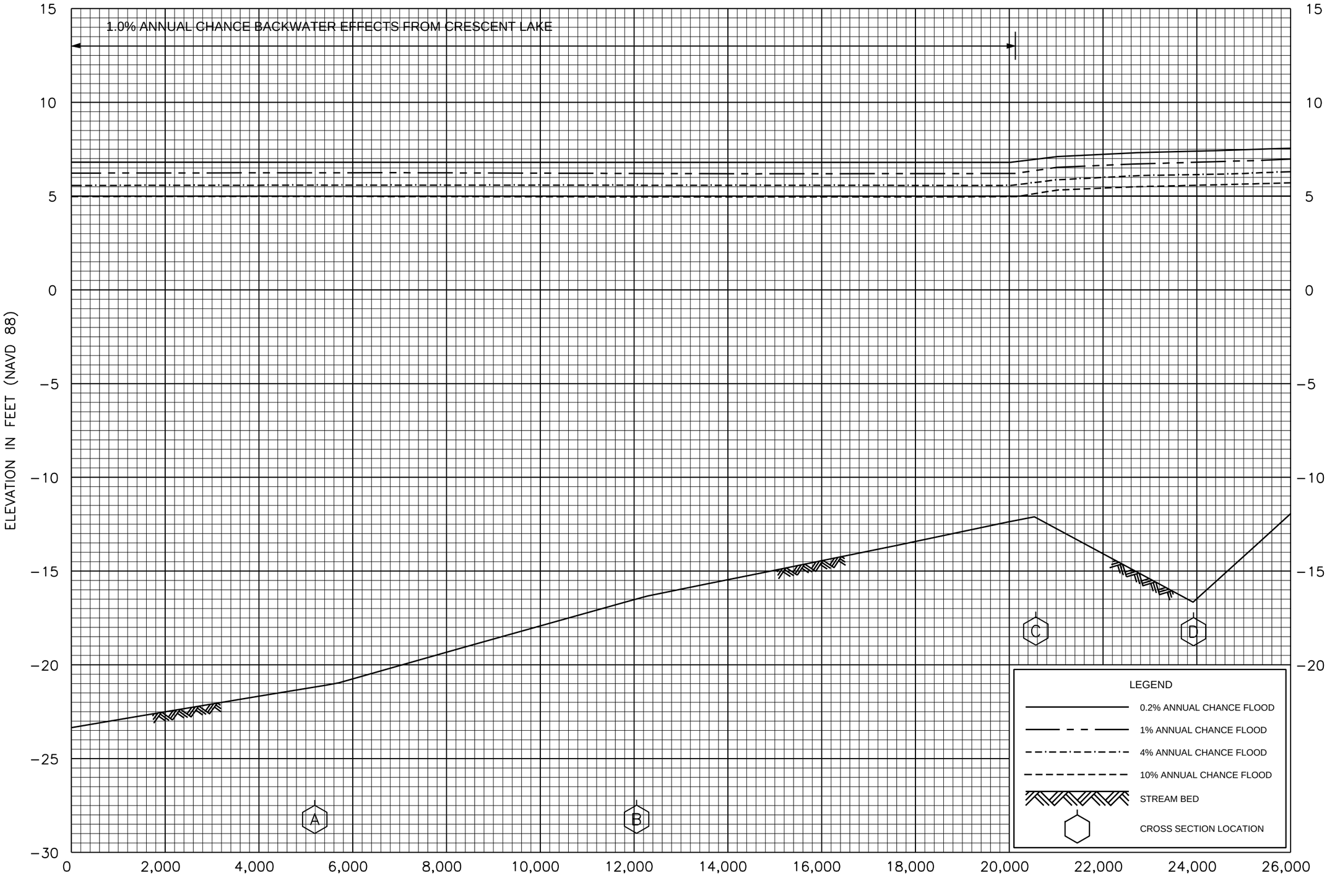
FLOOD PROFILES

TRIBUTARY TO INTRACOASTAL WATERWAY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY FL

AND INCORPORATED AREAS



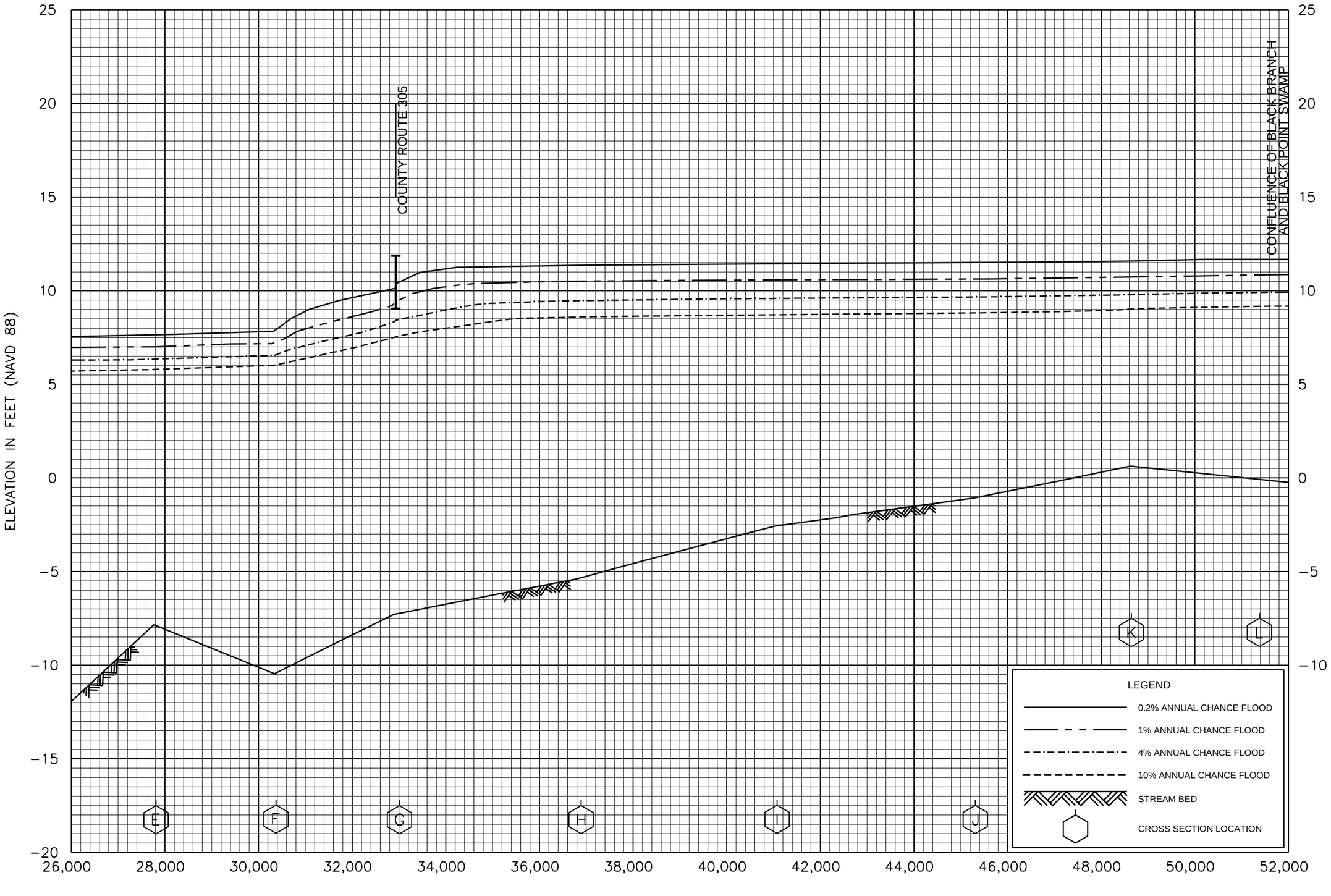
FLOOD PROFILES

HAW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



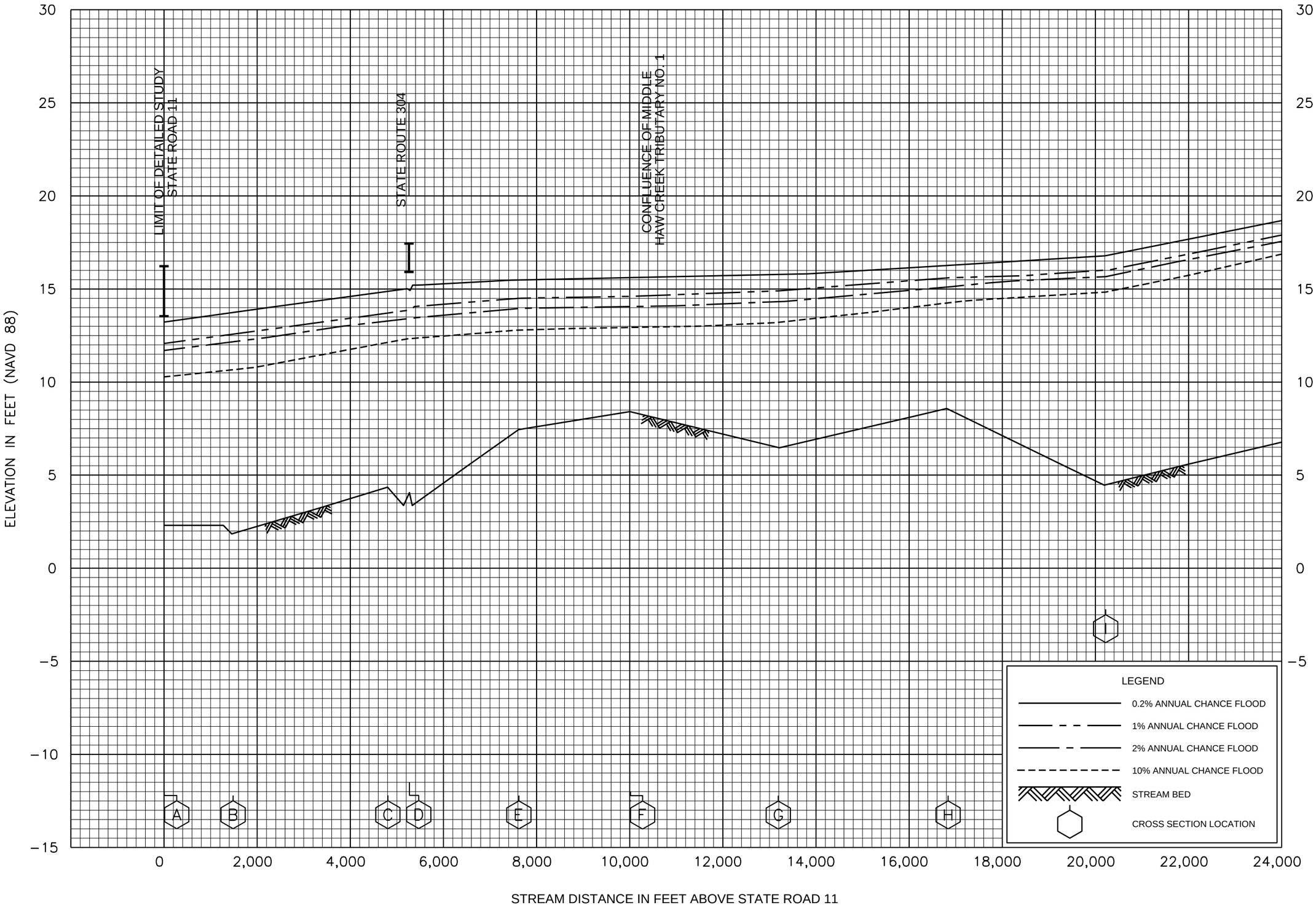
FLOOD PROFILES

HAW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



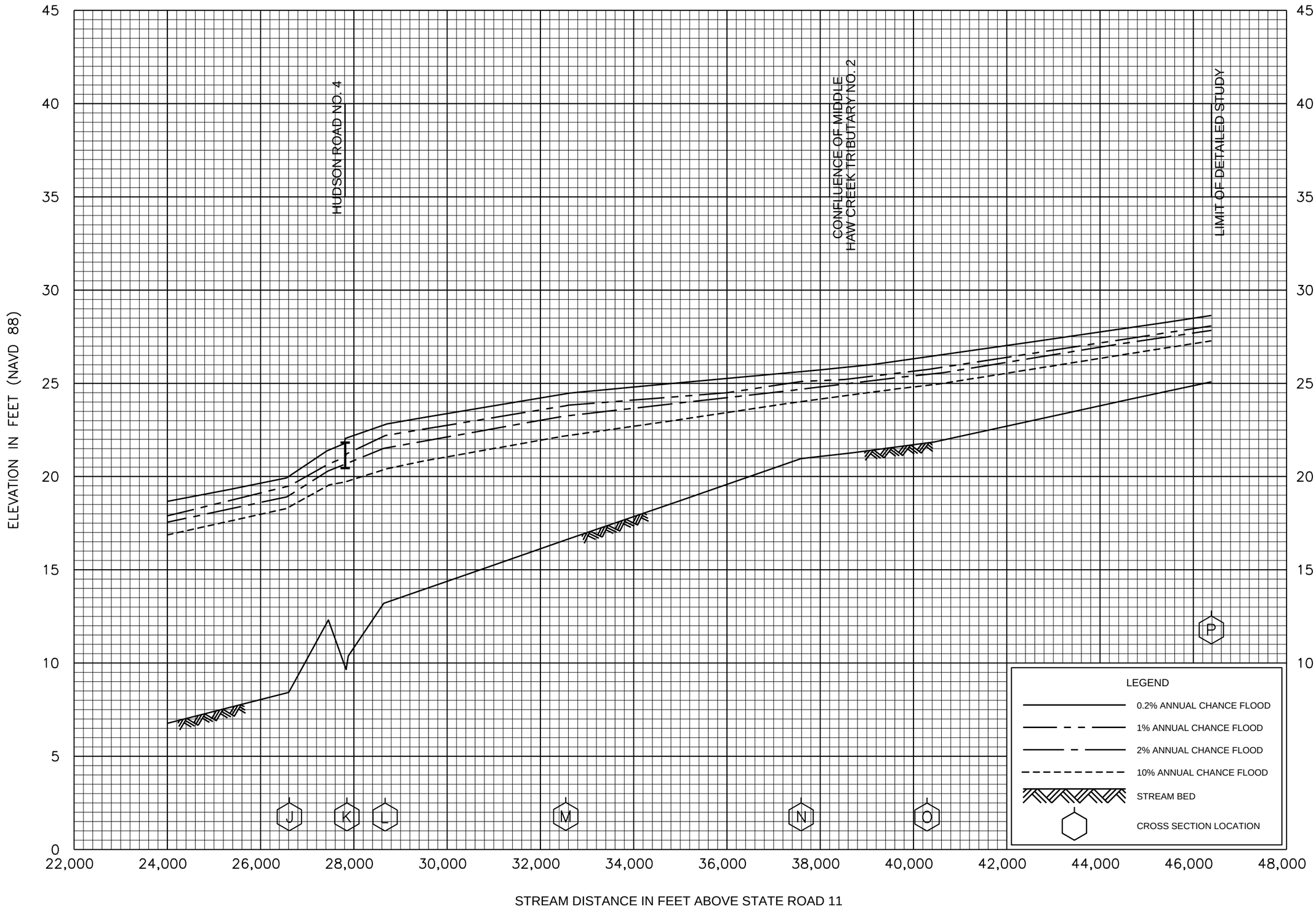
FLOOD PROFILES

MIDDLE HAW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



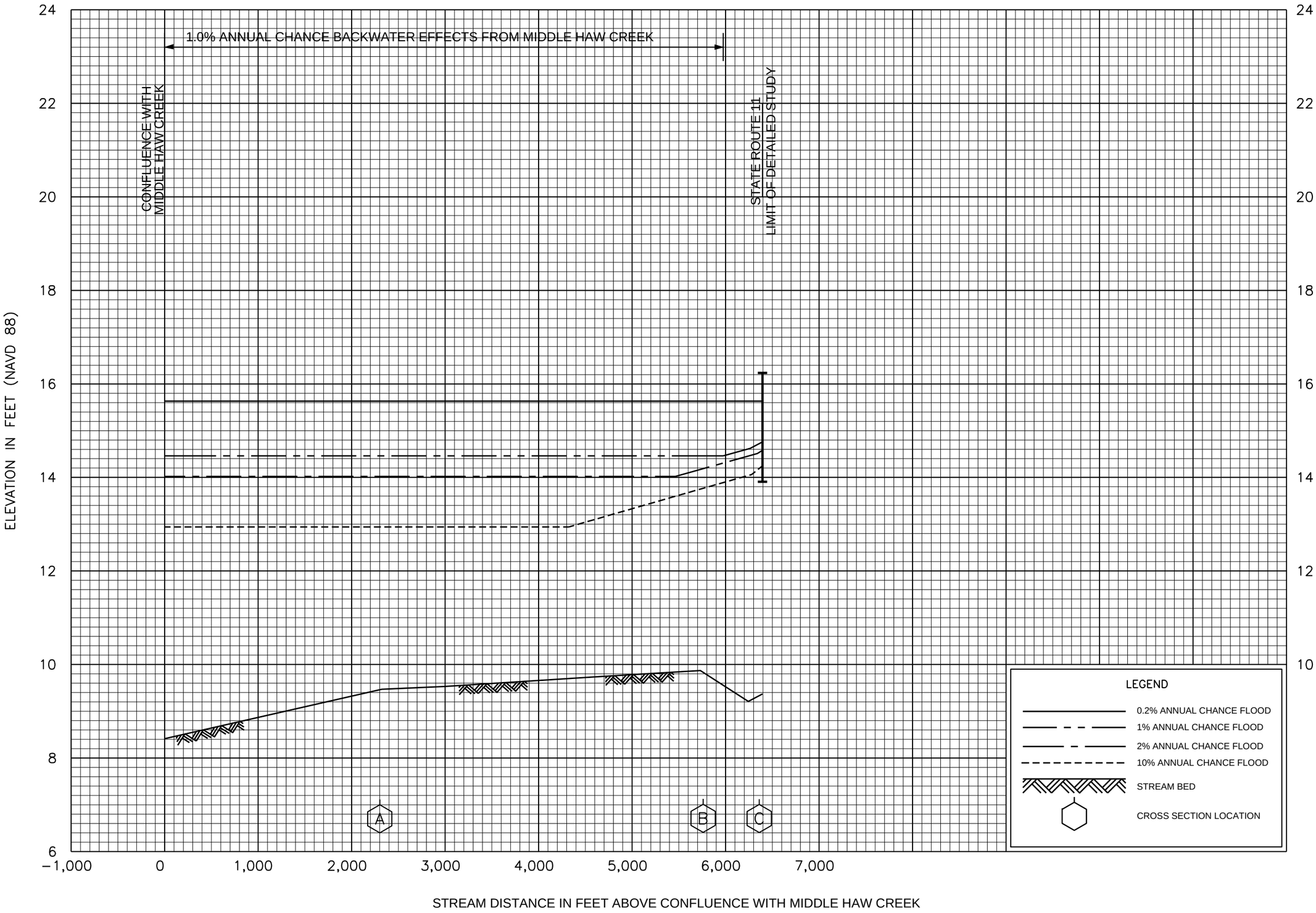
FLOOD PROFILES

MIDDLE HAW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



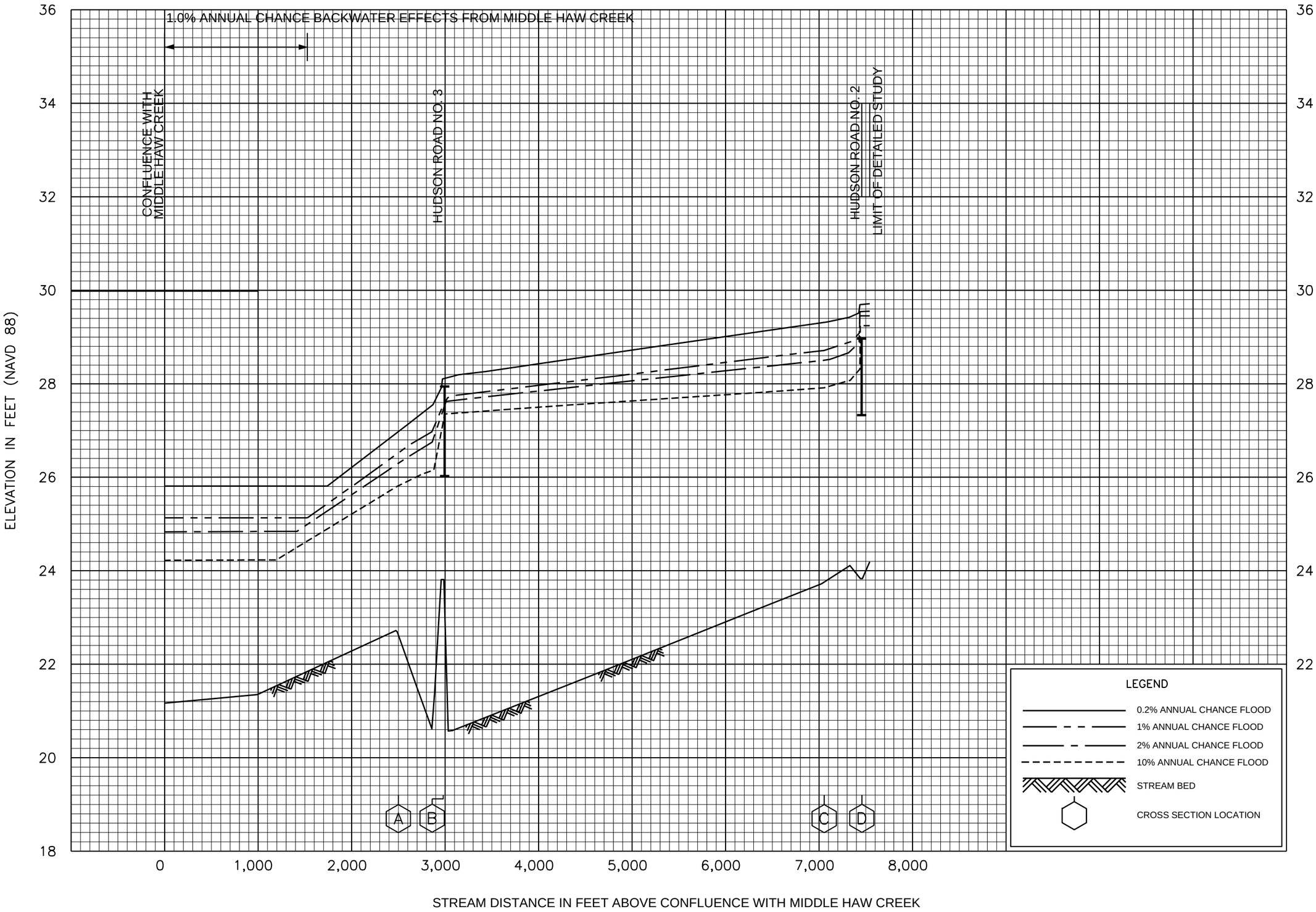
FLOOD PROFILES

MIDDLE HAW CREEK TRIBUTARY NO. 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



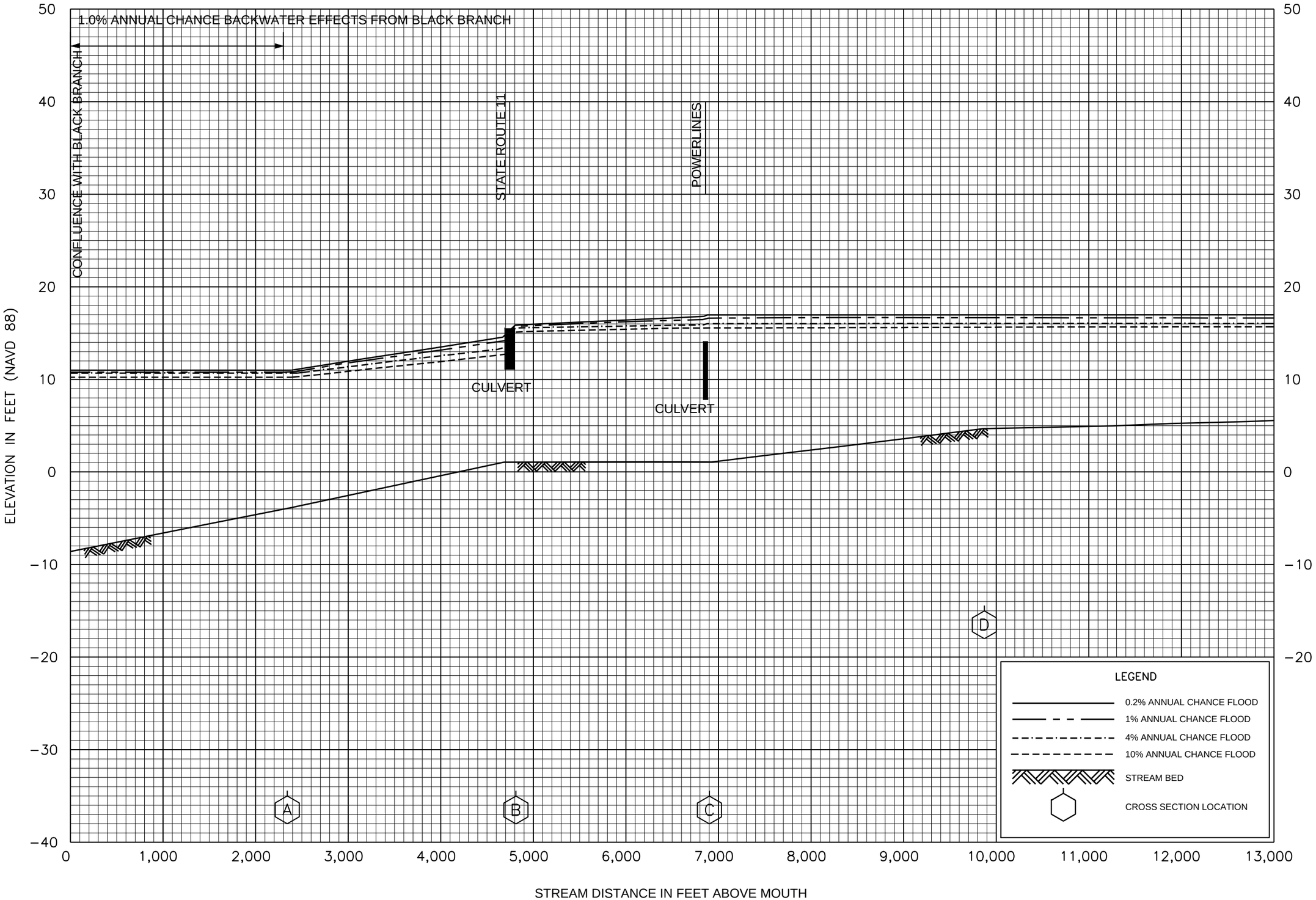
FLOOD PROFILES

MIDDLE HAW CREEK TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



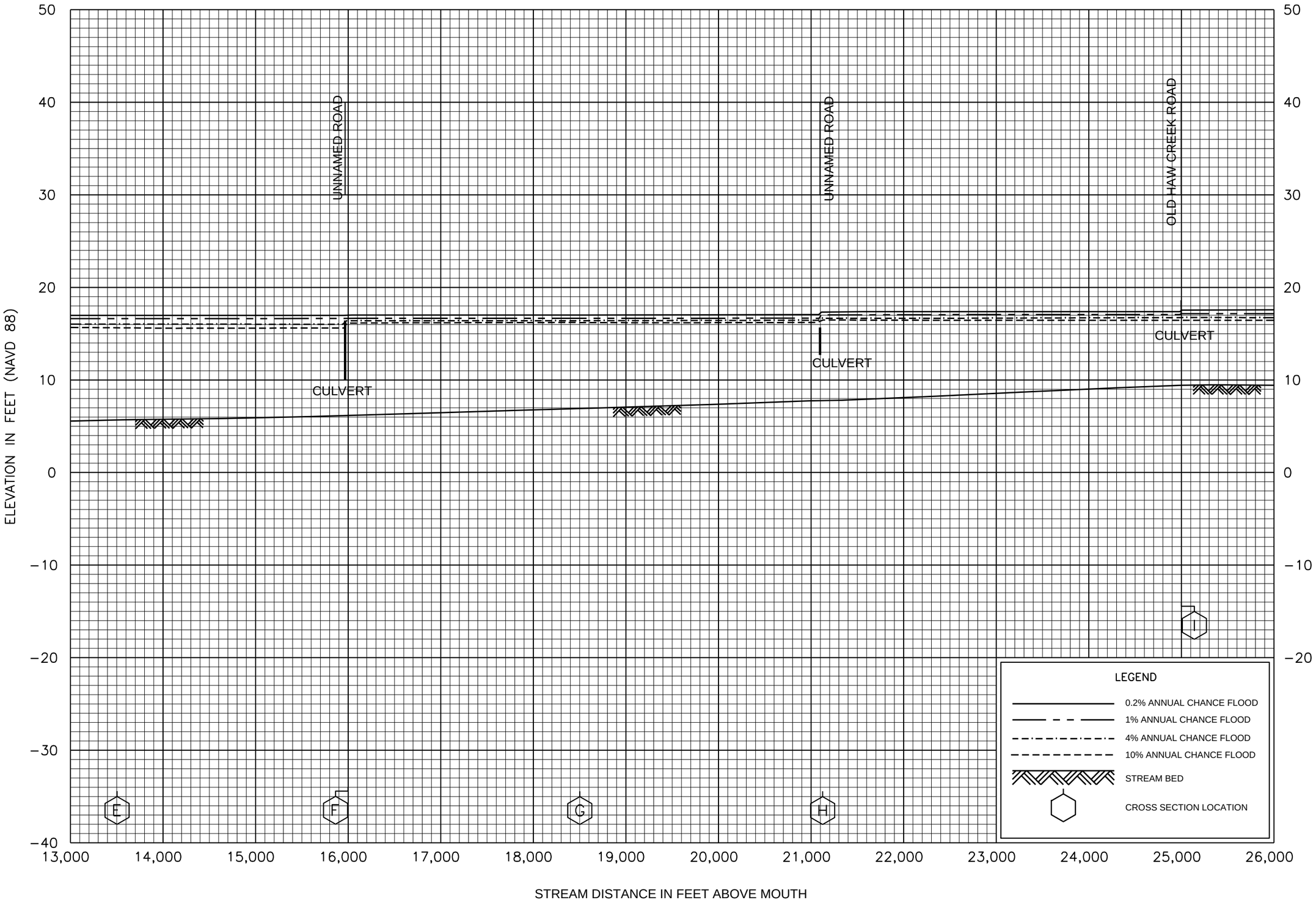
FLOOD PROFILES

PARKER CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



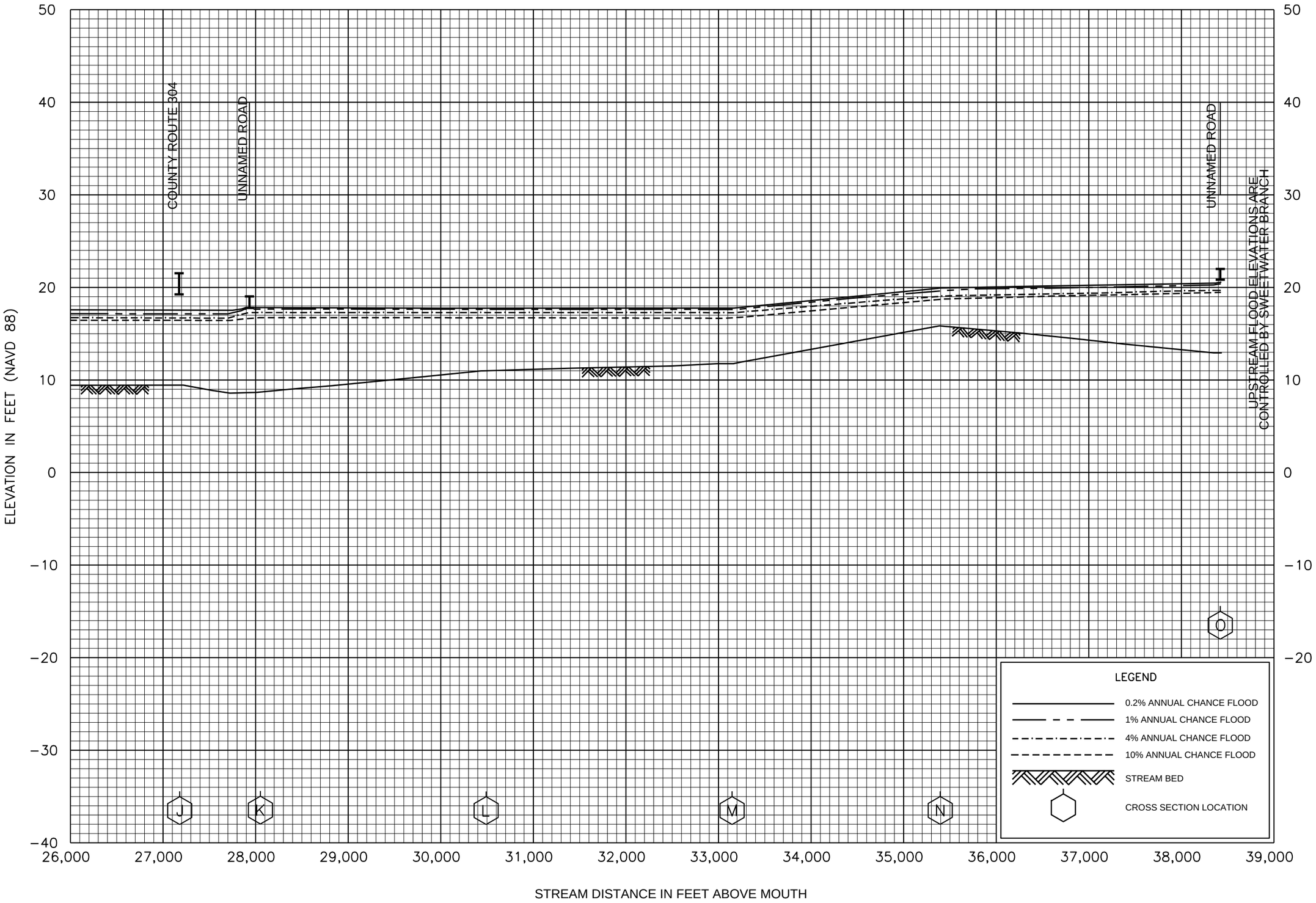
FLOOD PROFILES

PARKER CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



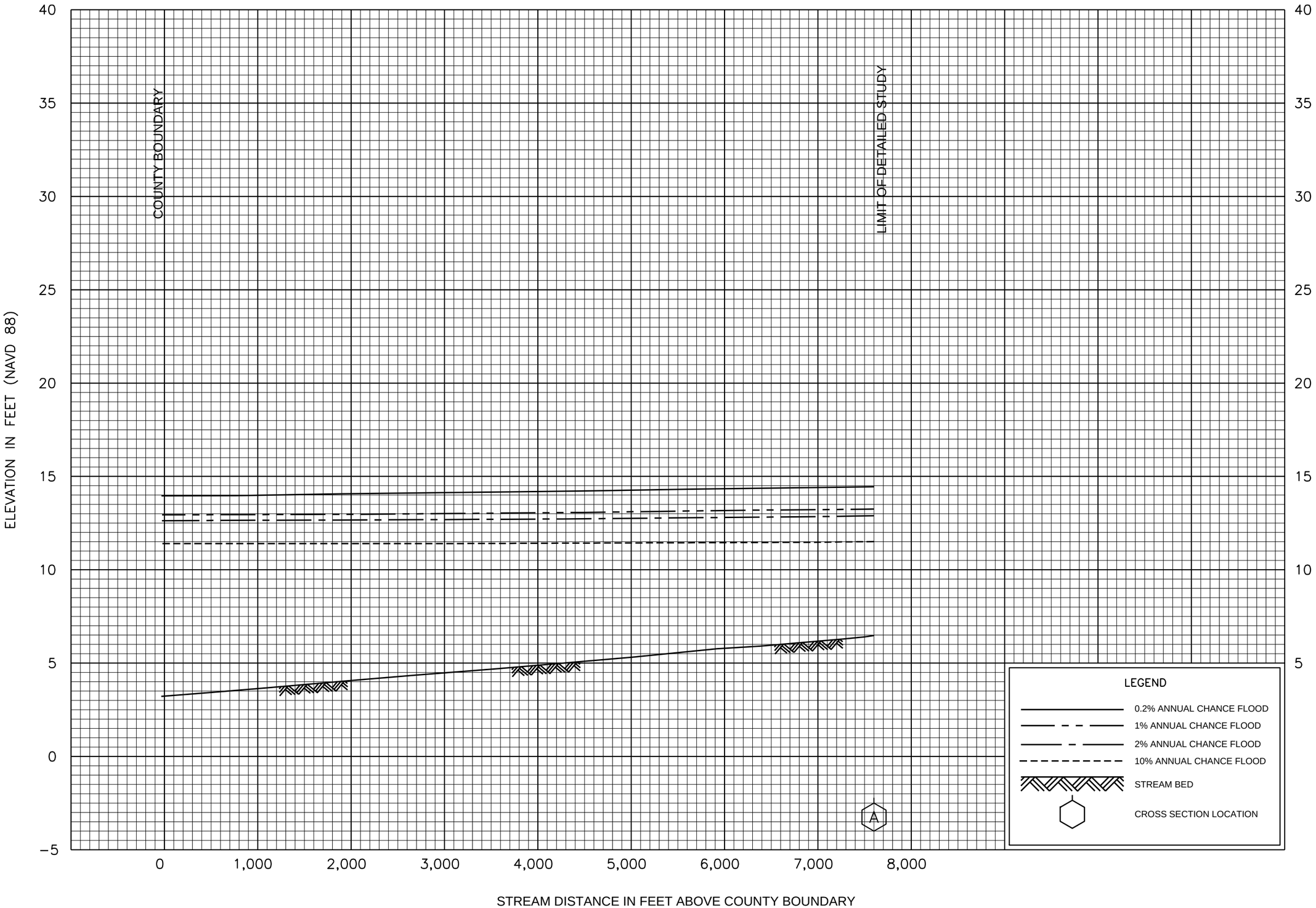
FLOOD PROFILES

PARKER CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



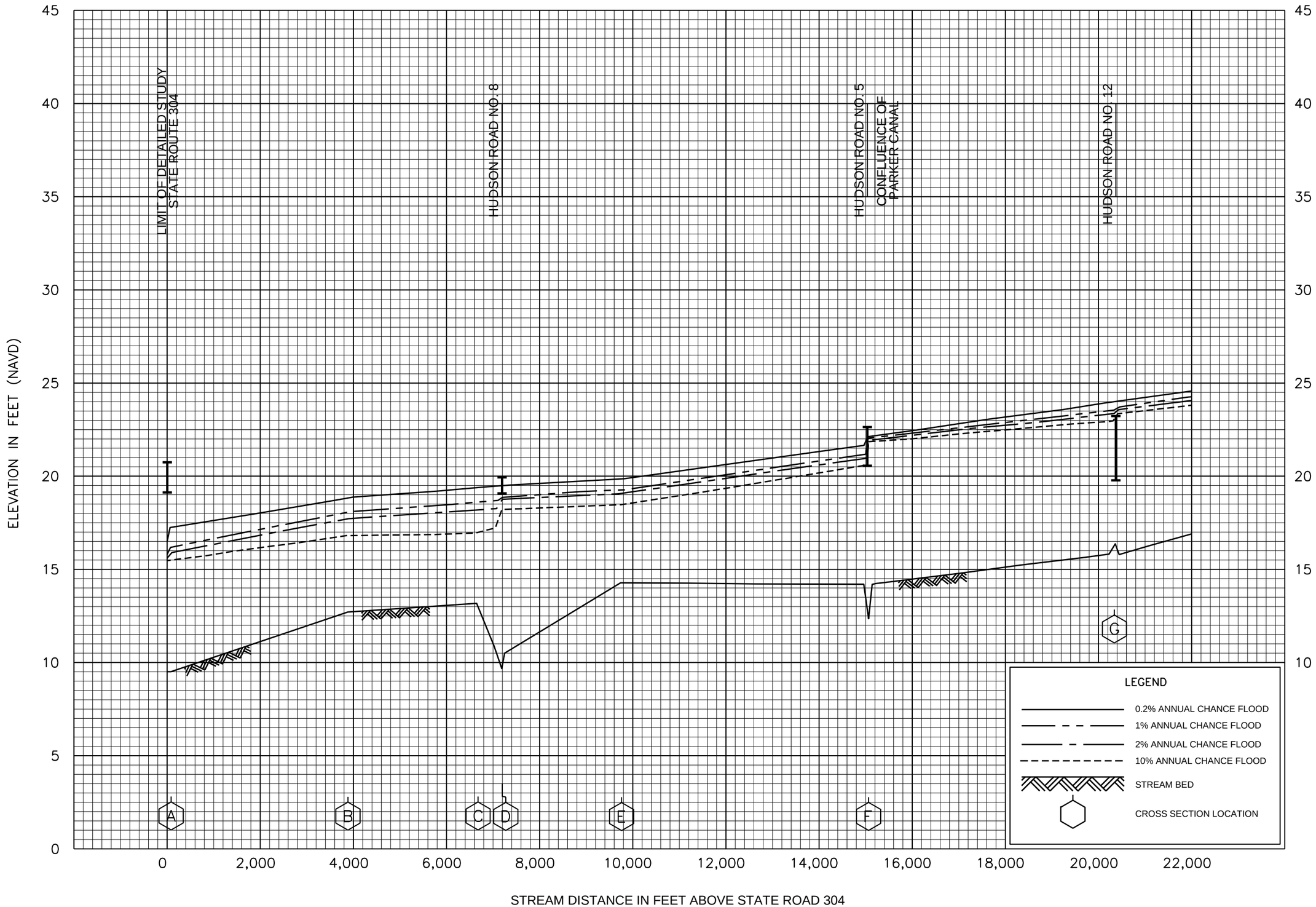
FLOOD PROFILES

SIXTEENMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



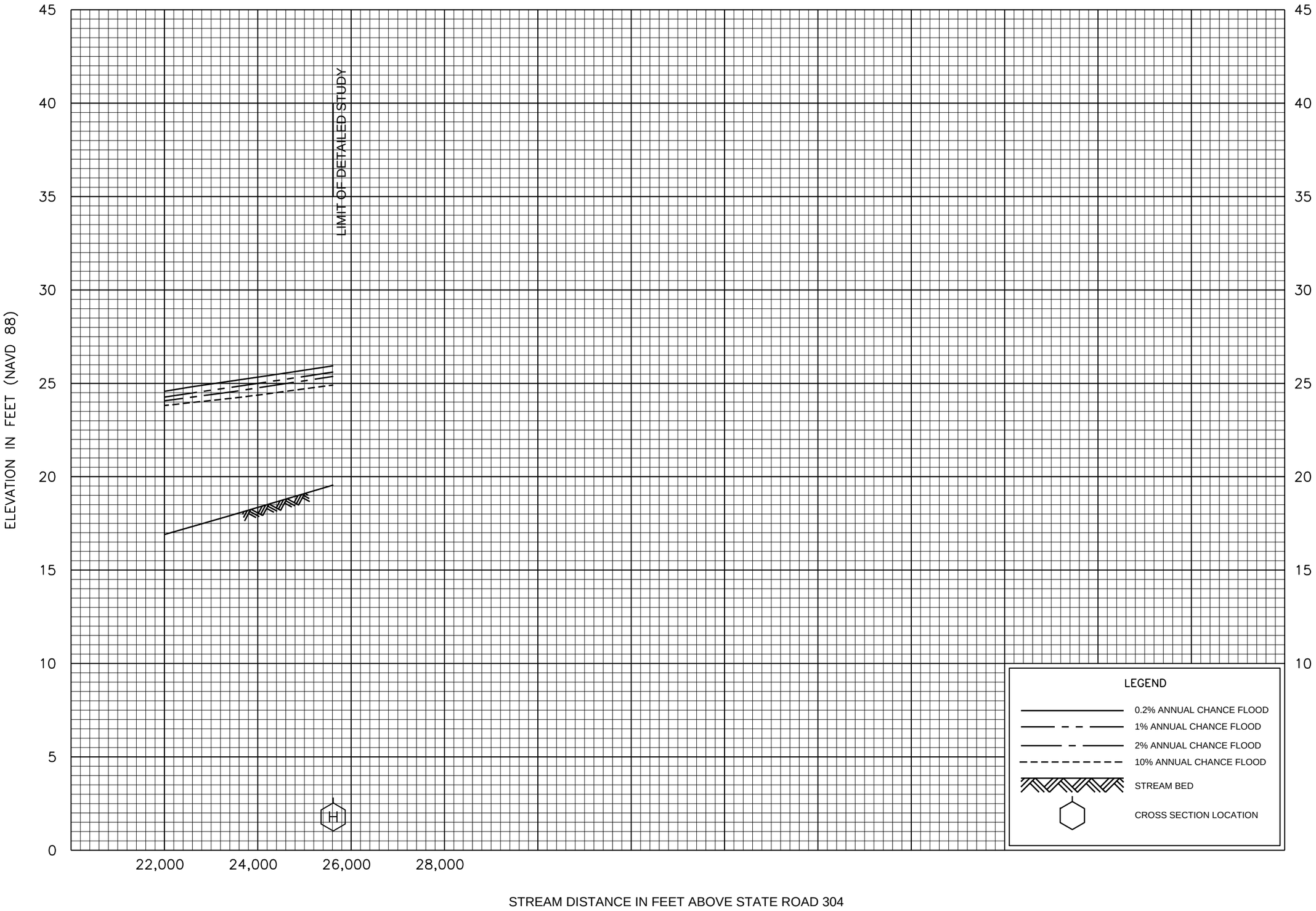
FLOOD PROFILES

SWEETWATER BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



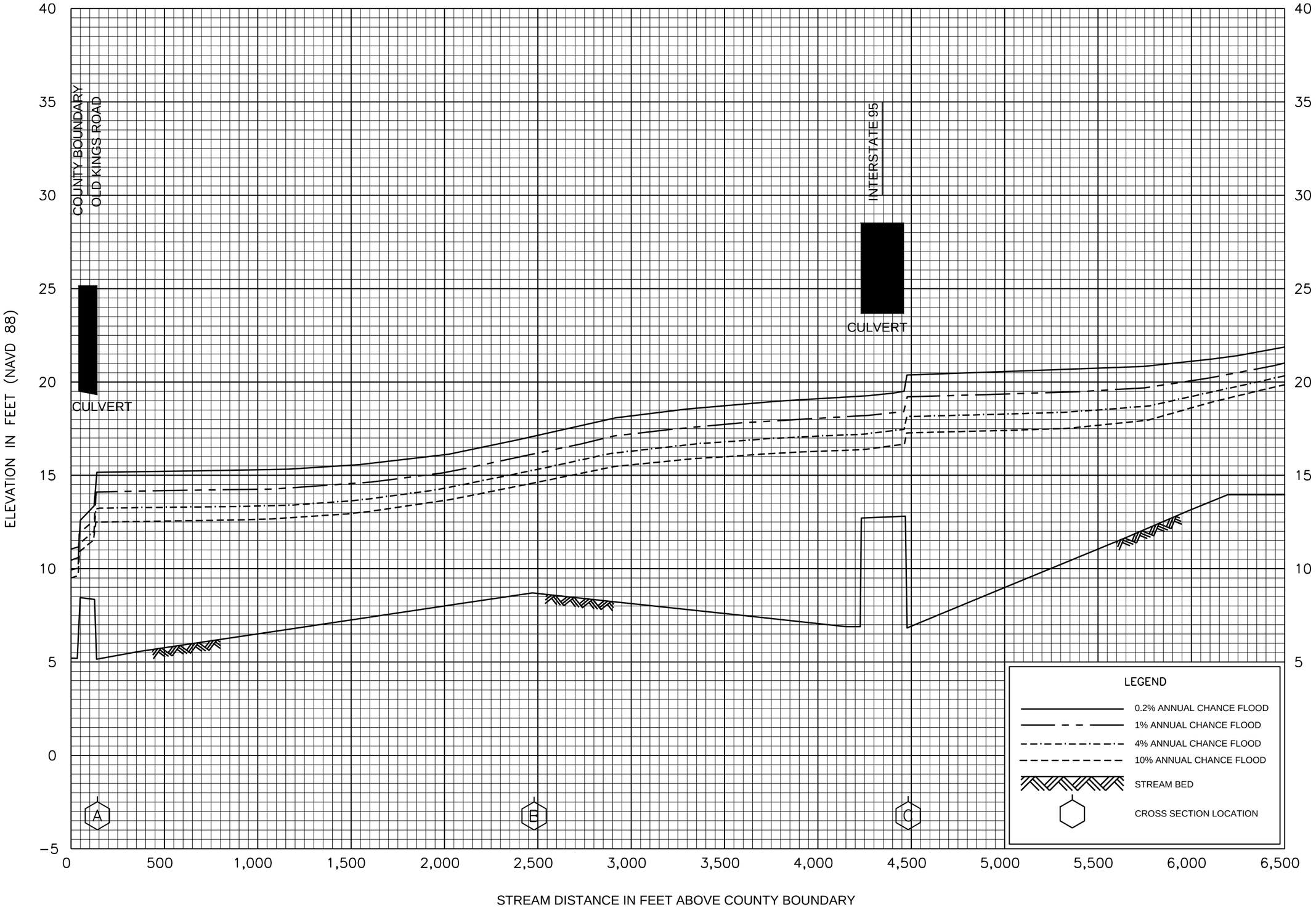
FLOOD PROFILES

SWEETWATER BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



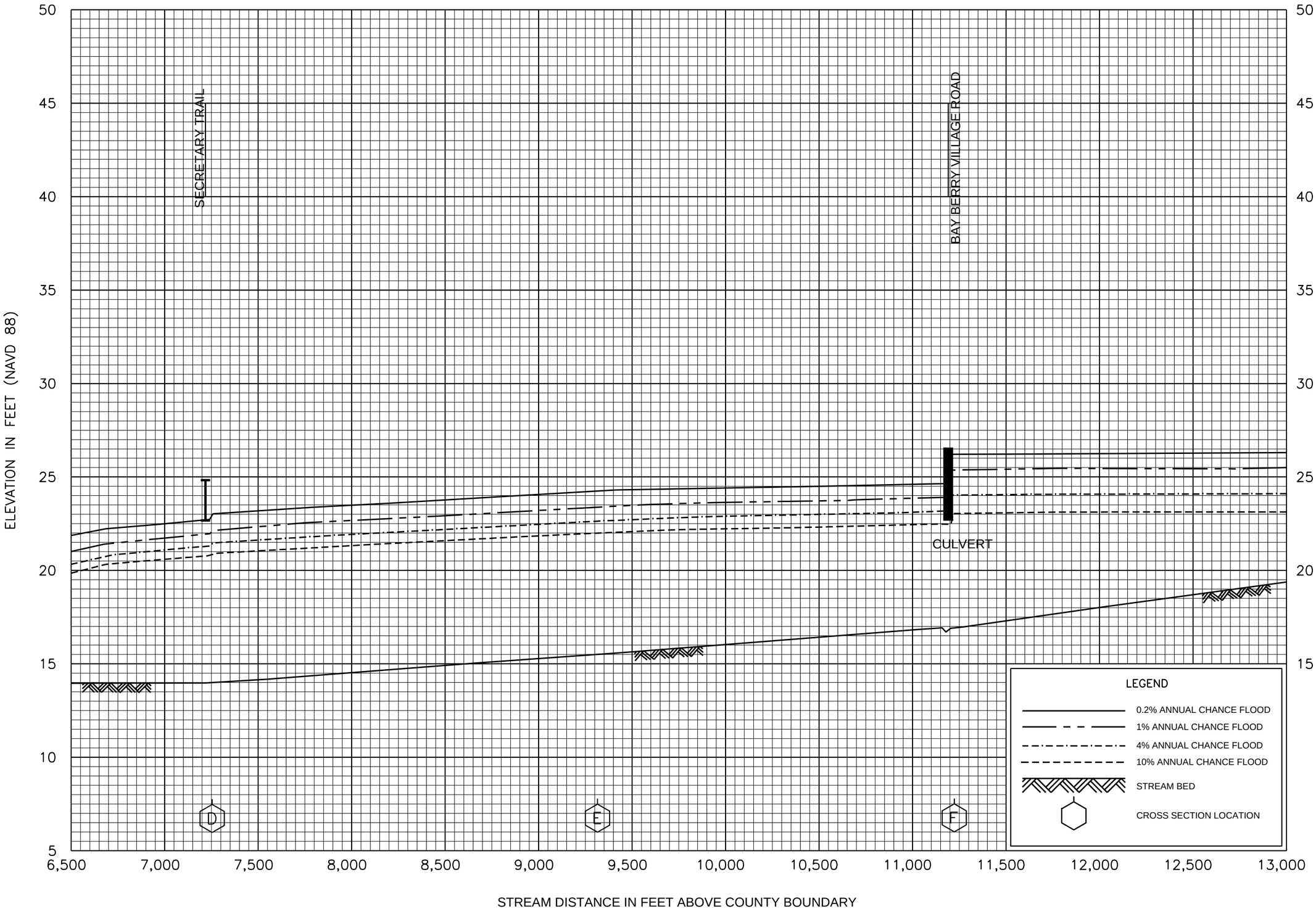
FLOOD PROFILES

WADSWORTH/KORONA CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



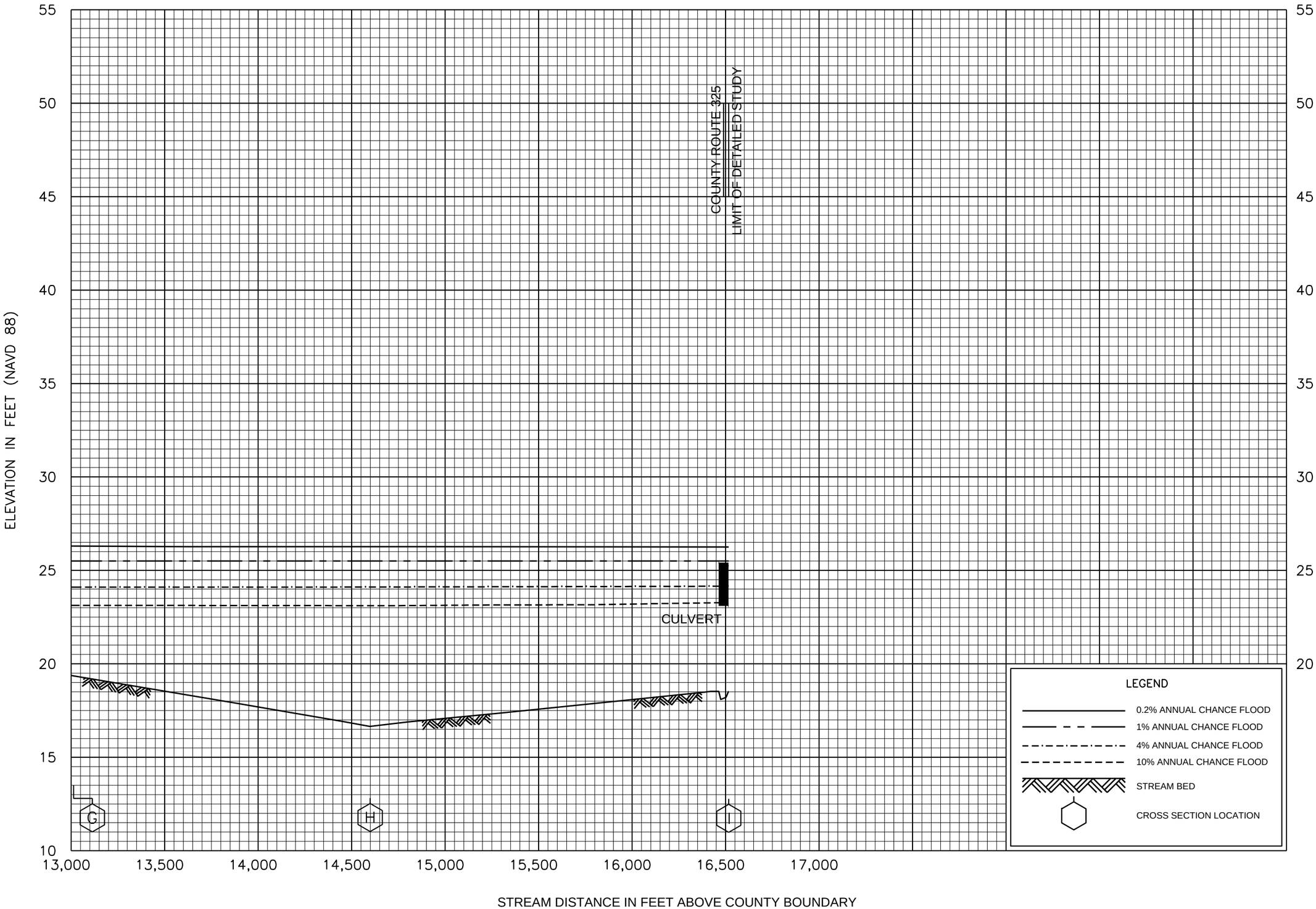
FLOOD PROFILES

WADSWORTH/KORONA CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



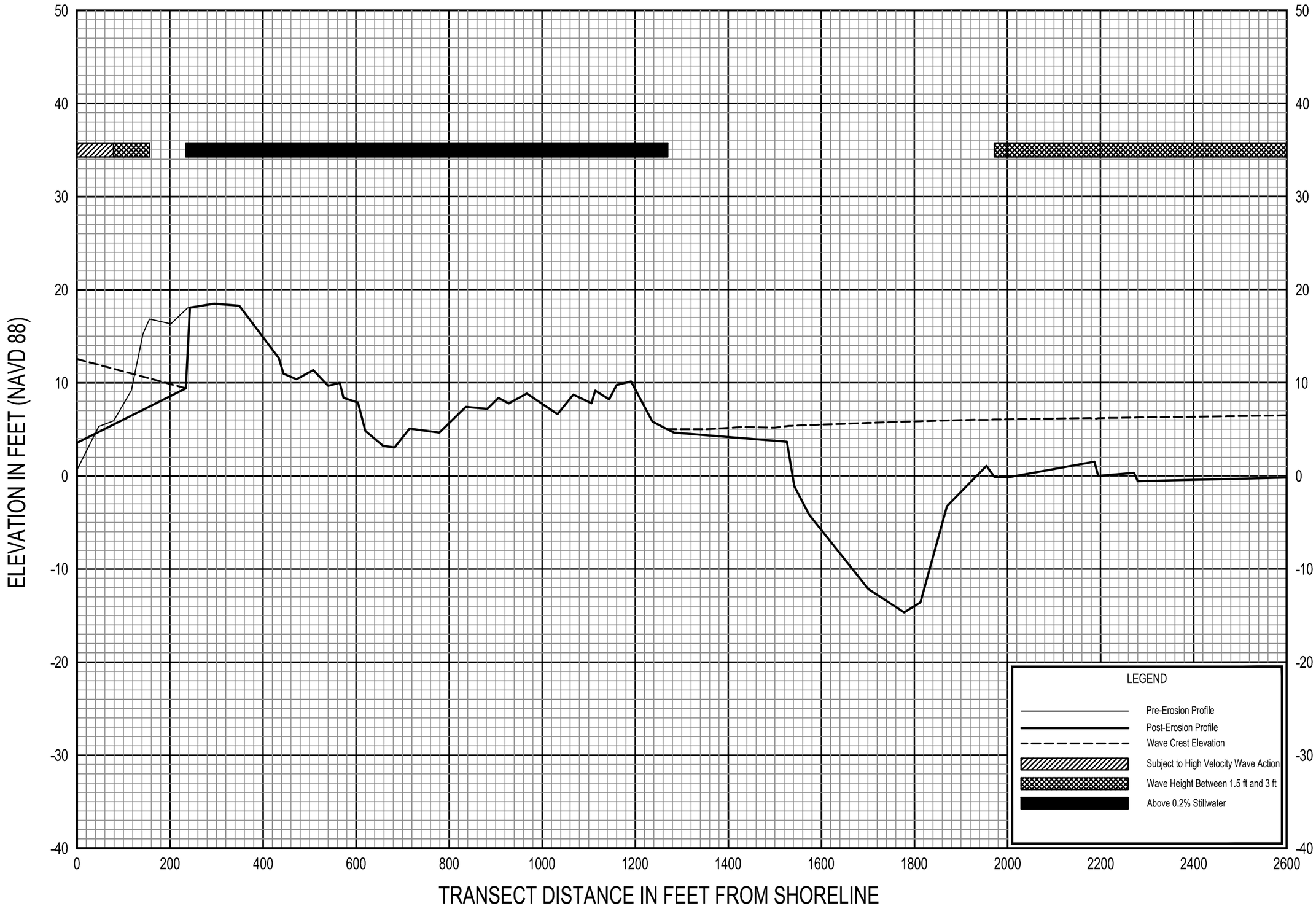
FLOOD PROFILES

WADSWORTH/KORONA CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL

AND INCORPORATED AREAS



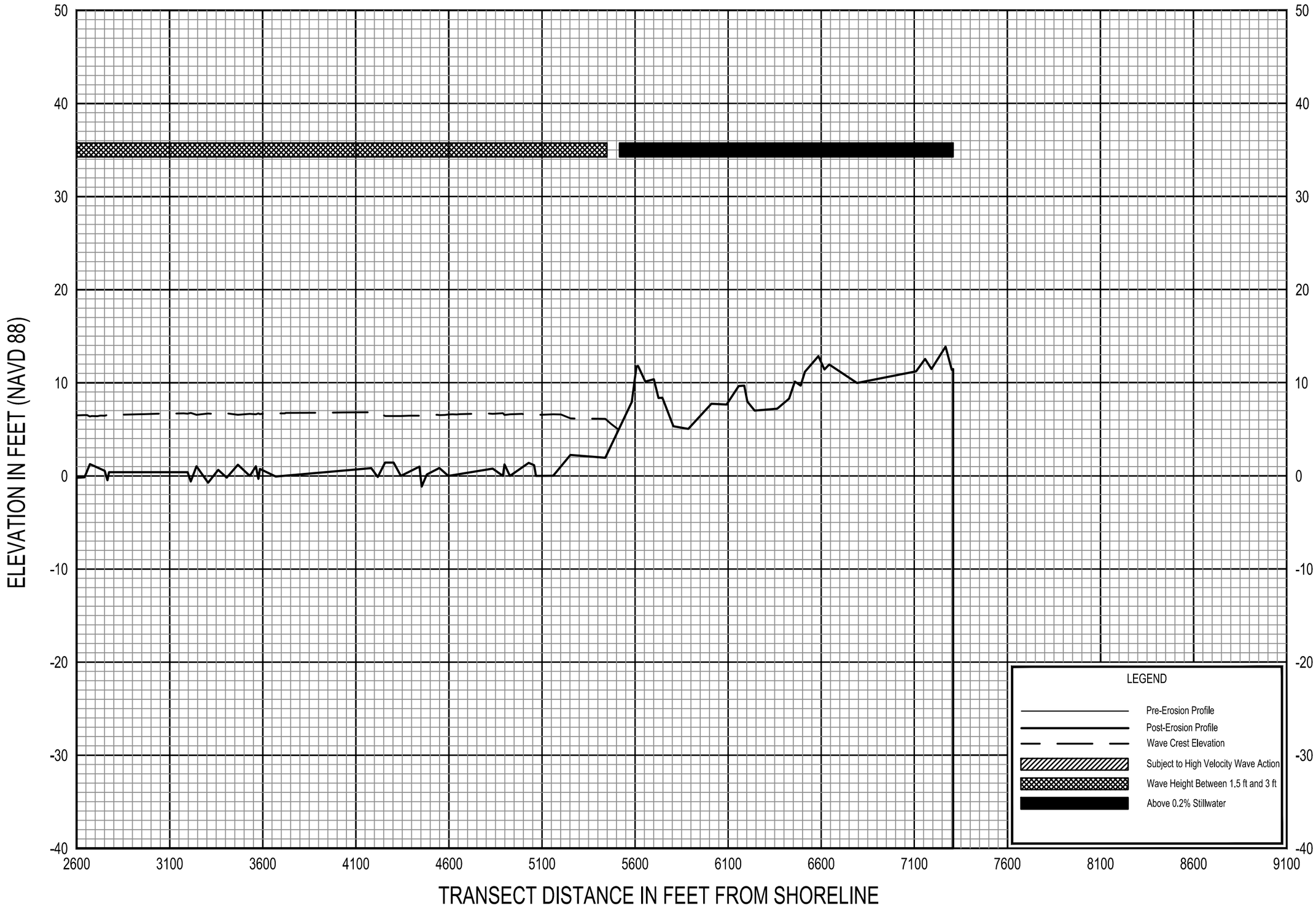
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

1 P

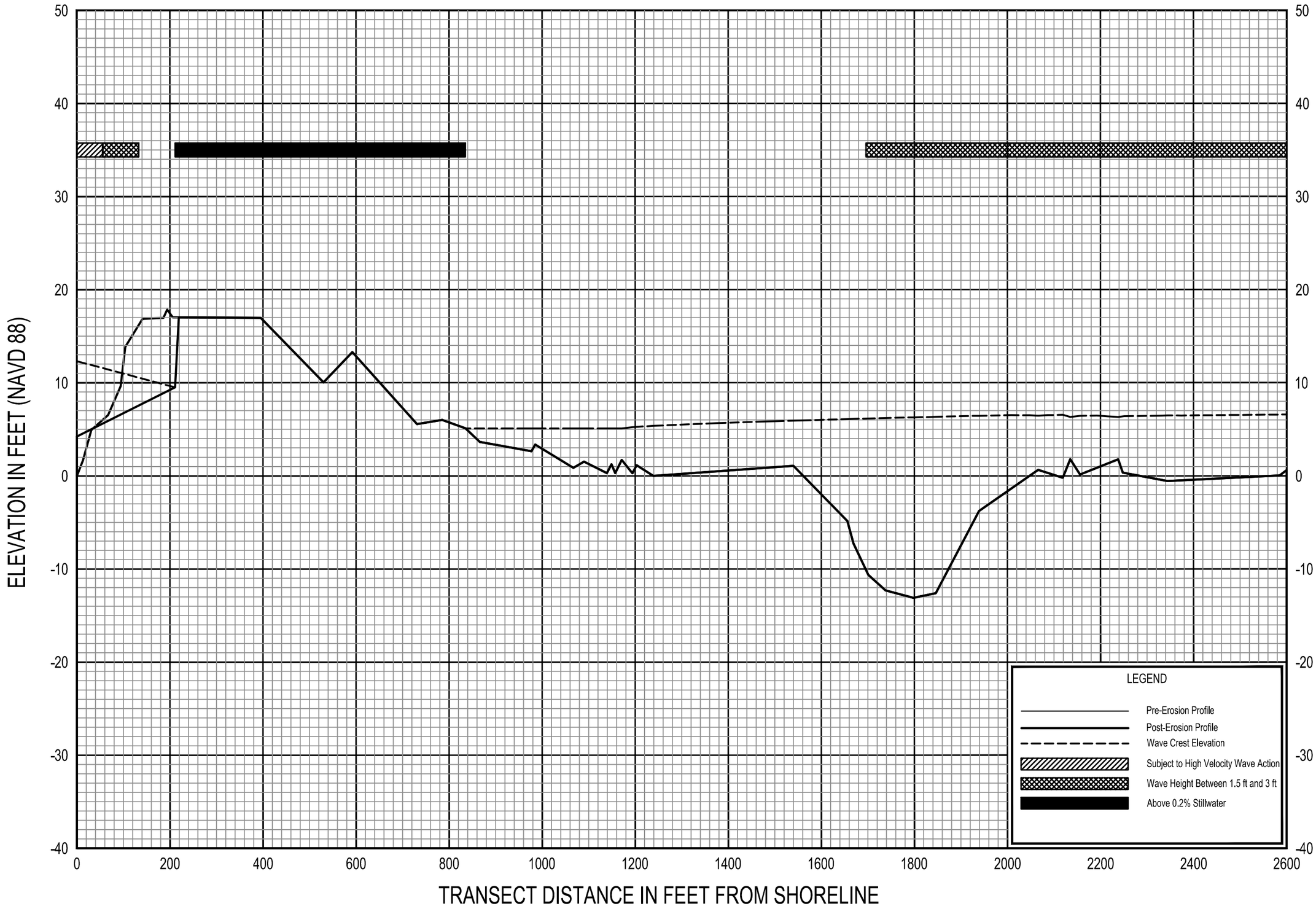


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

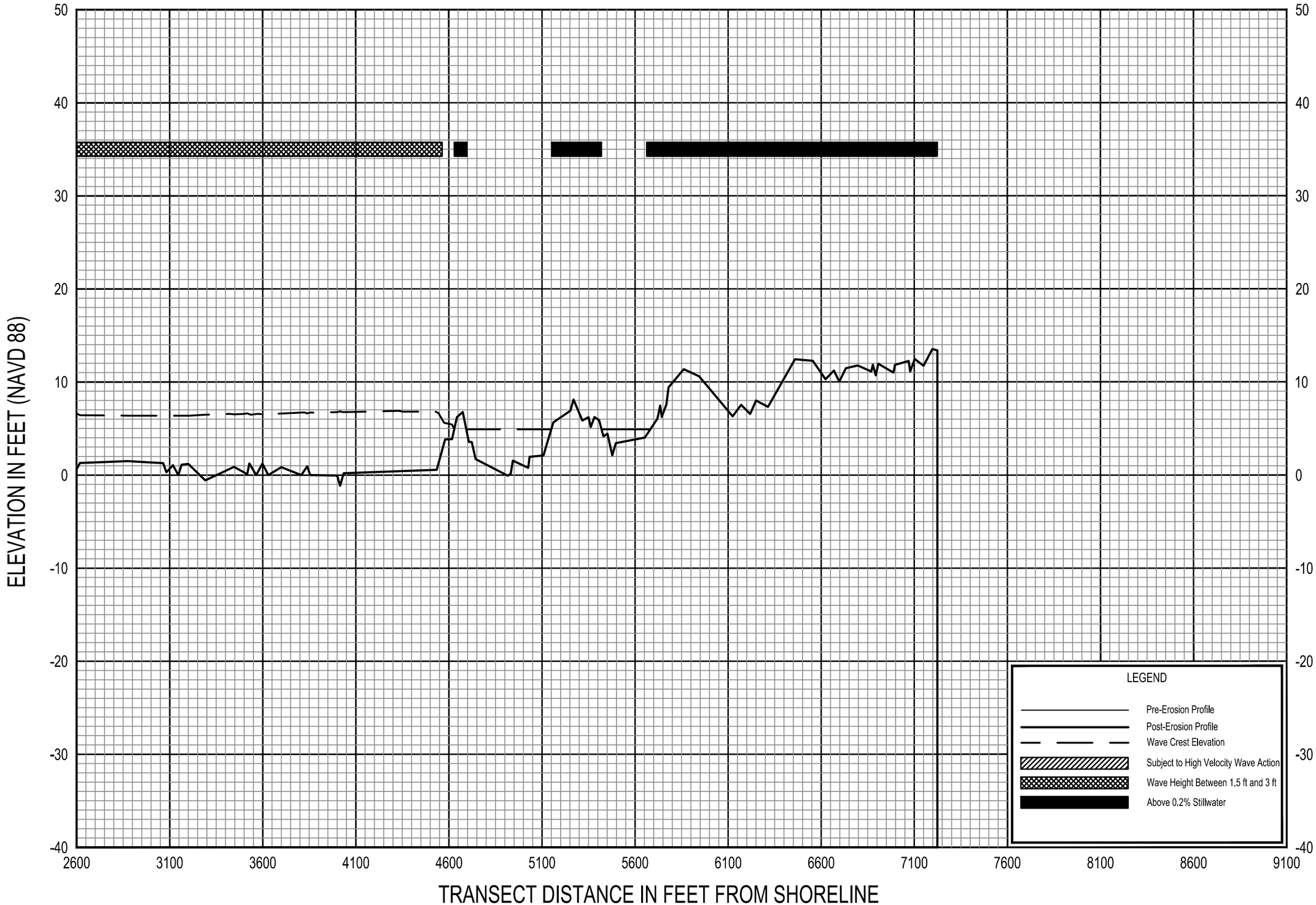


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

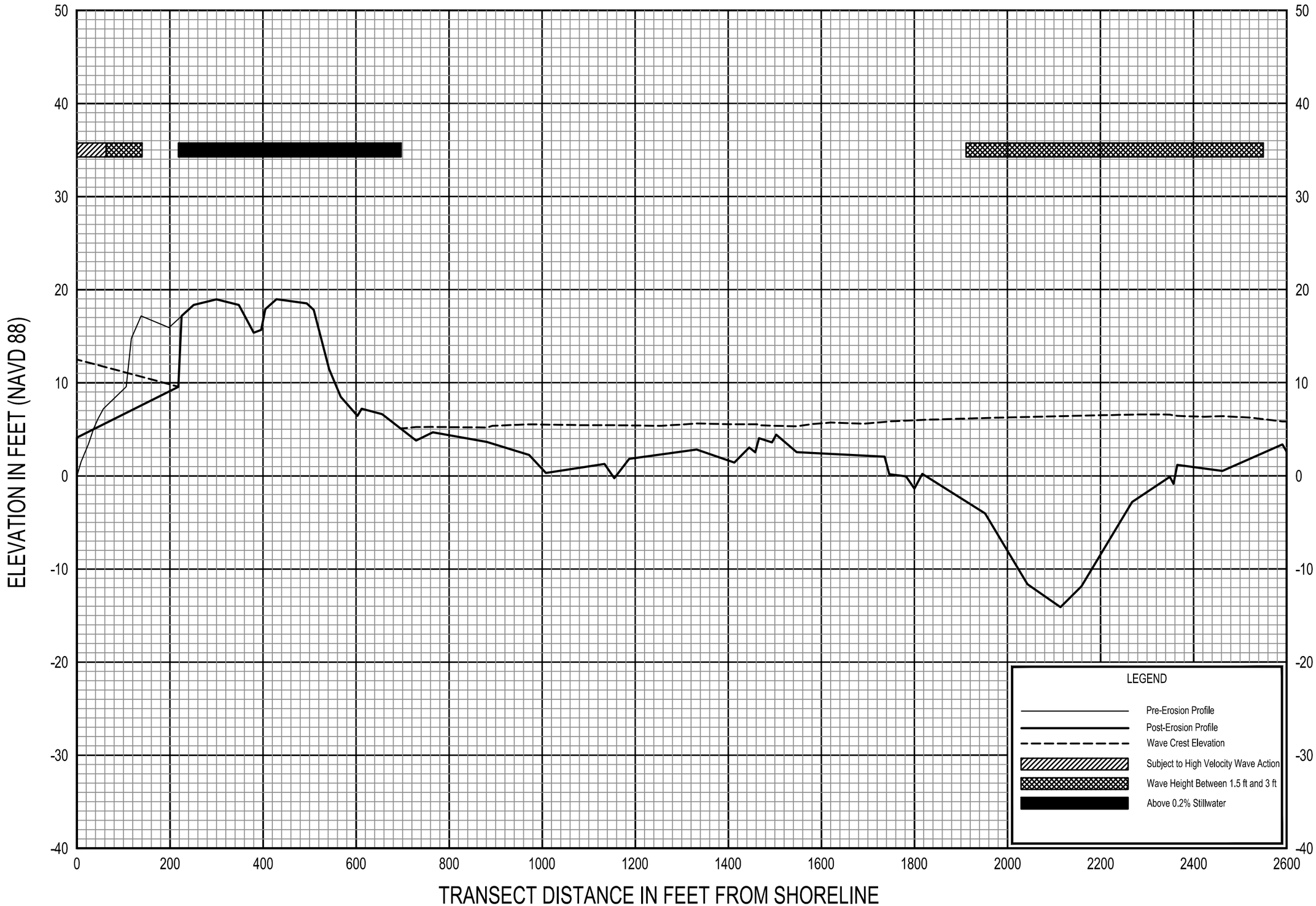


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

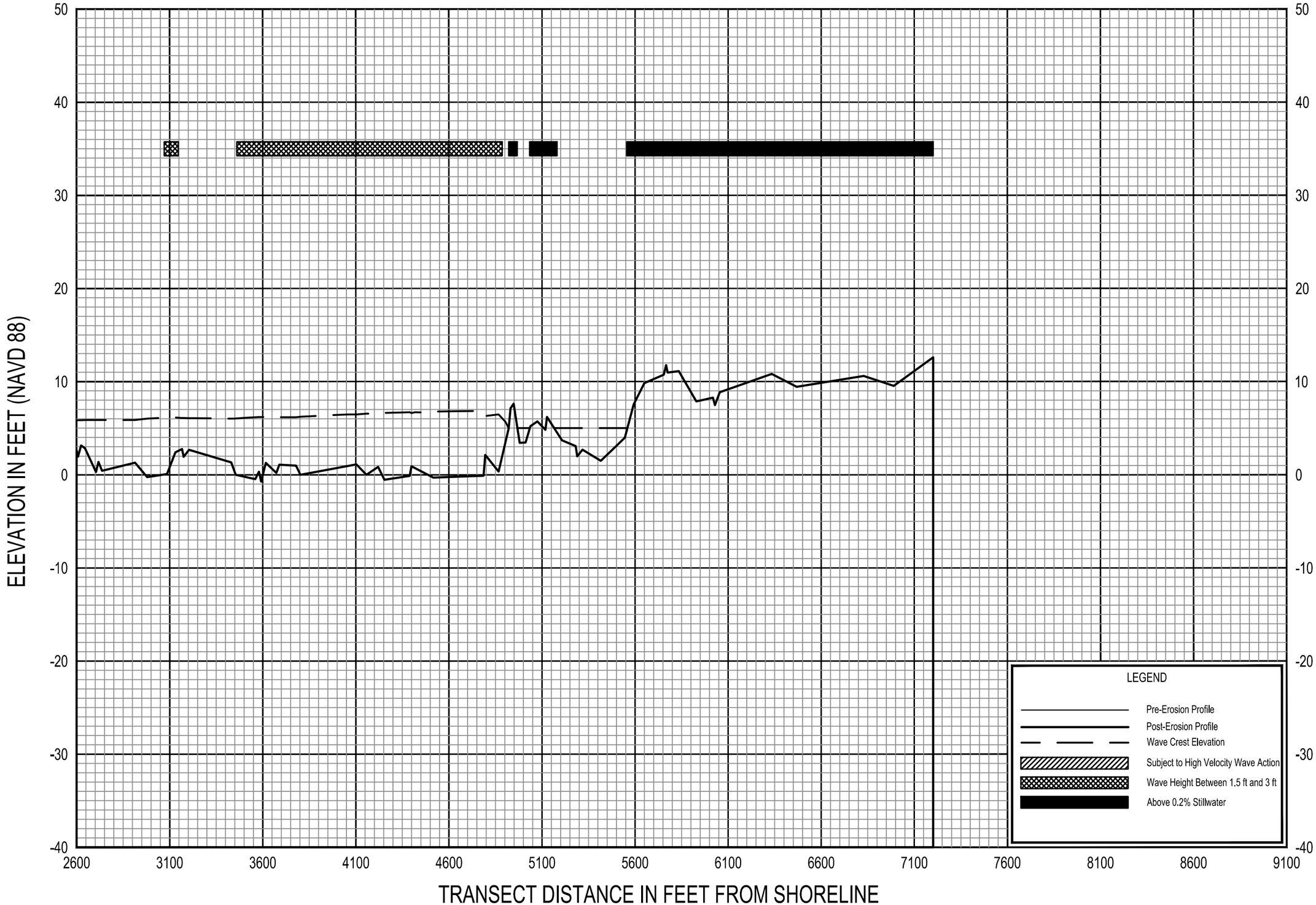


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

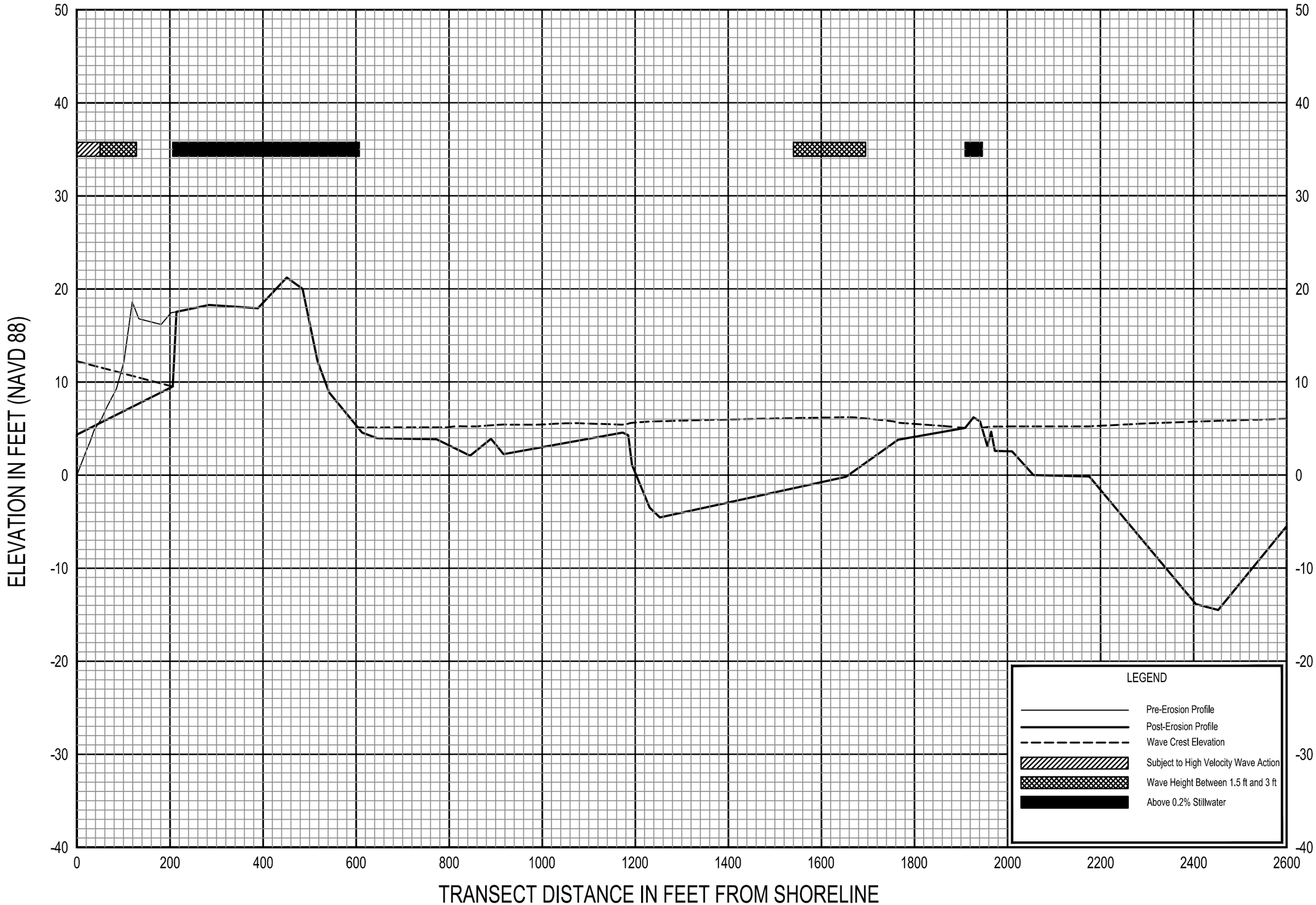


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

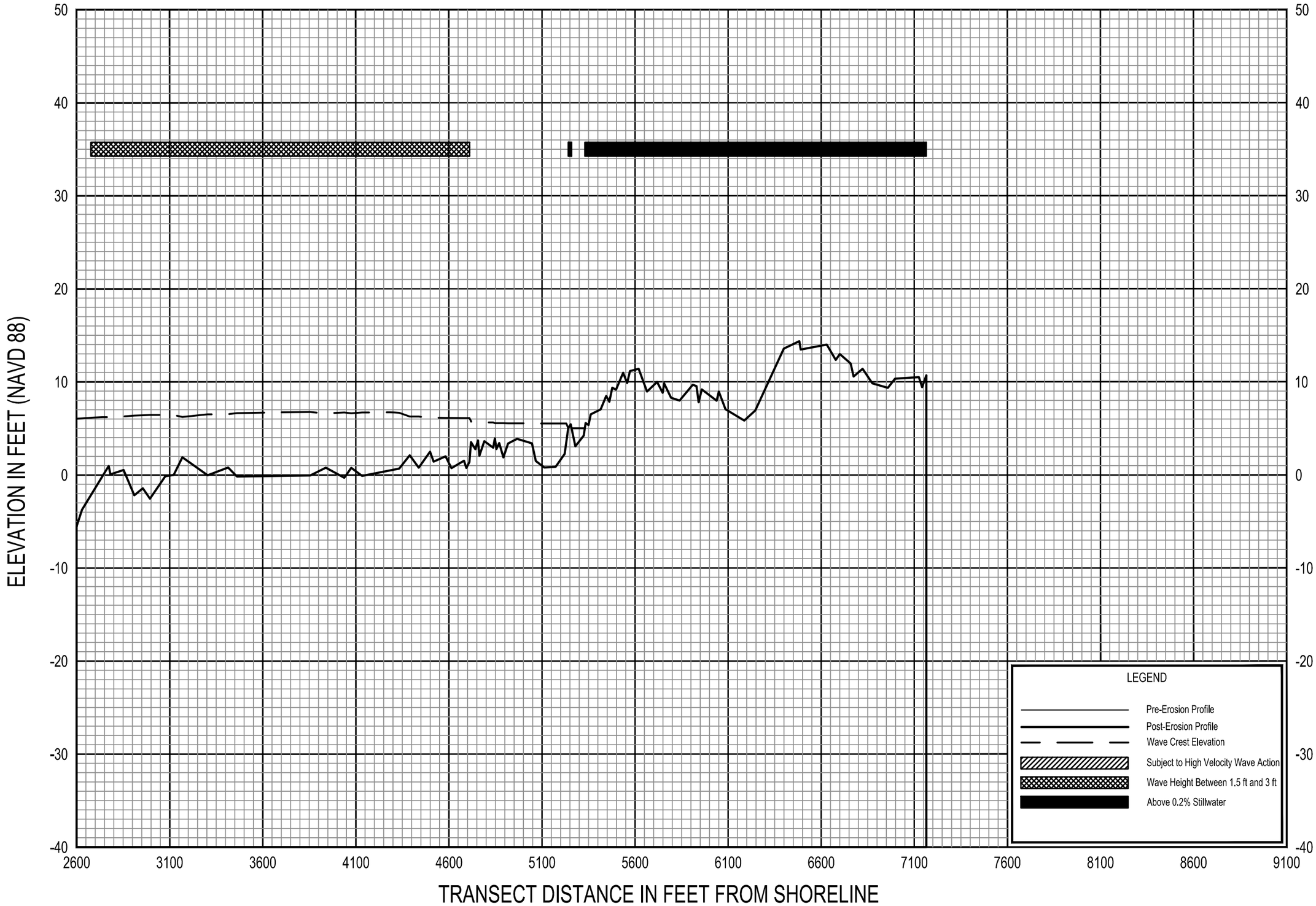


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

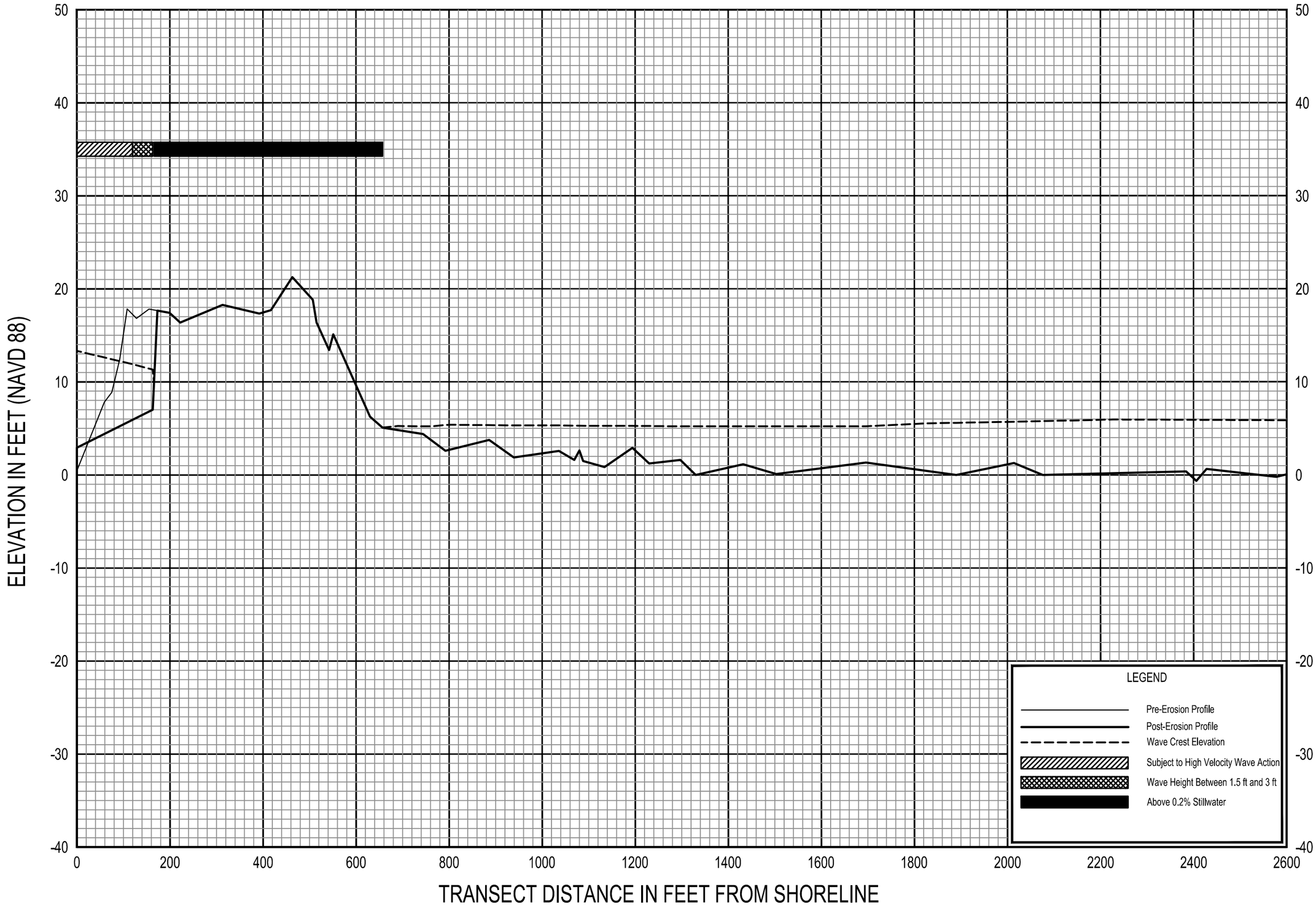


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

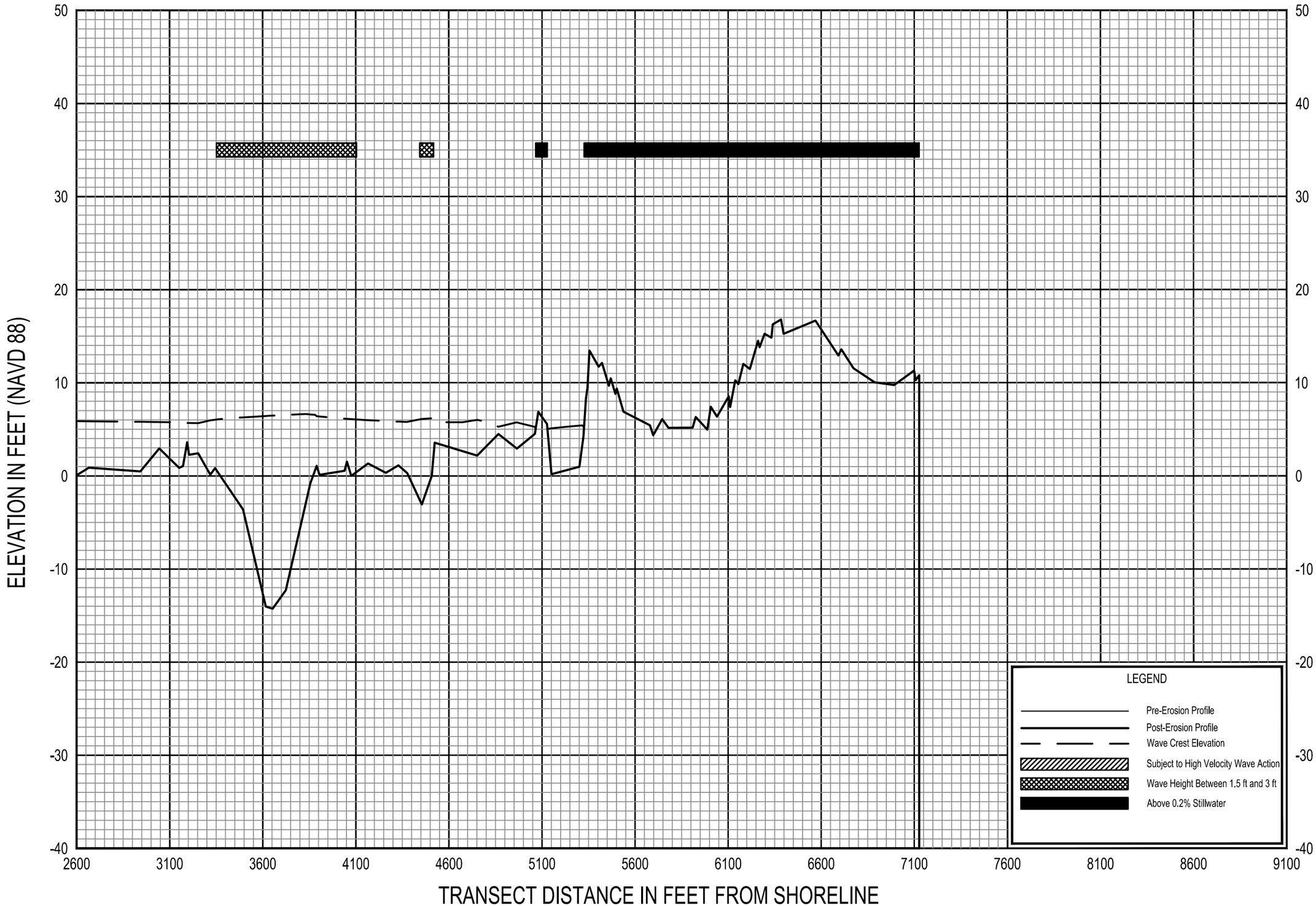


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

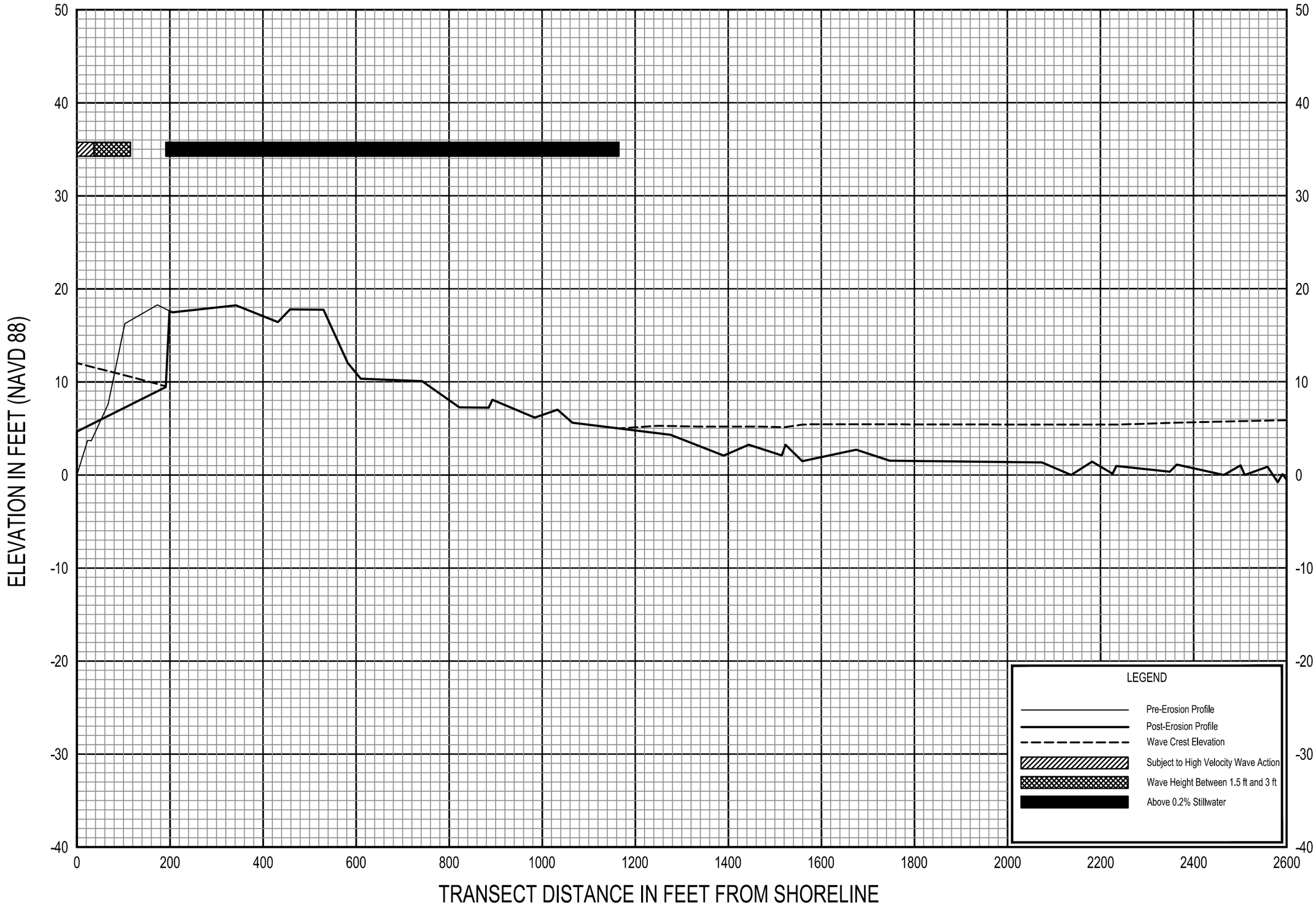


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

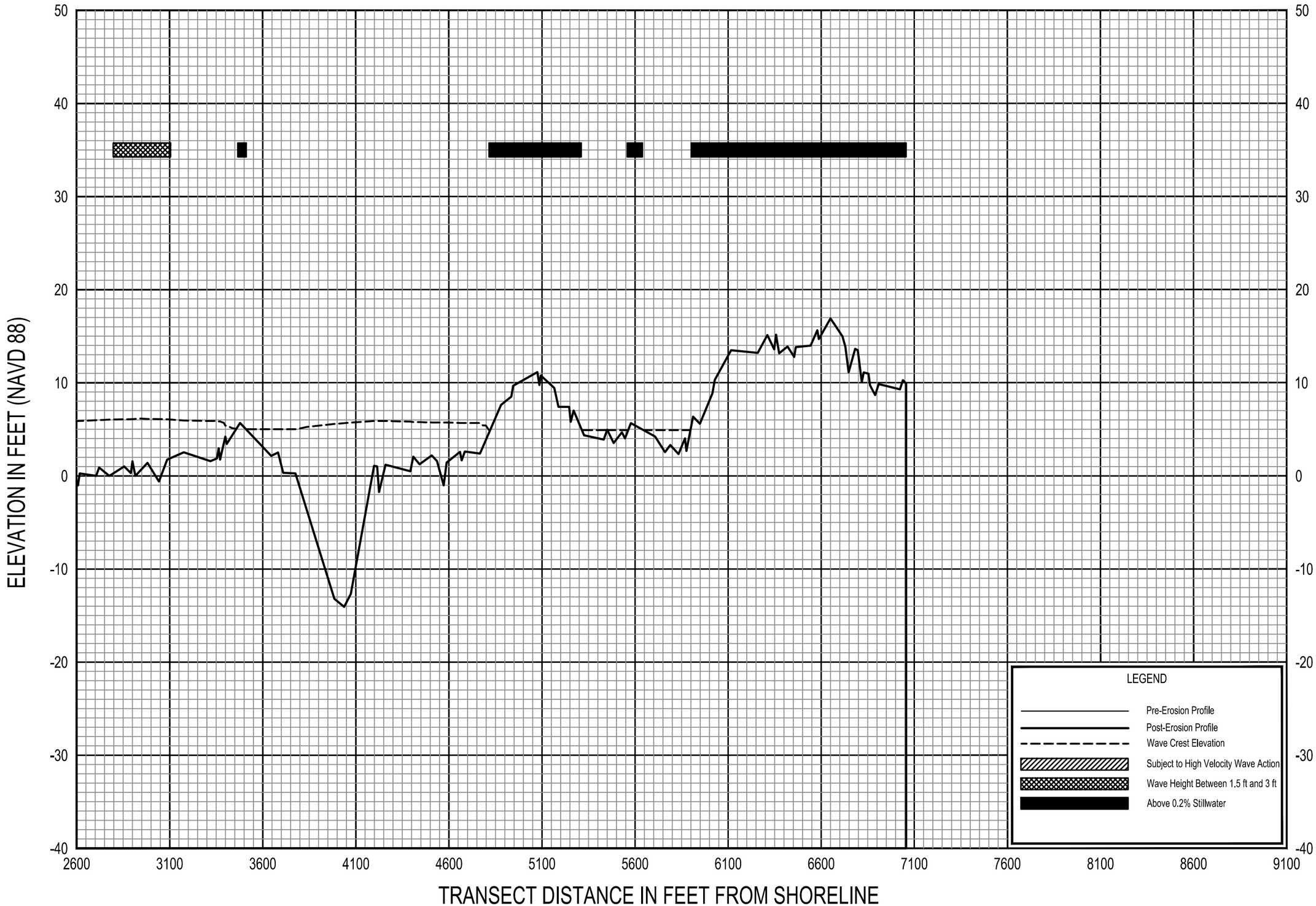


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

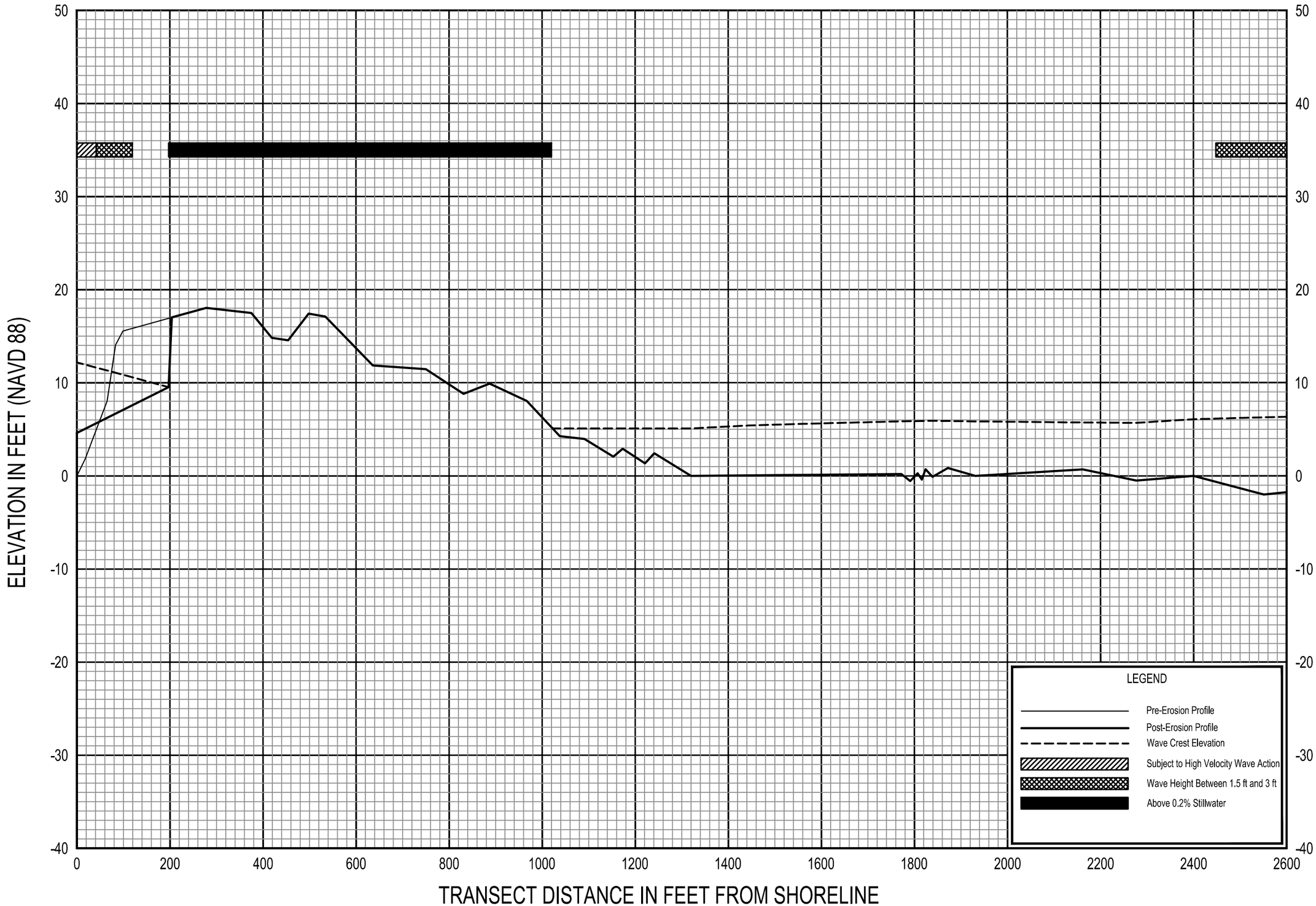


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

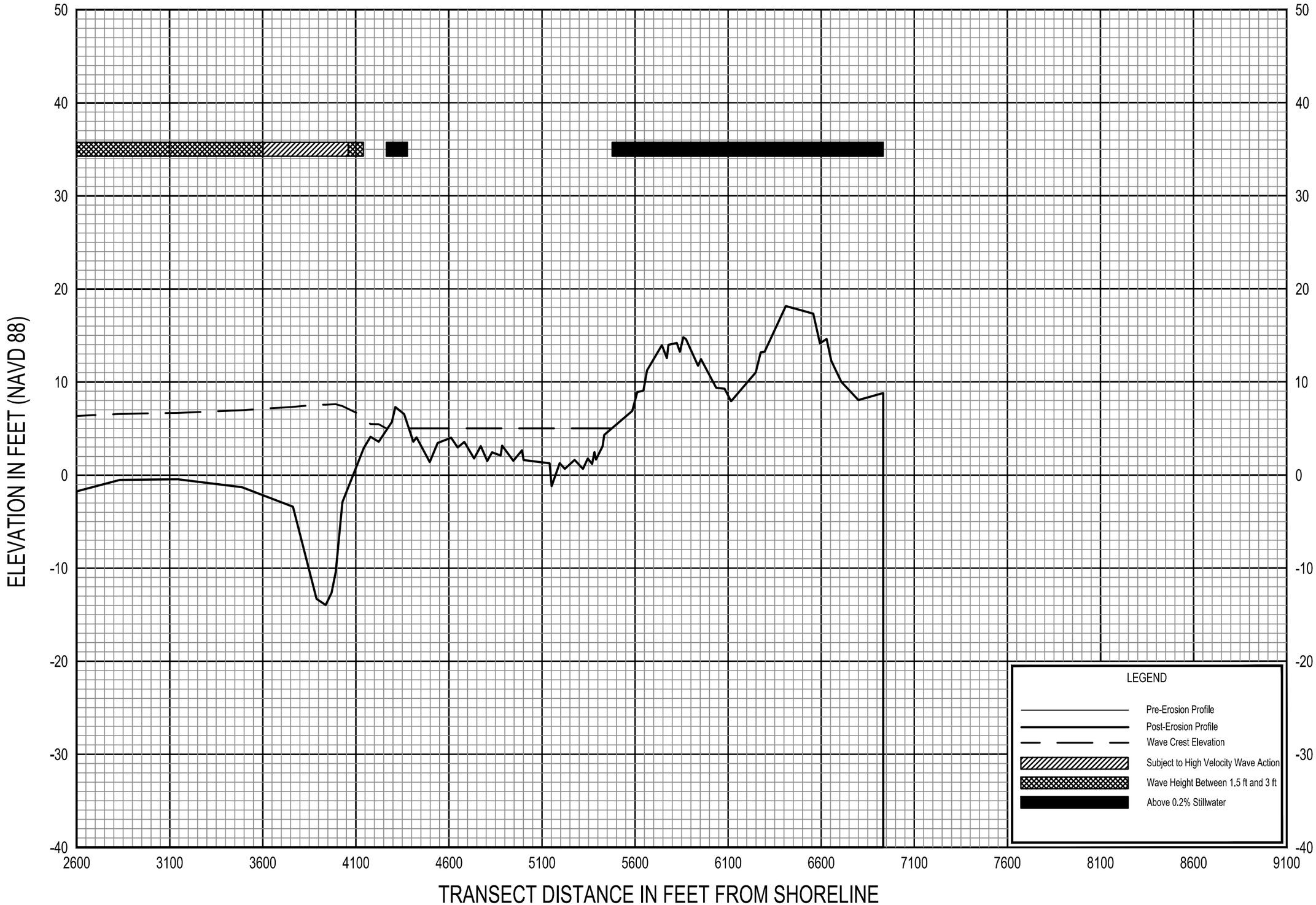


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

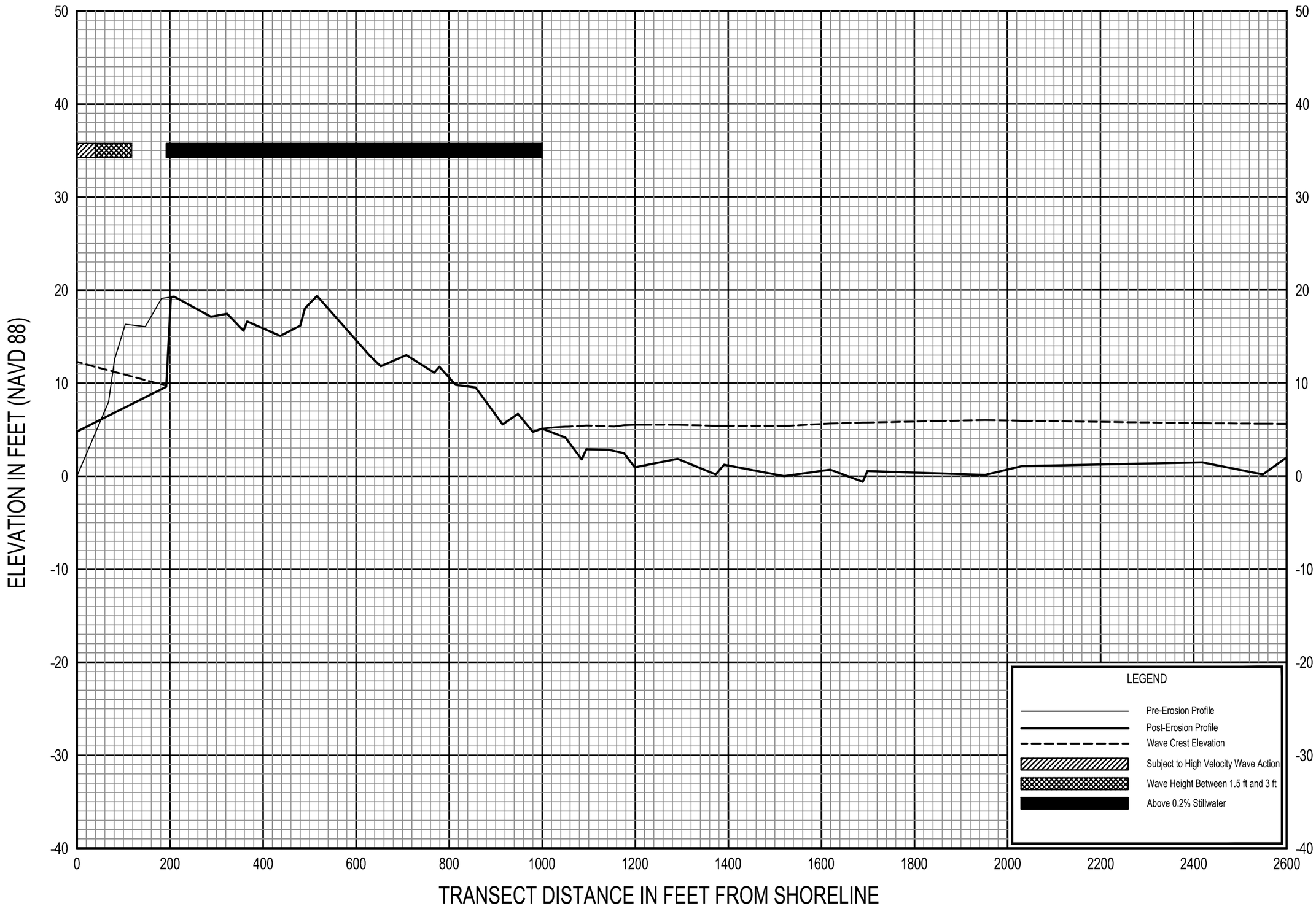


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

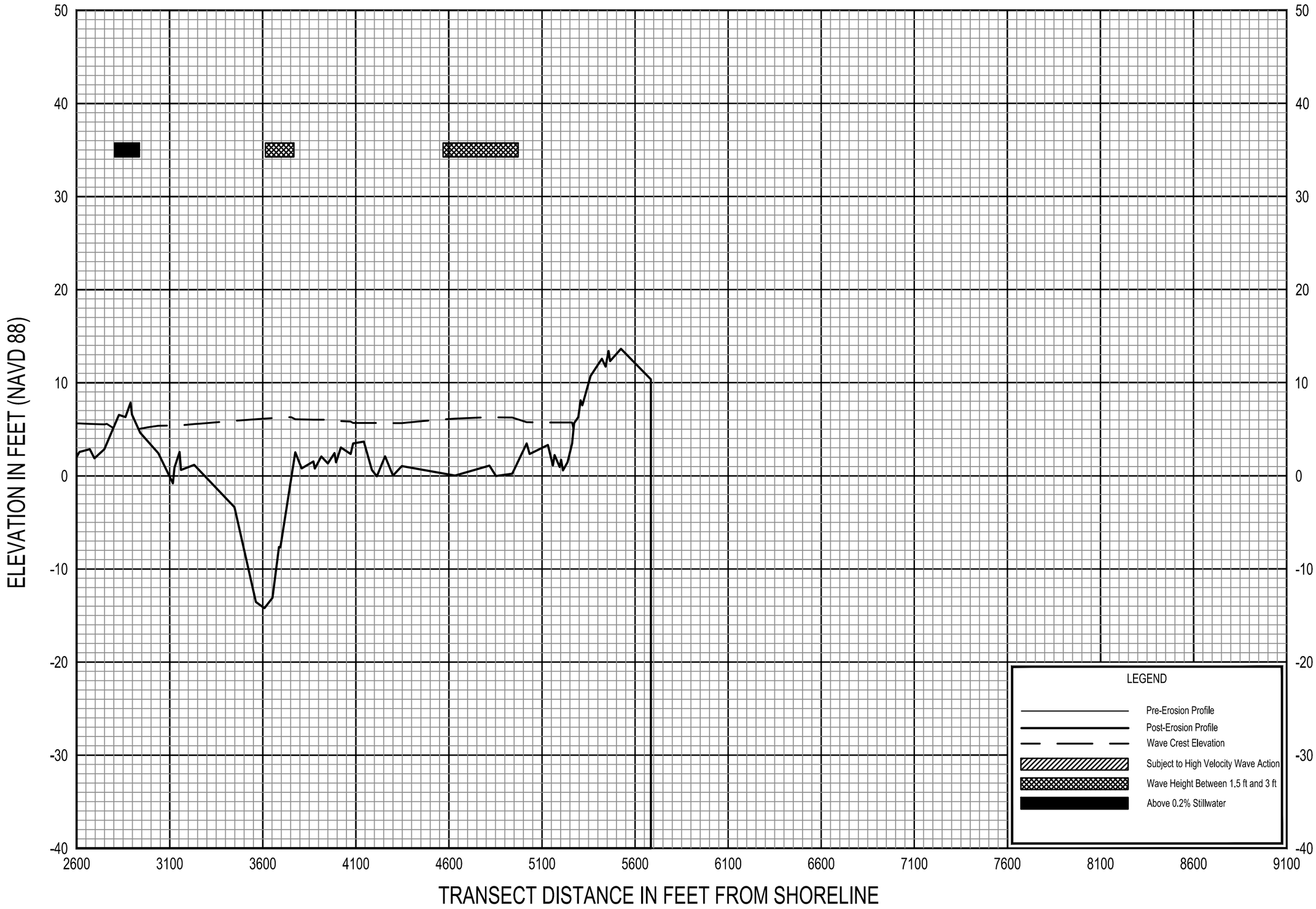


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

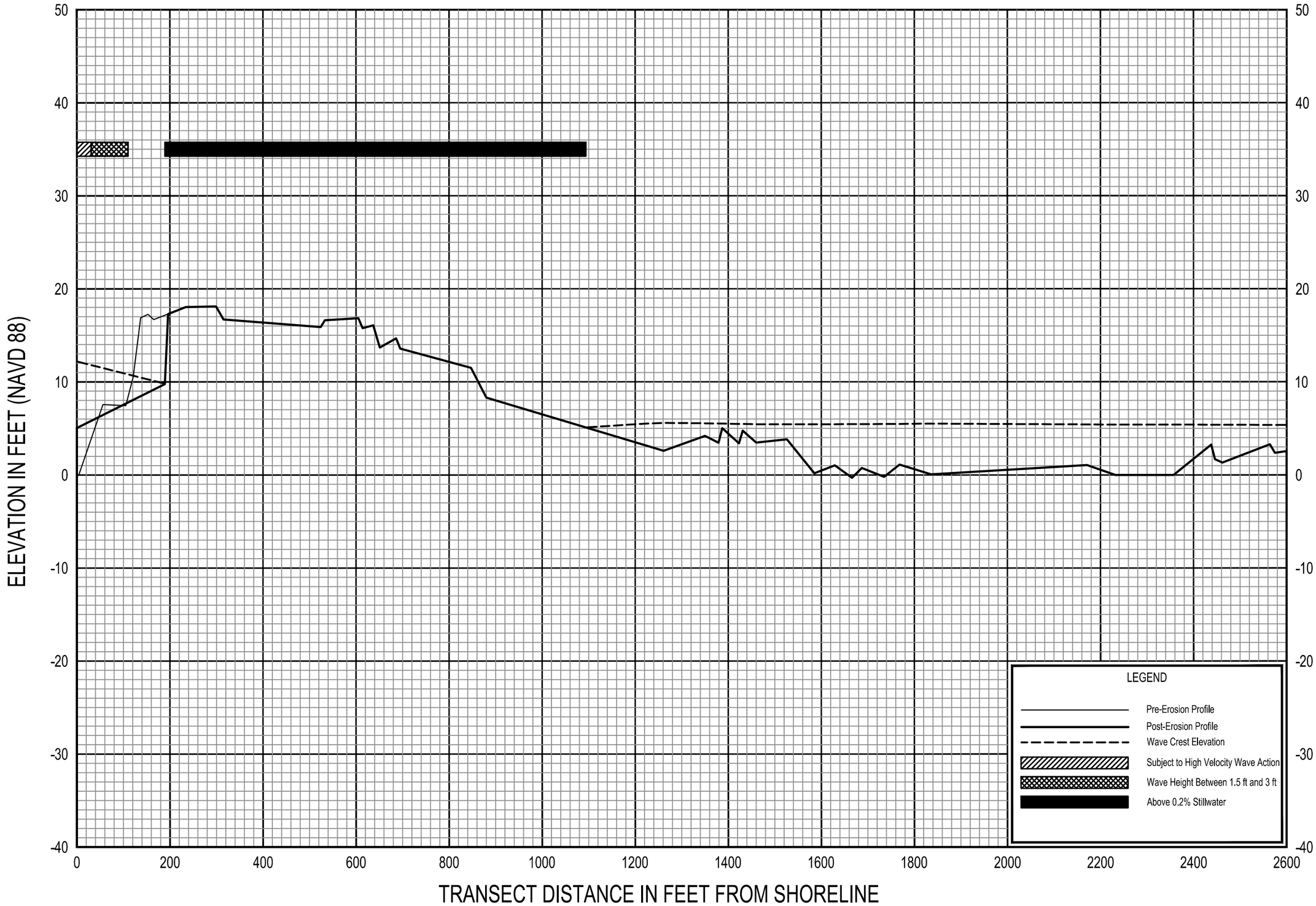


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

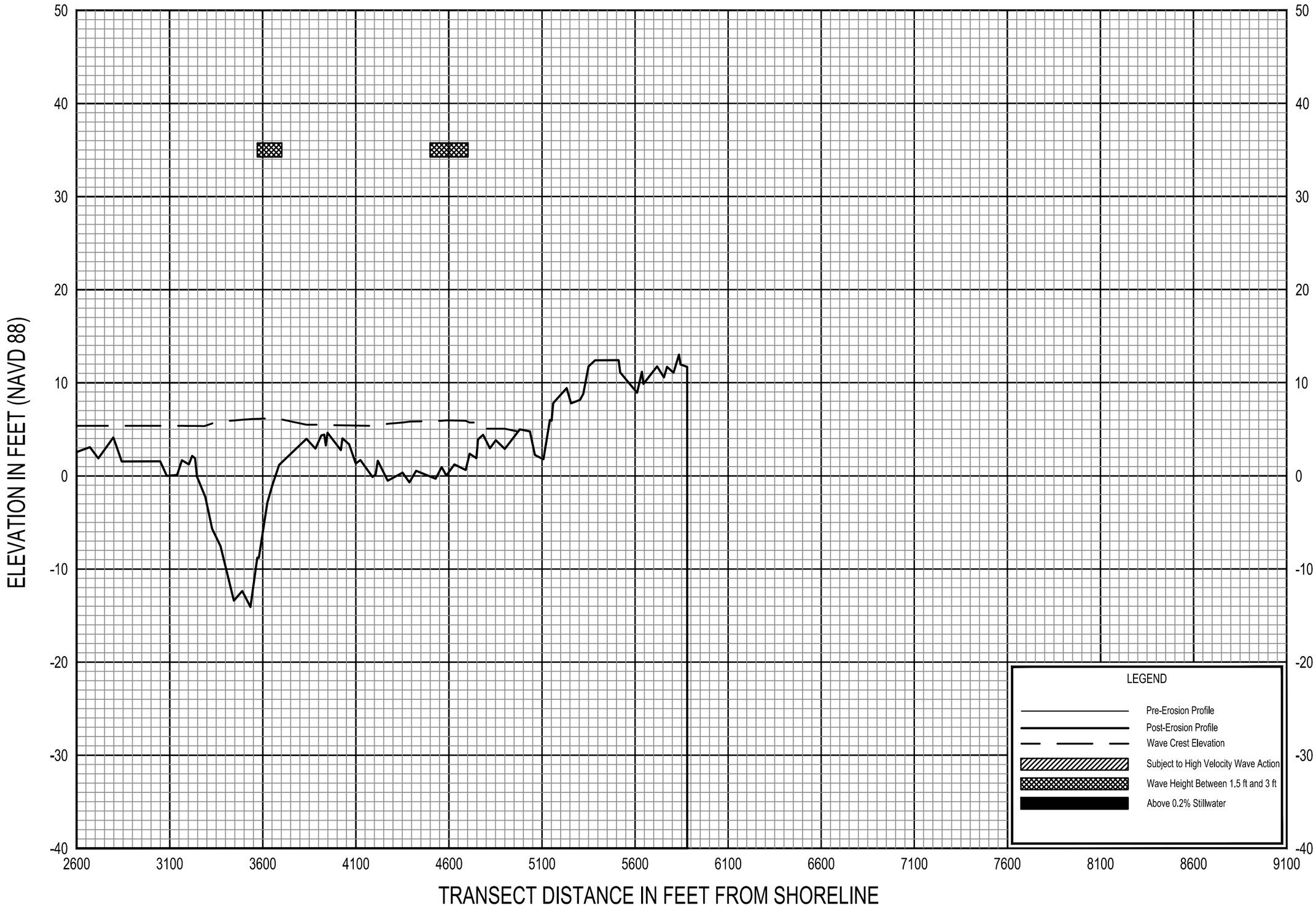


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

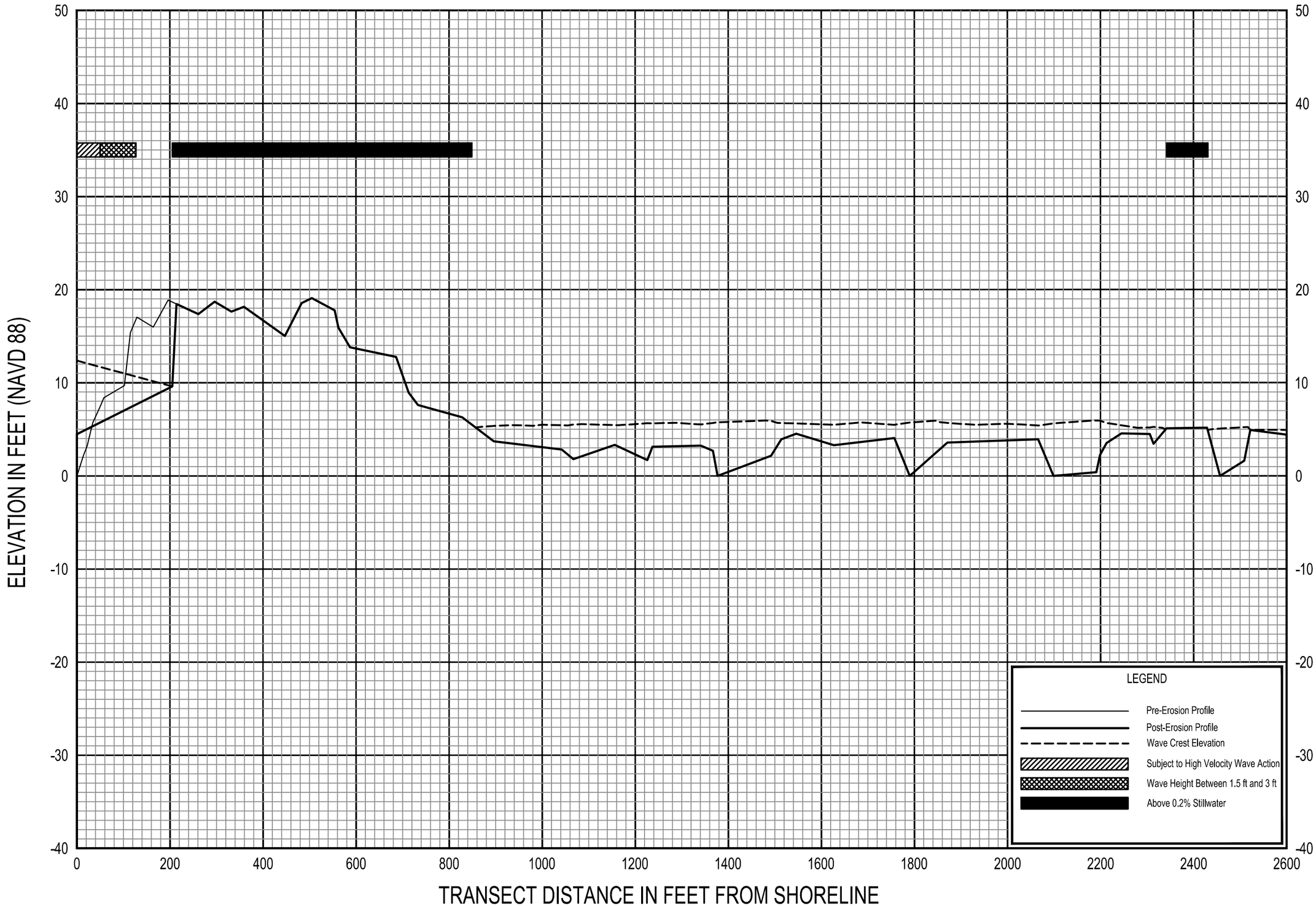


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

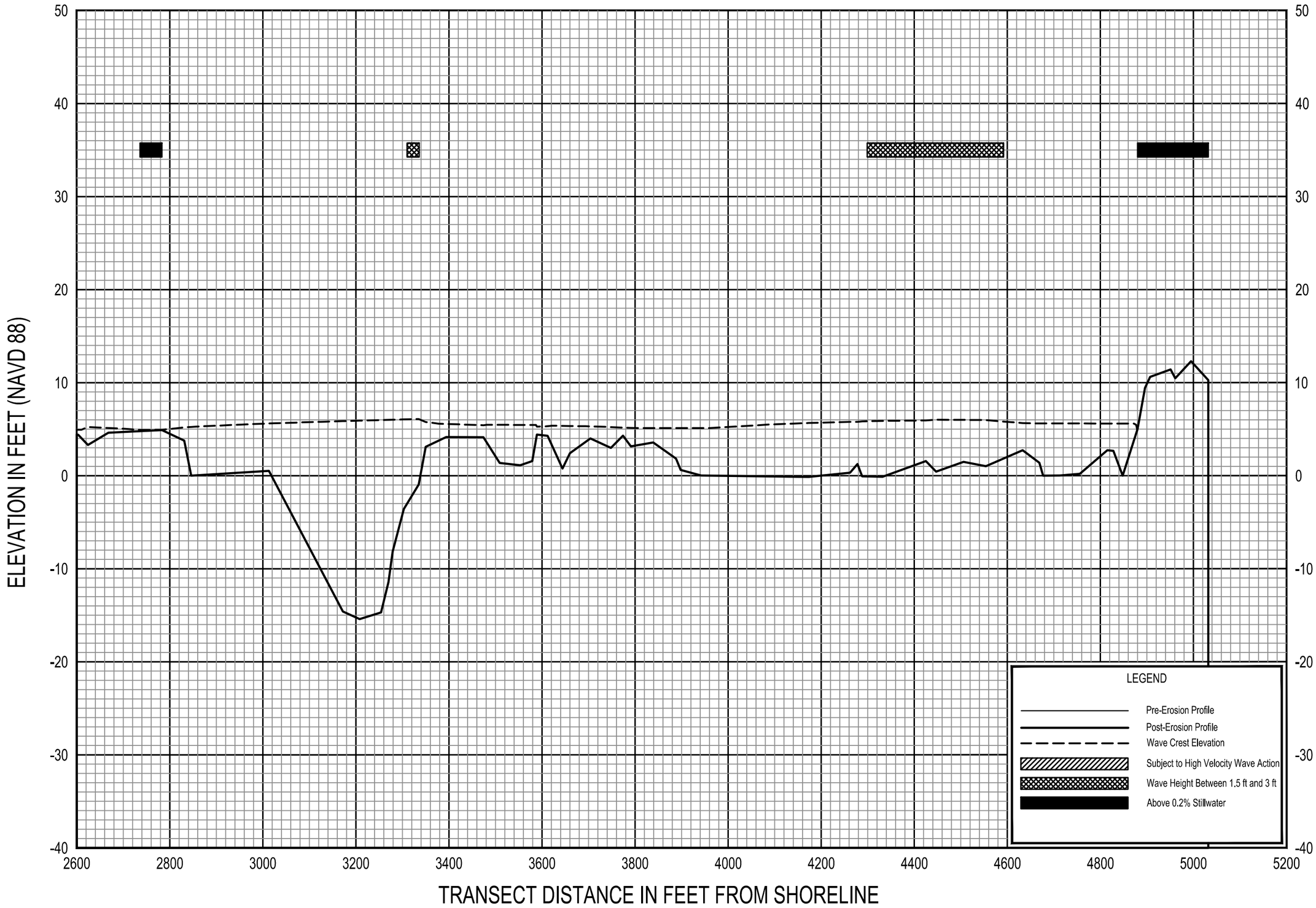


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

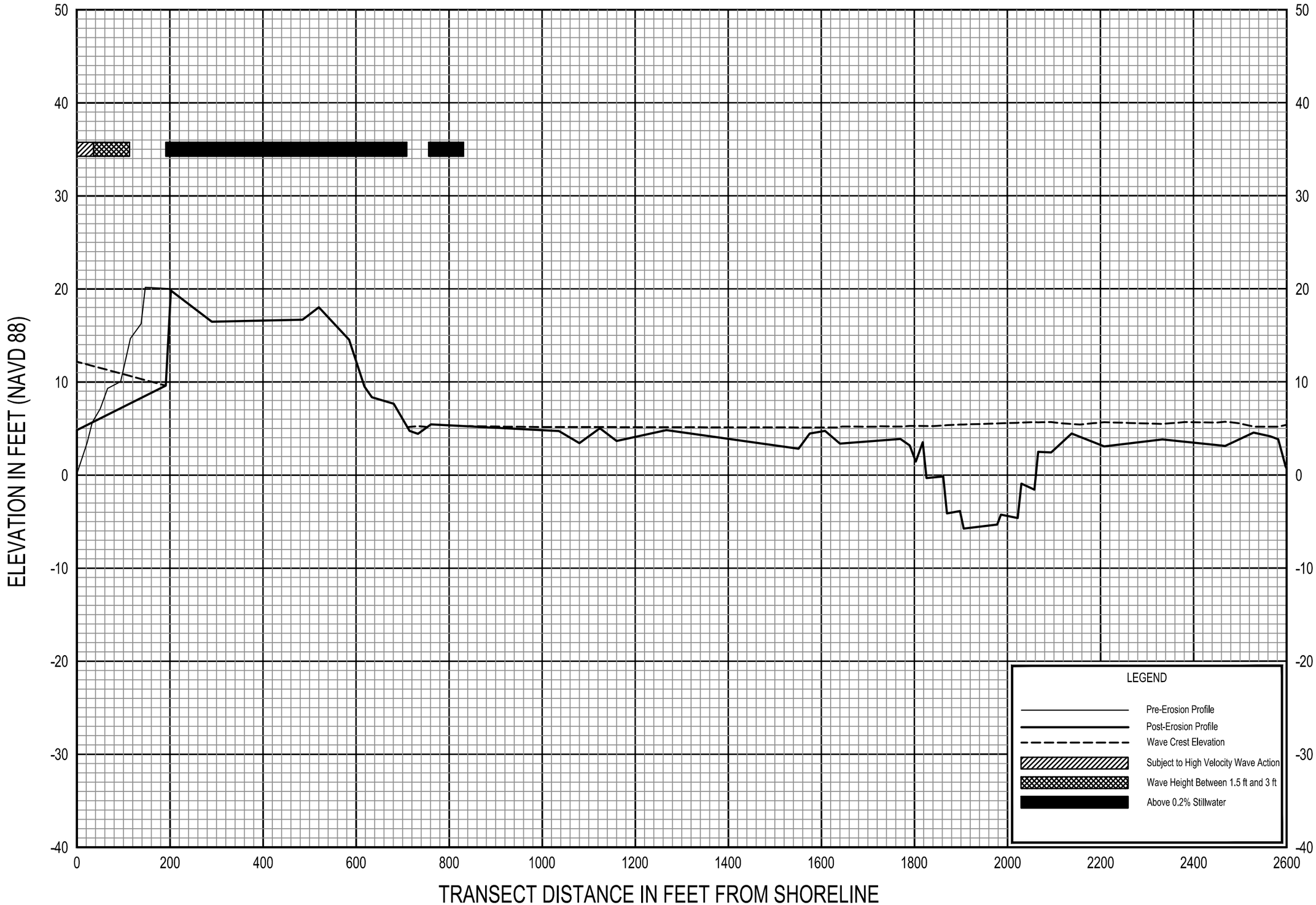


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS

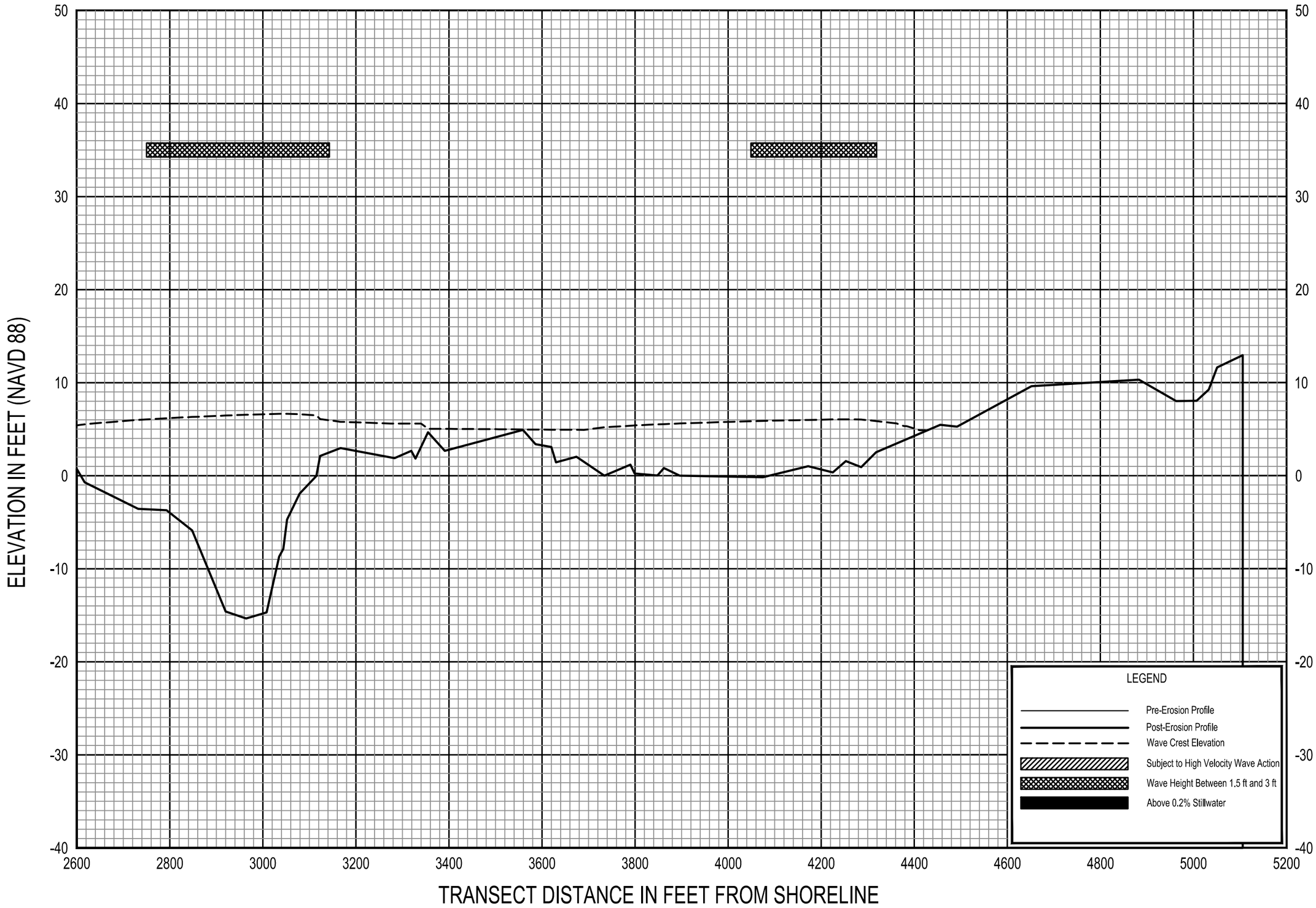


0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLAGLER COUNTY, FL
AND INCORPORATED AREAS