DRAFT

Panhandle Watershed Case Study
TMDL BASINS 03

FAU
FLORIDA ATLANTIC UNIVERSITY

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Executive Summary

Flooding is the most common and costly disaster in the United States. Over 98% of counties in the entire United States having experienced a flood and just one inch of water causing up to $25,000 in damage (FEMA 2018). Flooding can impact a community's social, cultural, environmental and economic resources; therefore, producing sound, science-based, long-term decisions to improve resiliency are critical to future prosperity and growth. To meet the longer-term goals to protect life and property, in 1990, FEMA created the National Flood Insurance Program's (NFIP) Community Rating System (CRS) program, a voluntary program for recognizing and encouraging community floodplain management activities.   Nearly 3.6 million policyholders in 1,444 communities participate in the CRS program, but this is only 5% of the over 22,000 communities participating in the NFIP.

The Florida Department of Emergency Management (FDEM) contracted with FAU to develop data to enable local communities to reduce flood insurance costs through mitigation and resiliency efforts by developing watershed management plans. There are several steps to address the development of watershed plans including the development of a watershed planning template and development of support documents to establish risk associated with community risk within the watershed.

The effort discussed herein focuses on the development procedures for a screening tool to assess risk in the Panhandle TMDL 03 area of Florida. The watershed located in Northwest Florida combines readily available data on topography, ground and surface water elevations, tidal data for coastal communities, open space and rainfall to permit an assessment of the risk of inundation of property within the TMDL 03 Basin. Such knowledge permits the development of tools to permit local agencies to develop means to address high risk properties.

1.0   Introduction

In 1972, the Florida Legislature created the Northwest Florida Water Management District (NWFWMD) within the passage of the Water Resources Act (Pratt et al., 1996). The NWFWMD encompasses an area of about 11,200 square miles. The Panhandle Basin borders the Suwannee River Water Management District. The Panhandle consists of 5 TMDLs, and this report will focus on the eastern basin, TMDL 03. The basin is coastal, so flood risks from rainfall, wet season thunderstorms and tropical storm activity are concerns for local officials and the nearly 300,000 people who live in the watershed. Figure 1 depicts the Choctawhatchee, TMDL 03, shown in orange, within the Panhandle region.

The Panhandle is the least populated and most lightly visited portion of Florida and is closer in appearance to its Deep South neighbors than the tropical backdrop that characterizes the rest of the state.
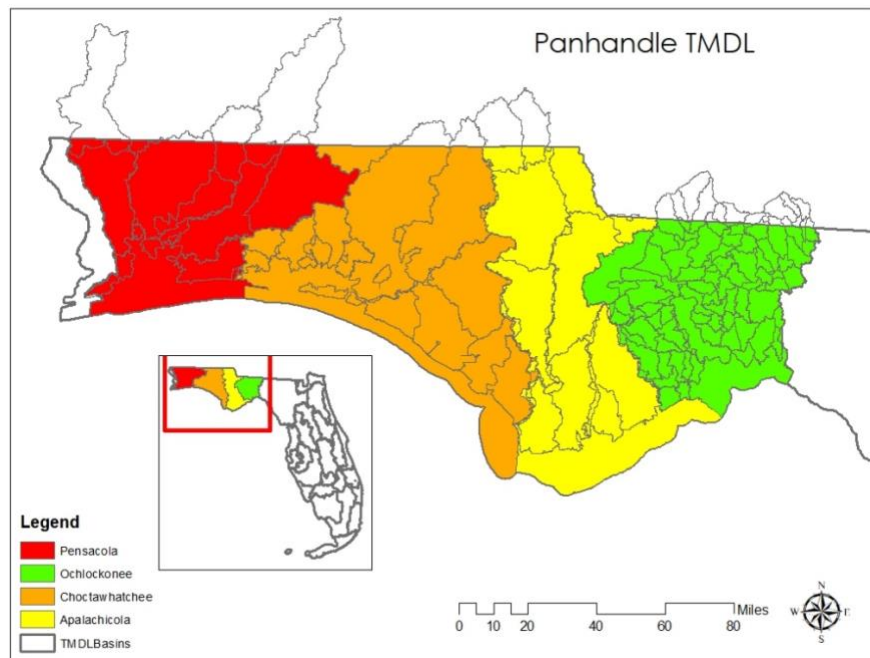

Figure 31. Location of Panhandle

2.0   Summary of Watershed

2.1.   General Description of Watershed

2.1.1.   Climate/Ecology

Nature reigns supreme in North Florida; forests, preserves and parks remain home to wildlife such as black bears, bald eagles and the rare Florida panther (smilingglobe.com, 2020). Cool freshwater springs can be seen throughout the panhandle area allowing for some recreational opportunities such as tubing, cave diving, etc. Normal annual rainfall ranges from about 55 to 67 inches per year; the average annual rainfall is generally highest in the western portion of the NWFWMD and lowest in the eastern portion (Pratt et al., 1996). There are two distinct rainy seasons each year, the first resulting from frontal storm systems during the winter and early spring, and the second occurring during the summer as a result of afternoon and evening thunderstorms.

2.1.2.   Topography and Soils

The regions rolling, hilly terrain more closely resembles areas within Alabama or Georgia than peninsula Florida. Elevations in the highlands area range from 50 to 345 feet above sea level. The highest point in Florida, at 345 feet, is located near the town of Lakewood, which is almost on the Alabama border (smilingglobe.com, 2020). The major physiographic features include the Northern Highlands, and the Coastal Lowlands (Pratt et al., 1996). Panhandle beaches are famous for their white 'sugar sand', composed of quartz washed down from the Appalachian Mountains by ancient rivers. Elevations are low, ranging from sea level to about 100 feet above sea level. The native soil and topography create an environment that is highly permeable and can absorb a significant amount of water into the soil: however, the change in the land use has resulted in the flow of water leading to impermeable land where the water collects in pools or runs off rapidly where development has taken place, in direct contrast to the natural condition. The land in many areas is poorly drained due to a flat topography and associated high water table.

2.1.3. Boundaries/Surface Waters

Drained by several large rivers, the region has extensive pine and hardwood forests, springs and swamps. Barrier islands, beaches, and tidal marshes border most of the Gulf Coast. East of the town of Apalachicola, the beaches and barrier islands give way to vast salt marshes and the coastline is accessible only by boat (smilingglobe.com, 2020). The key elements of the watershed include the bays (Choctawhatchee Bay, West Bay, and East Bay), a few lakes, the rivers, the canal system and the rainfall over the area. Figure 2 depicts the TMDL 03 Basin subdivided into 3 HUCs that will later be analyzed individually through the use of CASCADE.
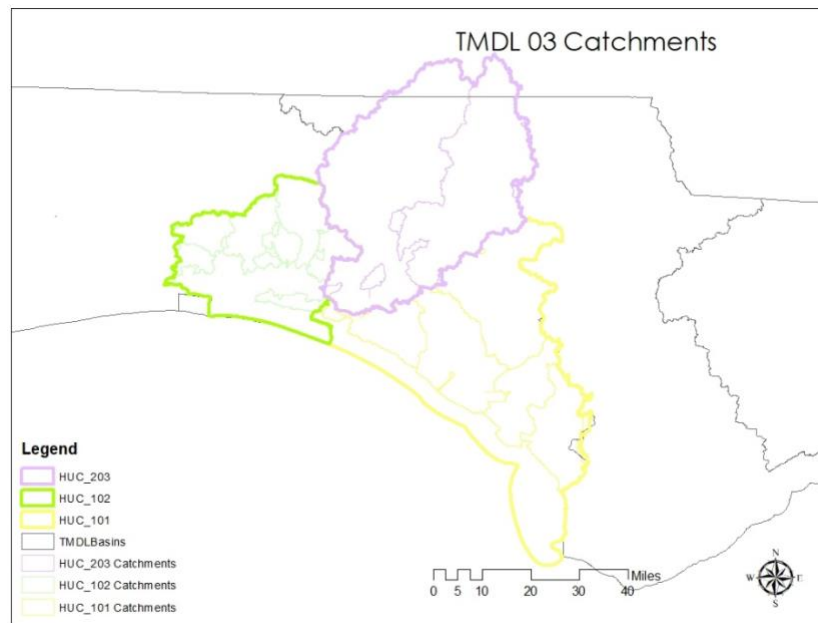
Figure 32. TMDL 03 Catchments

2.1.4. Hydrogeological Considerations

In northwest Florida, the hydrogeologic framework is divided into four groups of sediments that constitute distinct hydrogeologic systems, and each system is a compilation of lithologic beds that have similar hydrogeologic characteristics. (Pratt et al., 1996). Systems are defined by their ability to accelerate or hinder the flow of water and, thus, are not constrained by lithologic or stratigraphic

boundaries. In descending order from land surface, the four systems are: Surficial Aquifer System, which includes the Sand-and-Gravel Aquifer; Intermediate System; Floridan Aquifer System; and Sub-Floridan System. In northwest Florida, the Ad Hoc Committee recognized three aquifer systems, which includes the surficial aquifer system, the intermediate aquifer system and the Floridan aquifer system, and two confining units, which includes the intermediate confining unit and the sub-Floridan confining unit. The subsurface characteristics of each system vary both laterally and with depth. The nature of the variability determines ground water availability or the degree of detention for the respective system at any given location.

2.2. Socio-economic Conditions of the Watershed

2.2.1. Demographics (US Census, 2010)

As of the 2010, the 3 counties that make up the TMDL 03 Basin had a total population of 307,505 people and 117,490 households. The average household size for the TMDL 03 was 3 people per household. The population consists of roughly 19.92% under the age of 18, 20.50% who were 65 years of age or older. The racial makeup of the county was 85.20% White, 9.94% Black or African American, 1.10% Asian, 0.94% Native American, 0.25% Pacific Islander. As of the 2010, the median income for a household in the county was $45,140, and roughly 18.36% of the population were below the poverty line.

2.2.2. Property

According the US Census, the median property valuation, as of 2018, is roughly near $149,720.

2.2.3. Economic Activity/Industry

As of 2018, the total number of employments within the TMDL 03 area is 18,370, with roughly 1,619 establishments. The total retail sales are roughly $4 million (US Census, 2018). Cool freshwater springs bubble up everywhere, affording recreational opportunities such as tubing, swimming, snorkeling, cave diving and sightseeing on glass-bottom boats (smilingglobe.com,

2020). Outdoor enthusiasts can canoe wild and scenic rivers, camp on an open prairie, cycle along the Gulf of Mexico, catch their own scallops, kayak past centuries-old forts and more.

3.0   Watershed Analysis

3.1.   Data Sets

3.1.1. Topography

Figure 3 depicts the results of the LiDAR DEM, using 3-meter tiles, processed conducted for the Panhandle Basin.   The highest points are approximately 528 feet above sea level near the borders of Alabama and Georgia, and the lowest points are 0 feet at sea level shown along the coast of the panhandle.

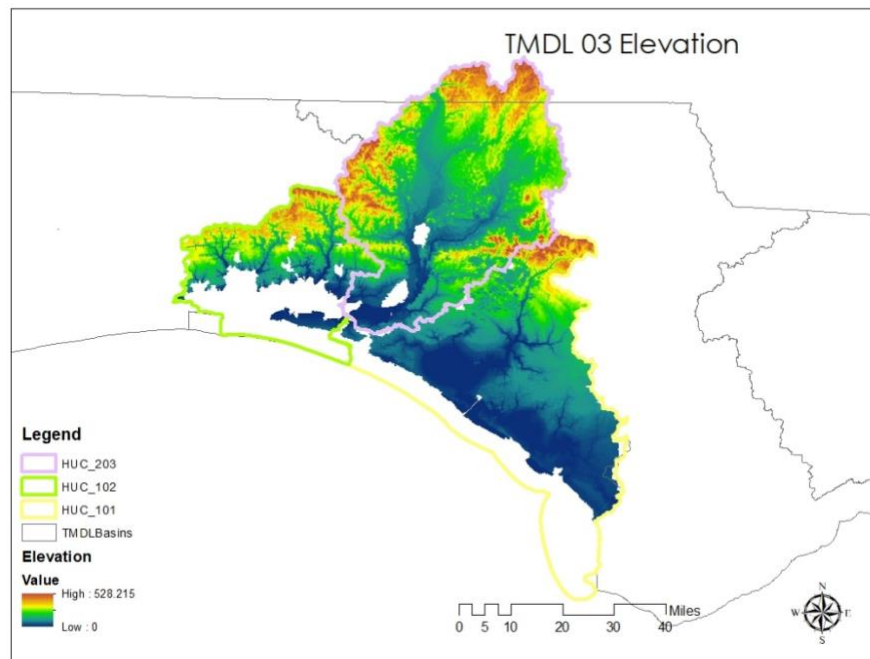Figure 33. Topography of TMDL 03 based on Lidar DEM

The area with the highest elevation belongs to Econfina Creek (HUC_101) at 100 feet, which is located near the Gulf of Mexico, seen in Table 1. Choctawhatchee River (HUC_203) has the largest area at roughly 2.2 billion square feet. The catchments were separated by the bodies of water within them, as well as by the location of water stations.

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Table 3. TMDL 03 Elevation

HUC_101

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN	ACRES
1	Econfina Creek	1	1187731	1068957900.000001	1	100	99	32.797814	19.869042	38954981	100	18	100	27	24539.896694
2	Crooked Creek	2	400009	360008100	0	30	30	7.89389	5.926146	3157627	28	0	30	8	8264.64876
3	Burnt Mill Creek	3	831812	748630800.000001	0	32	32	7.175923	7.161078	5969019	33	0	32	5	17186.198347
4	Sandy Creek	4	473996	426596400	0	161	161	9.320961	7.392051	4418098	30	0	44	9	9793.305785
5	Wetappo Creek	5	528904	476013600	0	22	22	6.38808	3.943138	3378681	23	4	22	5	10927.768595

HUC_102

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN	ACRES
1	Lightwood Kno	1	107690	96921000	0	61	61	24.315489	12.067765	2618535	62	22	61	23	2225
2	Turkey Creek	2	189425	170482500	0	78	78	40.963875	15.575238	7759582	79	52	78	43	3913.739669
3	Rocky Creek	3	280018	252016200	0	88	88	38.632816	19.027855	1081788	89	18	87	39	5785.495868
4	Bear Branch	4	141051	126945900	0	66	66	23.613913	12.995931	3330766	67	22	66	22	2914.27686
5	Alaqua Creek	5	368562	331705800	0	91	91	42.533878	20.696494	1567637	92	59	91	43	7614.917355
6	Lafayette Cree	6	169843	152858700	0	67	67	24.401483	15.185692	4144421	68	6	67	25	3509.152893
7	McQuage Bayo	7	92245	83020500	0	19	19	3.680405	2.88495	339499	20	5	19	3	1905.88843

HUC_203

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN	ACRES
1	Choctawhatchee River	1	2488143	2239328700.000002	0	98	98	34.314386	20.758903	85379099	99	21	98	31	51407.913223
2	Holmes Creek	2	1840286	1656257400.000001	2	101	99	37.291727	17.813646	68627443	100	41	2	36	38022.438017

3.1.2. *Groundwater*

Figure 4, shown below, depicts the ground water levels within the Panhandle region. The highest point reaches 211 feet near the Alabama and Georgia borders, and the lowest point is nearly at 7 feet below sea level along the coastline.
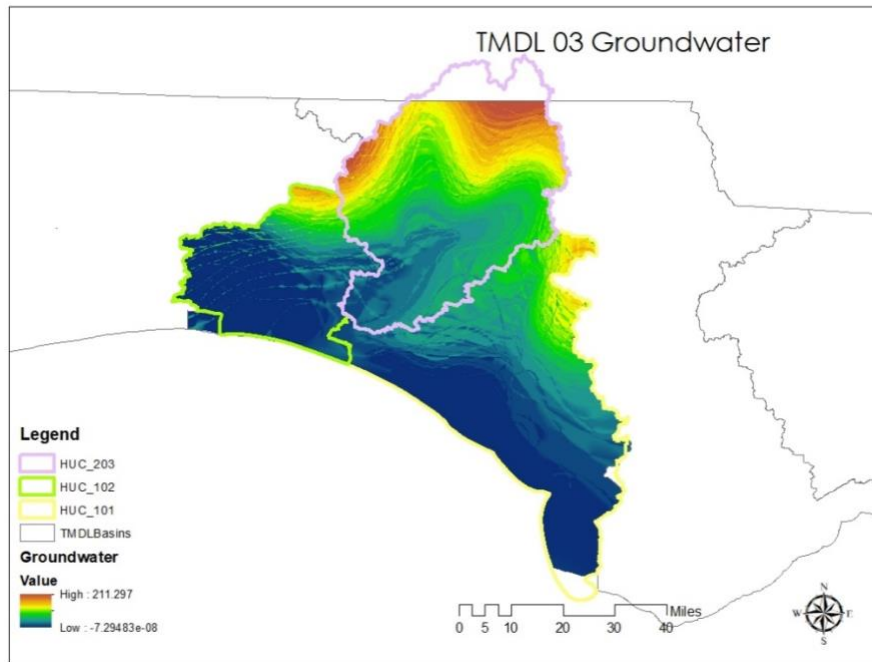

Figure 34. TMDL 03 Groundwater

The area with the highest groundwater level occurs within the Econfina Creek (HUC_101) at 139 feet, which is located near the Gulf of Mexico, seen in Table 2.

Table 4. TMDL 03 Groundwater

HUC_101

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Econfina Creek	1	1187658	1068892200	10	139.928741	129.928741	58.036427	23.330158	68927426.560246
2	Crooked Creek	2	399992	359992800	0	42.767731	42.767731	15.658382	12.284863	6263227.52552
3	Burnt Mill Creek	3	831808	748627200	0	49.999535	49.999535	11.740413	12.882744	9765769.55044
4	Sandy Creek	4	473996	426596400	0	69.977829	69.977829	17.818515	13.238611	8445904.620038
5	Wetappo Creek	5	528900	476010000	0	39.993809	39.993809	13.898185	8.708171	7350749.978892

HUC_102

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Lightwood Knot Creek	1	107683	96914700	0	78.432442	78.432442	1.222626	6.523438	131656.056517
2	Turkey Creek	2	189402	170461800	0	89.996185	89.996185	6.130482	14.273197	1161125.59037
3	Rocky Creek	3	280003	252002700	0	119.853859	119.853859	20.977949	25.424961	5873888.558437
4	Bear Branch	4	141051	126945900	0	79.648445	79.648445	14.742706	12.265668	2079473.396665
5	Alaqua Creek	5	368490	331641000	0.008556	139.983856	139.9753	65.619471	31.797213	24180118.998961
6	Lafayette Creek	6	169822	152839800	5.469113	59.560009	54.090896	19.387278	8.638044	3292386.32794
7	McQuage Bayou	7	92245	83020500	0	19.99958	19.99958	3.780832	5.263842	348762.854613

HUC_203

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Choctawhatchee River	1	2488043	2239238700	0	200	200	74.972421	45.107654	186534606.244977
2	Holmes Creek	2	1840083	1656074700	16.492241	200	183.507759	80.079316	47.342576	147352587.214706

3.1.3. *Impervious Areas*

Figure 5 represents the impervious areas, primarily roads in the Panhandle region. These are areas where water cannot seep into the soil and as a result seep to unsaturated areas. Most of the impervious areas are located near the coastline.
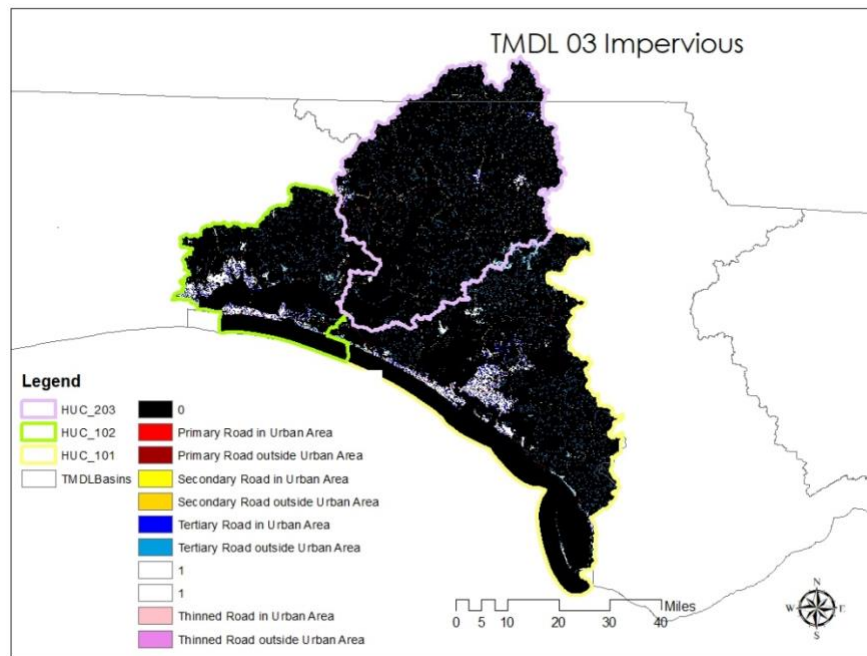

Figure 35. TMDL 03 Impervious Areas

Figure 6 is the water holding capacity. The highest capacity is at 0.65 feet and the lowest is at zero feet.
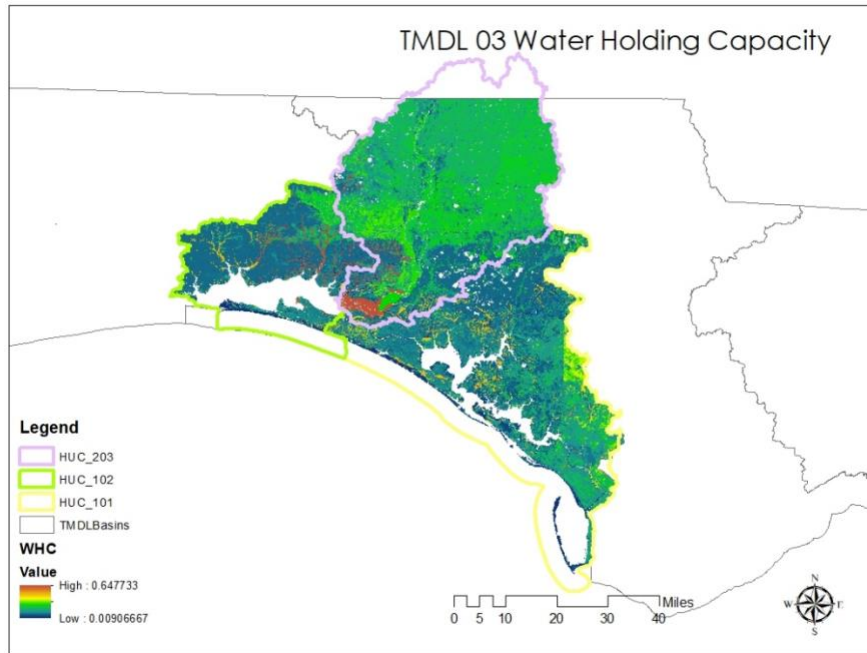
Figure 36. TMDL 03 Water Holding Capacity

3.1.4. Ground Storage

Figure 7 represents the ground storage within the Choctawhatchee area. The highest levels of ground storage are located in the northern portion, and stretch south within HUC_203. The lowest levels are concentrated near the coast.
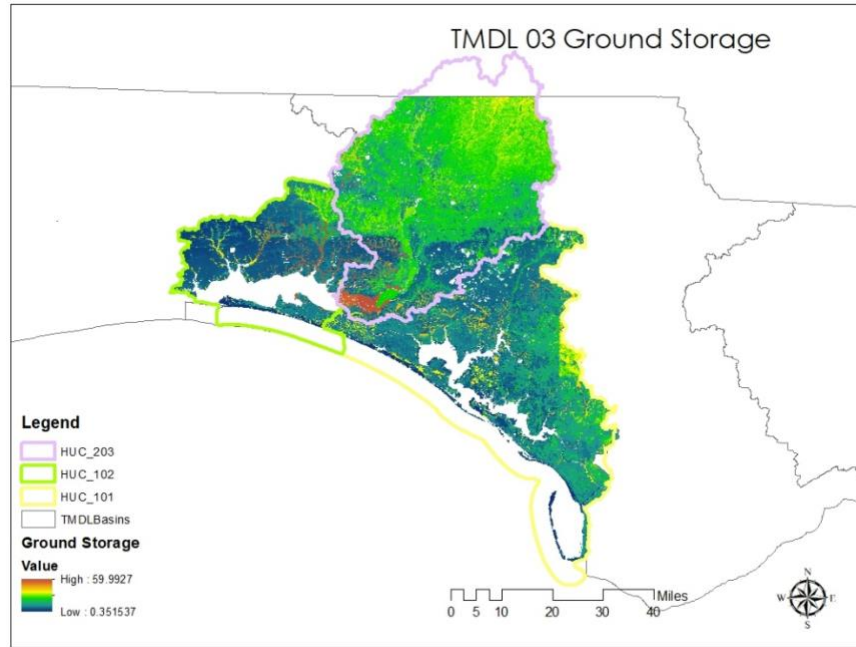
Figure 37. TMDL 03 Ground Storage

The area with the highest ground storage level occurs within the Choctawhatchee River (HUC_203) at 59 feet, seen in Table 3.

Table 5. TMDL 03 Ground Storage

HUC_101

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Econfina Creek	1	1035199	1035199200	4.398	38.91	34.5131	10.766129	5.369511	11145088
2	Crooked Creek	2	3108381	310838100	2.321	41.45	39.1335	10.400656	6.081116	32329200.
3	Burnt Mill Creek	3	5641146	564114600	2.288	32.93	30.6468	9.965431	5.819133	56216450.
4	Sandy Creek	4	3746035	374603500	0.351	36.56	36.2092	11.606279	5.433545	43477527.
5	Wetappo Creek	5	4705075	470507500	0.504	41.40	40.9054	12.445279	4.519376	58555973.

HUC_102

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Lightwood Knot Creek	1	962973	96297300	4.066	35.24	31.1780	6.383604	3.347215	6147238.6
2	Turkey Creek	2	1702444	170244400	3.278	38.91	35.6367	6.889436	5.248269	11728878.
3	Rocky Creek	3	2516006	251600600	3.729	53.91	50.1843	8.631221	7.809505	21716202.
4	Bear Branch	4	1260613	126061300	2.96	46.19	43.2380	9.91126	9.386854	12494263.
5	Alaqua Creek	5	3287165	328716500	4.126	55.21	51.0926	14.161921	9.472276	46552570.
6	Lafayette Creek	6	1503034	150303400	3.579	44.74	41.1667	10.713648	9.639567	16102977.
7	McQuage Bayou	7	689855	68985500	3.479	44.01	40.5485	9.813312	5.689478	6769762.6

HUC_203

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Choctawhatchee River	1	21970970	2197097000.000001	3.73312	59.992725	56.259605	16.812324	7.026273	369383062.426815
2	Holmes Creek	2	16285286	1628528600.000001	4.511121	43.663361	39.15224	16.674845	5.744885	271554617.61739

3.1.5. *Precipitation*

Figure 8 depicts the precipitation values within the TMDL 05 region. Precipitation flows from the northeast experiencing less rainfall with roughly 11 inches of rainfall, and the southwestern portion

experiencing higher levels of rainfall with approximately 14.5 inches of rainfall. Most of the area is medium rainfall. Almost exclusively, rainfall occurs in the southwest corner of the TMDL.
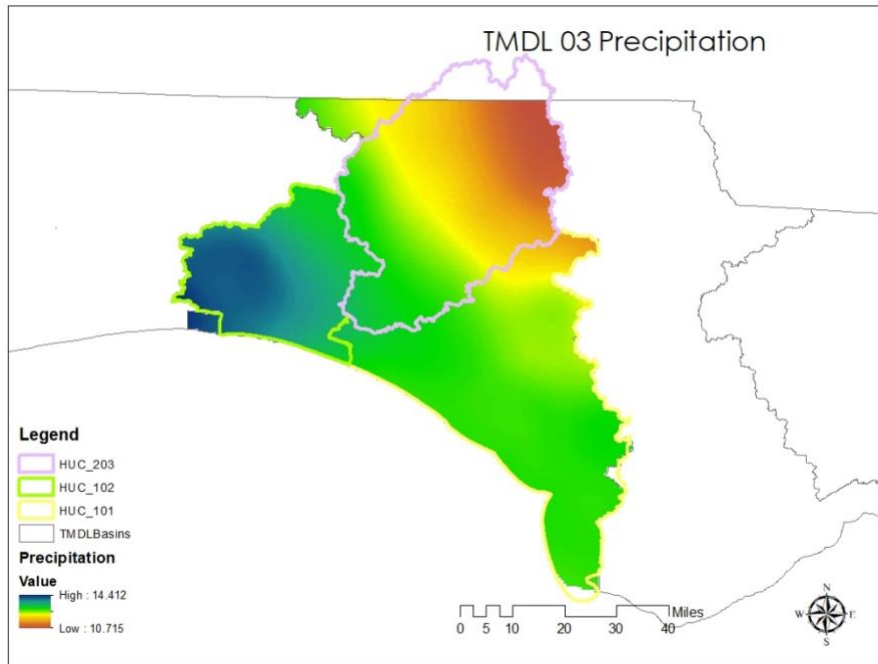

Figure 38. TMDL 03 Precipitation

Lightwood Knot Creek (HUC_102) and Rocky Creek (HUC_102) experience the largest amount of rainfall with roughly 14 plus inches of rainfall, seen in Table 4. Both Lightwood Knot Creek and Rocky Creek are located in the southwest portion of the Panhandle region. The area with the lowest rainfall, nearly 10.5 inches, is located near Holmes Creek.

Table 6. TMDL 03 Precipitation

HUC_101

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Econfina Creek	1	1406	1072031224.92003	11.423	12.746	1.323	12.365106	0.301989	17385.339006
2	Crooked Creek	2	469	357597897.928516	12.886	13.349	0.463	13.013264	0.091447	6103.221004
3	Burnt Mill Creek	3	985	751031832.536436	12.6	12.937	0.337	12.80936	0.066487	12617.220006
4	Sandy Creek	4	555	423170220.36317	12.467	12.934	0.467	12.811564	0.097954	7110.417986
5	Wetappo Creek	5	621	473493165.487438	12.689	12.991	0.302	12.907196	0.050511	8015.369005

HUC_102

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Lightwood Knot Creek	1	124	95144585.65733	14.084	14.412	0.328	14.155266	0.065319	1755.253
2	Turkey Creek	2	223	171106795.17407	13.813	14.16	0.347	14.033184	0.092955	3129.399996
3	Rocky Creek	3	328	251672774.964551	13.169	14.177	1.008	13.792168	0.304849	4523.831008
4	Bear Branch	4	162	124301797.391028	13.359	14.067	0.708	13.650154	0.188066	2211.324997
5	Alaqua Creek	5	435	333773344.84628	13.037	13.569	0.532001	13.18723	0.114292	5736.445001
6	Lafayette Creek	6	196	150389828.942232	12.986	13.479	0.493	13.198224	0.129219	2586.851998
7	McQuage Bayou	7	110	84402455.018599	13.371	13.931	0.559999	13.646764	0.158665	1501.144004

HUC_203

Rowid	NAME	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Choctawhatchee River	1	2949	2237685266.873972	11.066	13.354	2.288	12.347969	0.56239	36414.159977
2	Holmes Creek	2	2188	1660242578.474144	10.621	12.85	2.229	11.55421	0.613648	25280.611997

3.1.6. Surface Waters

Figure 9 shows the location of existing water stations. The data provided from each water station will justify the results obtained from CASCADE. Some HUCs did not contain any existing water stations, however due to the flow of the rivers, the data collected from the basin upstream will be used to prove the validity of the results.
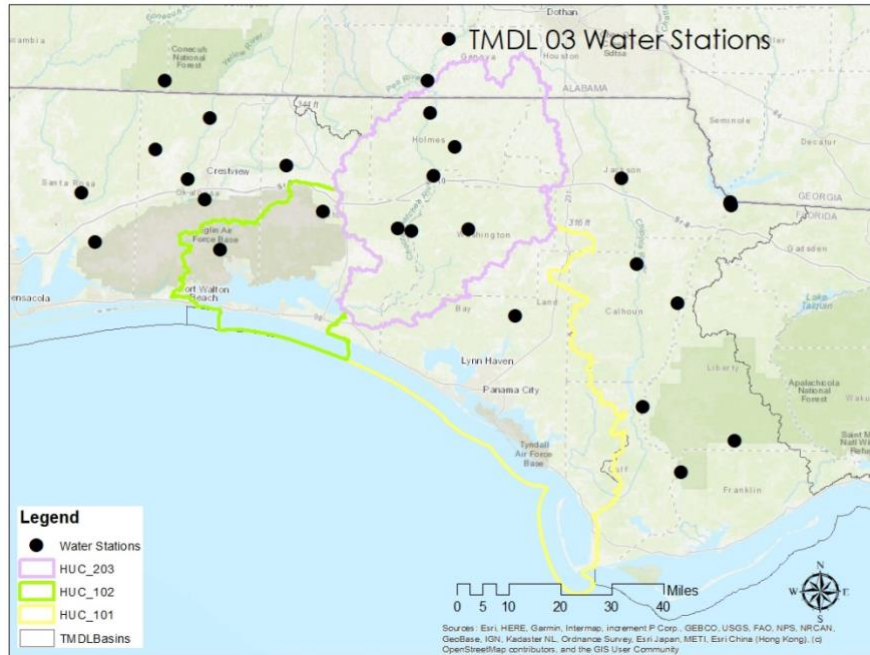

Figure 39. TMDL 03 Water Stations

3.1.7. Open Space

While the soil may have the capacity to store water, the type of land cover will either allow or prevent soil infiltration. If an area is covered by impervious surfaces, the rainfall will not infiltrate the soil causing surface runoff and increased flooding. Only those areas classified as open space, or pervious land, will minimize surface runoff, promoting soil infiltration and storage in the unsaturated zone. Therefore, incorporating impervious surfaces into the calculation of soil storage capacity is important. The National Land Cover Database was used to classify land as either pervious or impervious. Then, impervious surfaces were assigned a value of zero to designate all impervious areas as having no soil storage capacity since rainfall will simply runoff along the

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surface without any soil infiltration, preventing storage in the unsaturated zone. Figure 10 depicts the open spaces using a binary system. The open spaces are scattered across the TMDL.
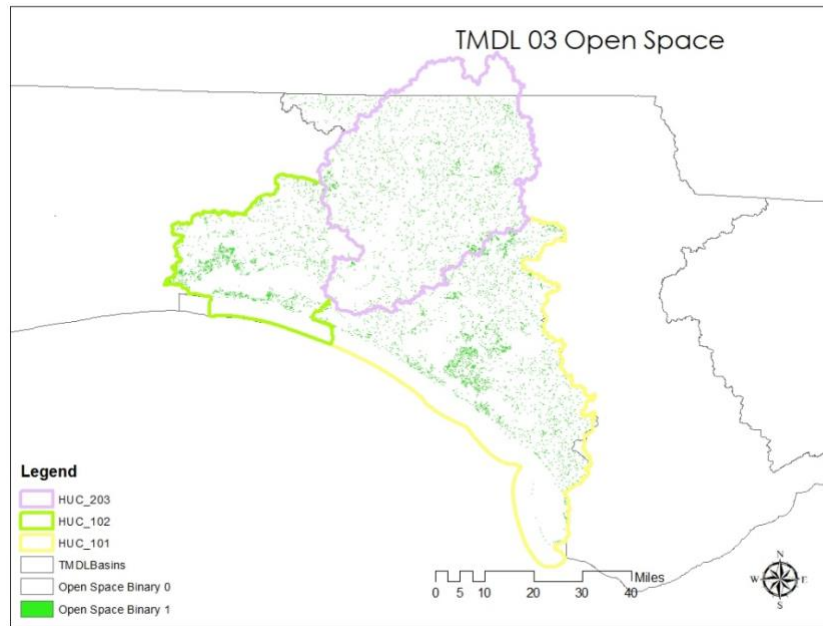

Figure 40. TMDL 03 Open Space

3.2.   Modeling Protocol

There are many contributing factors to flooding, including the low land elevations, high groundwater table, and low soil storage capacity. To accurately identify land areas within the watershed that are vulnerable to flooding, all these factors were included in the flood risk model. The previously discussed datasets were used to calculate input parameters needed to run a flood simulation model called CASCADE 2001, which was developed by the South Florida Water Management District. The advantage of this model is that it incorporates several characteristics unique to each watershed, including the topography, groundwater, surface water, tides, soil type, land cover, and rainfall. By following FAU's modeling protocol, all the necessary input parameters to run CASCADE 2001 were either directly calculated or derived from existing datasets. Several surfaces were derived from the data and used to determine characteristics of the watershed, which represent the primary contributing factors to flooding. While a contributing factor such as the land elevation in the watershed can be directly observed using data collection methods such as LiDAR, other factors require further data processing and modeling.

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CASCADE 2001 is a multi-basin hydrologic/hydraulic routing model developed by the South Florida Water Management District (SFWMD). The model develops solutions by basin. A basin is defined as an area where all the water that falls via rainfall stays in an area and travels to an outlet. The areas of the basin and the longest time it takes the runoff to travel to the most distance point to reach the point of discharge must be estimated. Rainfall is also needed. The waterway flow paths from ArcHydro as in Figure 11.
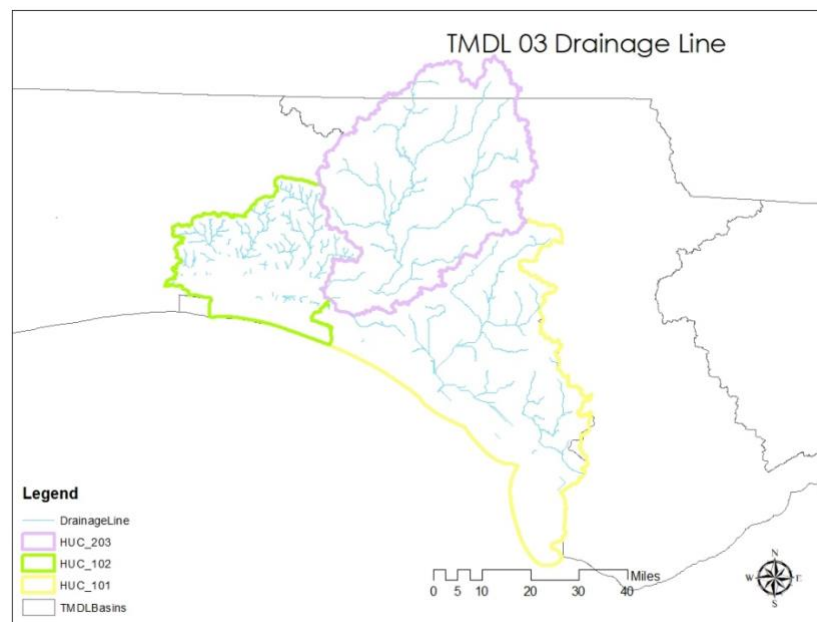
Figure 41. TMDL 03 Flow Paths

The inputs required by the model were prepared based on datasets of DEM, water table, soil storage, and rainfall. The steps are provided below.

1. Area: Basing this information on the DEM values, which were derived from merging the smaller catchments into larger ones, the area was determined and converted to acre-ft.

2. Offsites: These were given to each catchment. Which offsite, was determined by where the water body drained into.

3. The initial stage: This was determined by finding the outlets

4. Ground storage: Data came from soil storage/ ground storage tables

5. Time of concentration: determined by dividing the longest river length by 3600

6. Rainfall: Data was used from precipitation tables

7. Stage-Storage relationship:

8. Structure: Initial stage values were used for gravity structures.

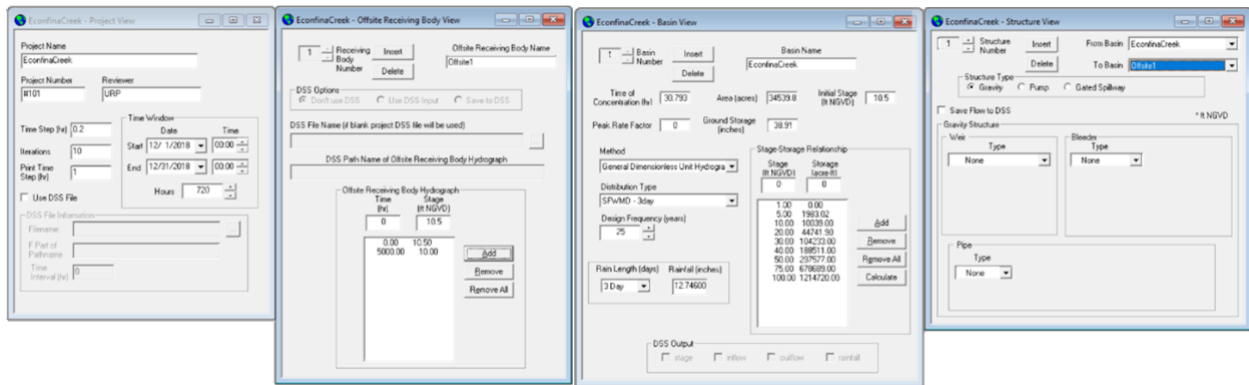Figures 12-25 are examples interface of the simulation for one catchment in Cascade 2001.

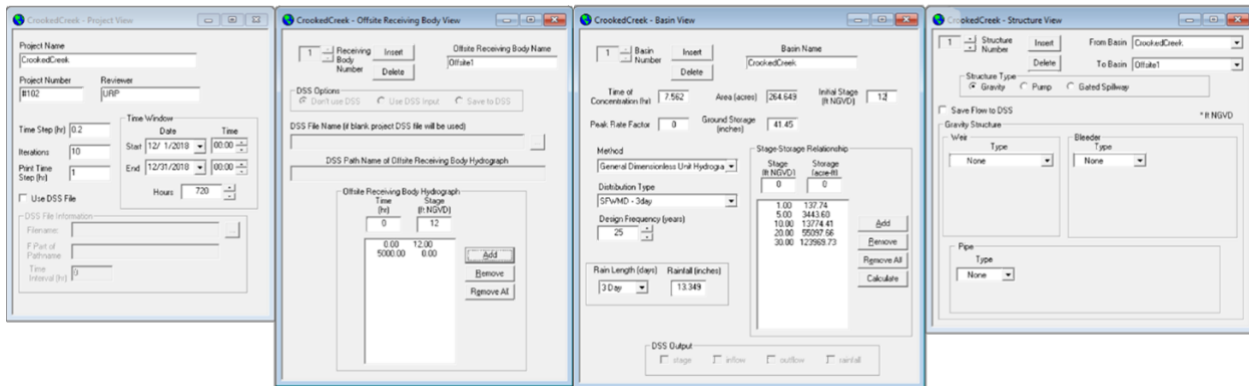Figure 42. Econfina Creek Cascade (HUC_101)
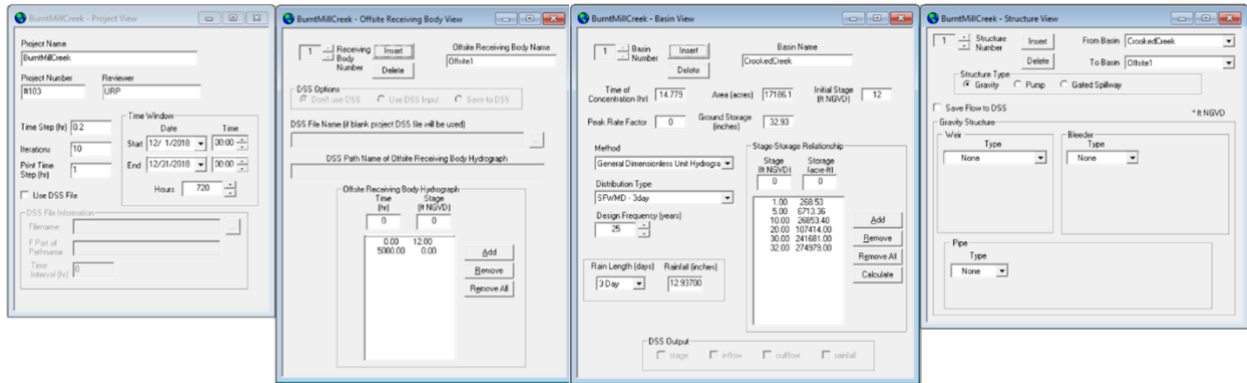

Figure 43. Crooked Creek Cascade (HUC_101)
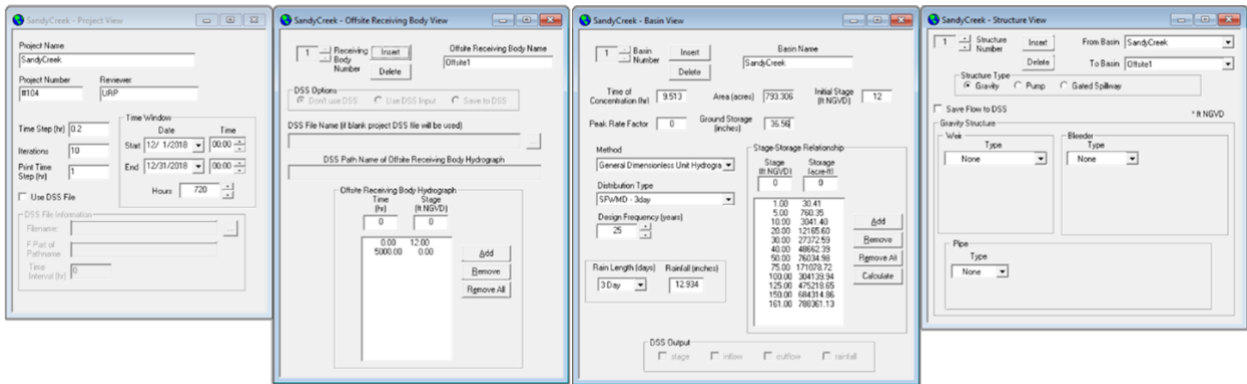
Figure 44. Burnt Mill Creek Cascade (HUC_101)

Figure 45. Sandy Creek Cascade (HUC_101)
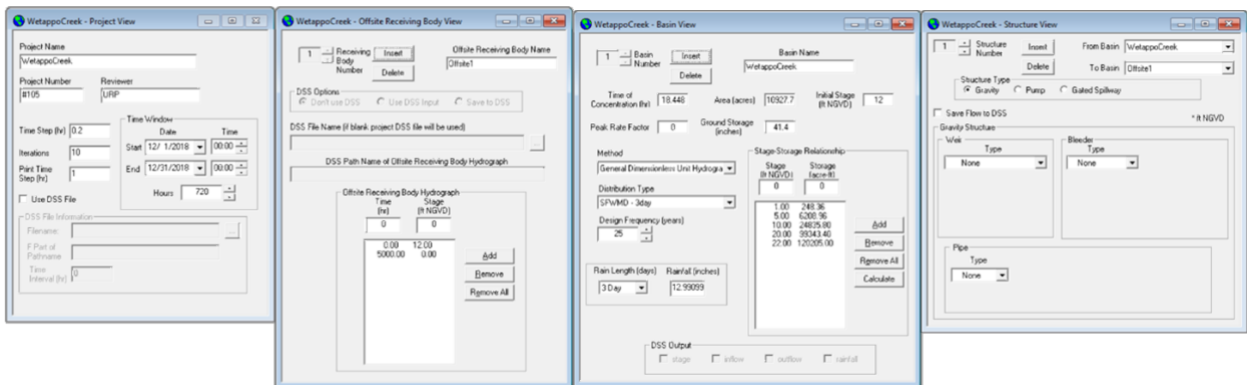
Figure 46. Wetappo Creek Cascade (HUC_101)
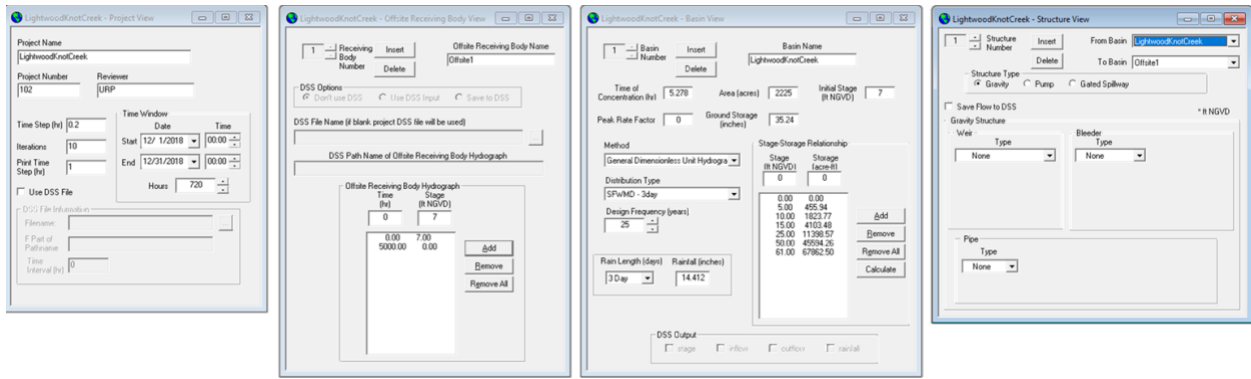
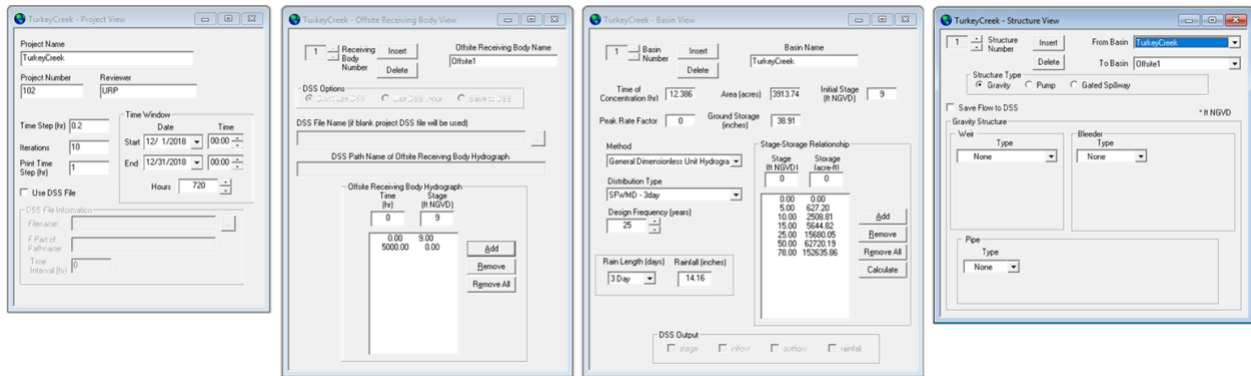Figure 47. Lightwood Knot Creek Cascade (HUC_102)
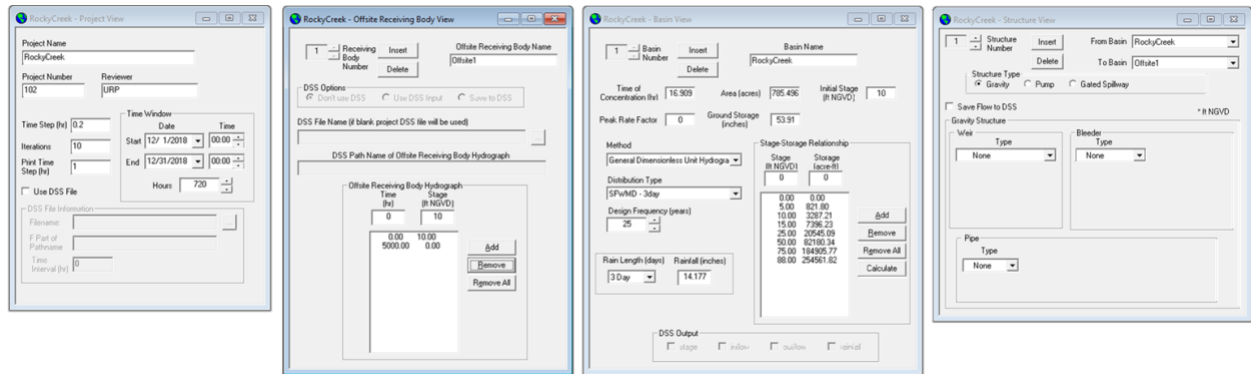

Figure 48. Turkey Creek Cascade (HUC_102)
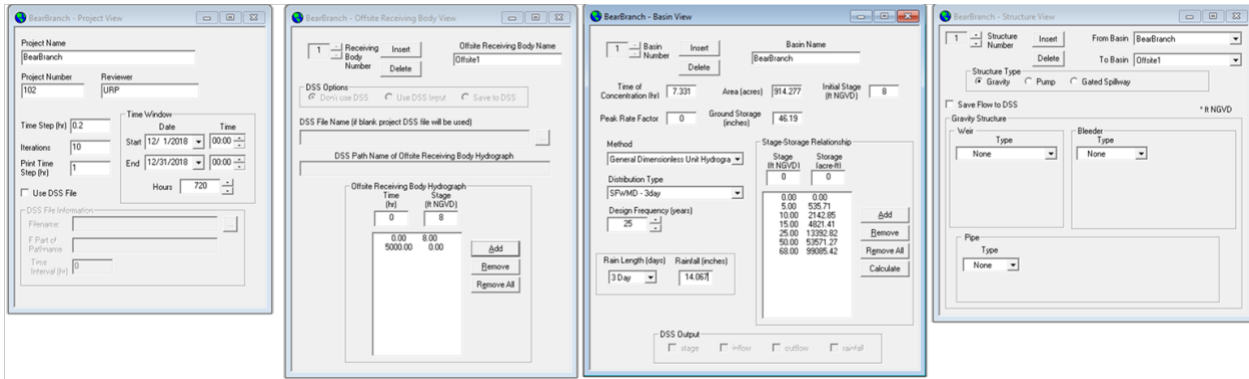

Figure 49. Rocky Creek Cascade (HUC_102)
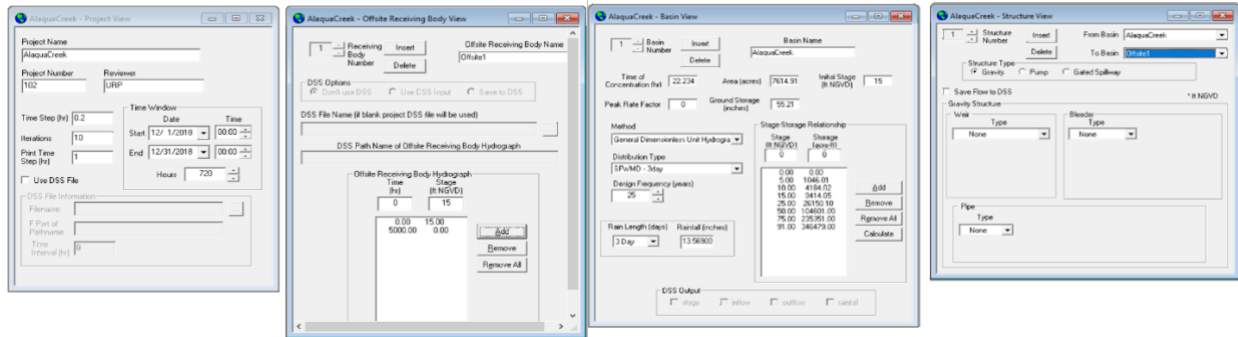
Figure 50. Bear Branch Cascade (HUC_102)

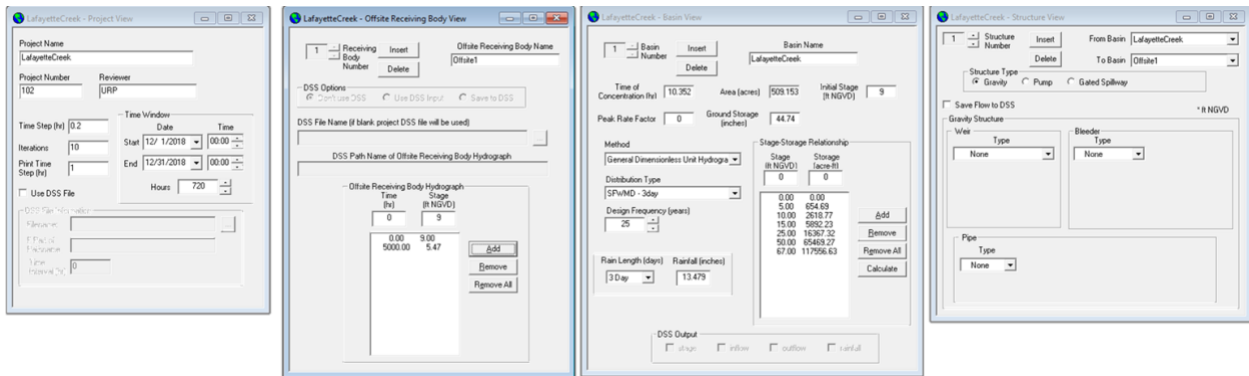Figure 51. Alaqua Creek Cascade (HUC_102)

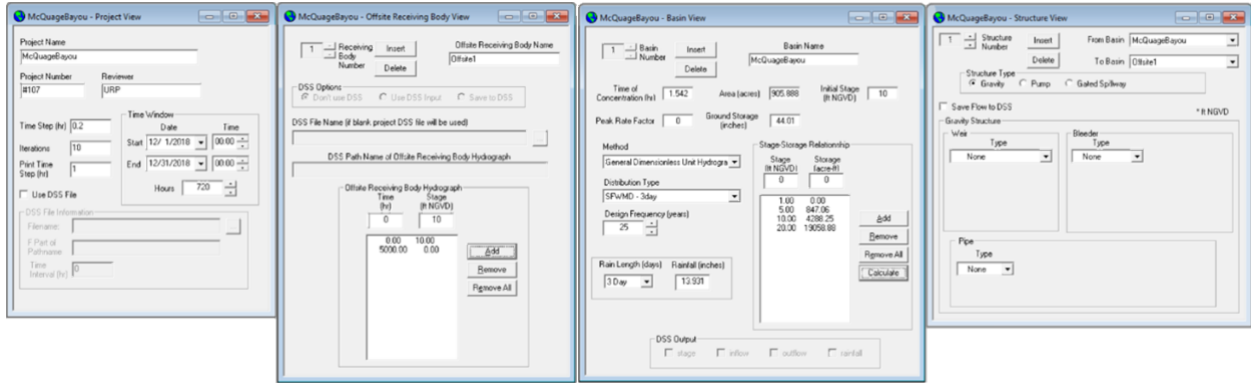Figure 52. Lafayette Creek Cascade (HUC_102)

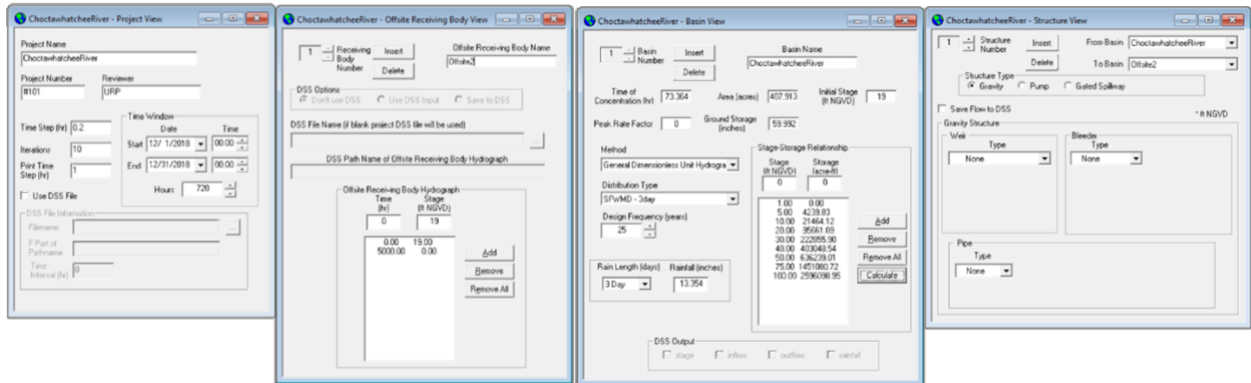Figure 53. McQuage Bayou Cascade (HUC_102)

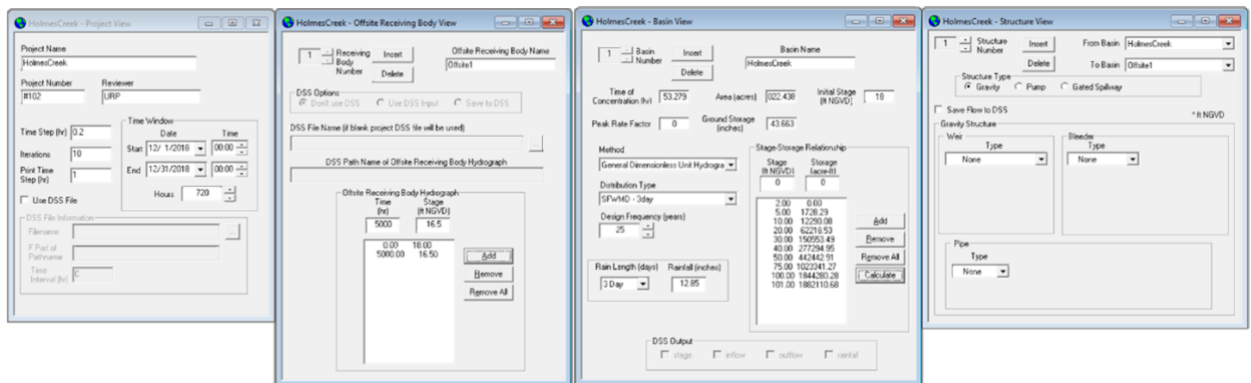Figure 54. Choctawhatchee River Cascade (HUC_203)

Figure 55. Holmes Creek Cascade (HUC_203)

3.3.   Modeling Results

3.3.1.   *Vulnerability to Flooding*

Figure 26 visualizes the estimated flood risk for the Choctawhatchee River Basin (TMDL Basin #3) based on a 3-day, 25-year rainfall. The highest risk is found along the coast and the lower

portion of Choctawhatchee River. The area is not densely populated but includes a large urban cluster along the coast. The largest city in the Choctawhatchee River Basin is Panama City. Other urban settlements include Bonifey, Chipley, De Funiak Springs, Graceville, and Santa Rosa Beach. The highest flooding risk is found in and around Santa Rosa Beach which lies at the confluence of the river and Choctawhatchee Bay. There is also higher flood risk in the northwest areas of Panama City and the coastal areas to the southeast including Mexico Beach.
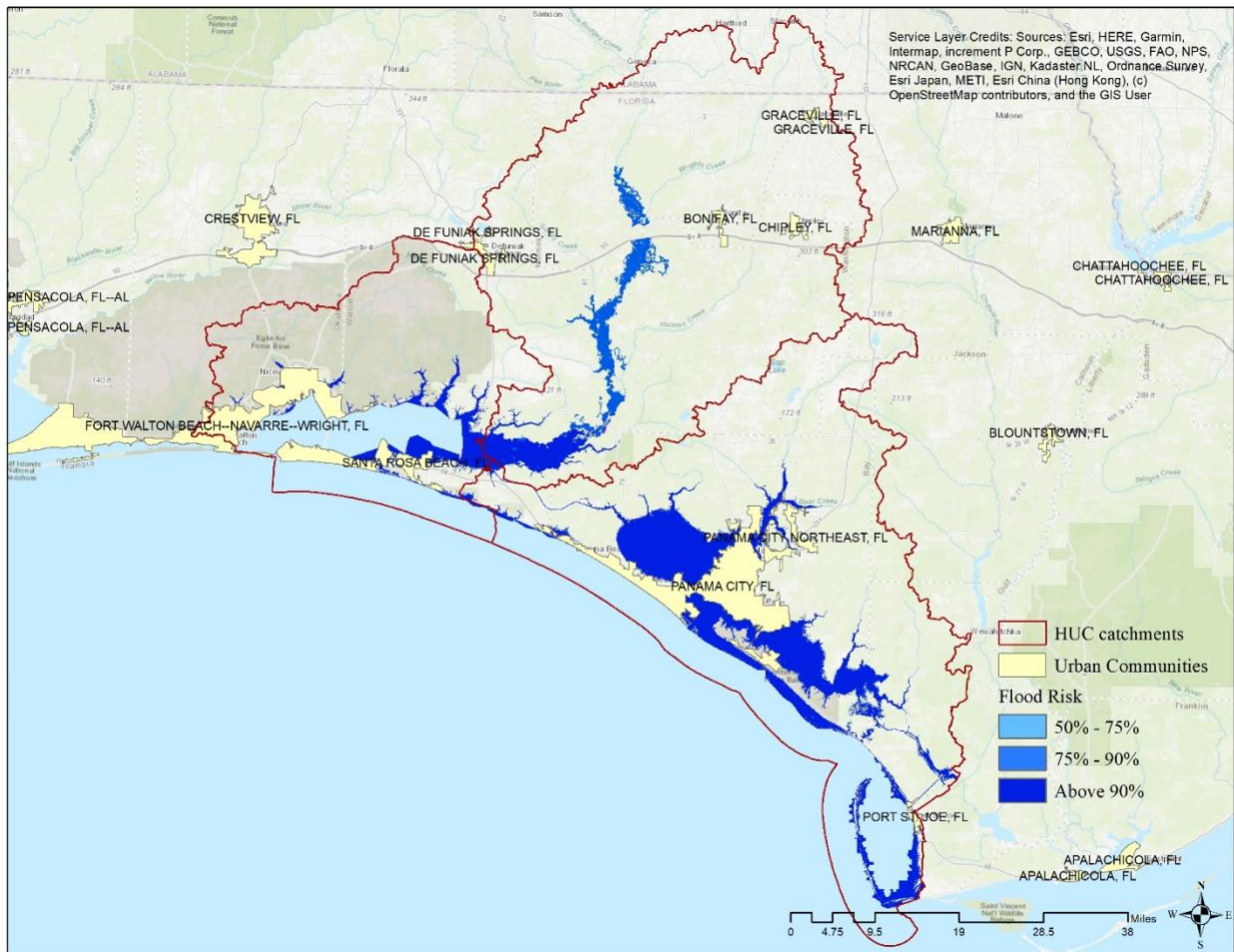

Figure 56. Flood Risk Map

3.3.2. *FEMA Flood Map Comparison*

For comparison, FEMA flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a "1-percent chance" of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year

flood. SFHAs are labeled as Zone A, Zone AE, and Zone VE. Figure 27 compares the flood risk zones based on the CASCADE results with the maps provided from FEMA. The two areas do show major similarities proposing that the results from CASCADE are efficient and valid. Figure 27 shows a comparison of the estimated flood risk map and FEMA's 100-year floodplain. Table 5 provides a summary of the overlay statistics.
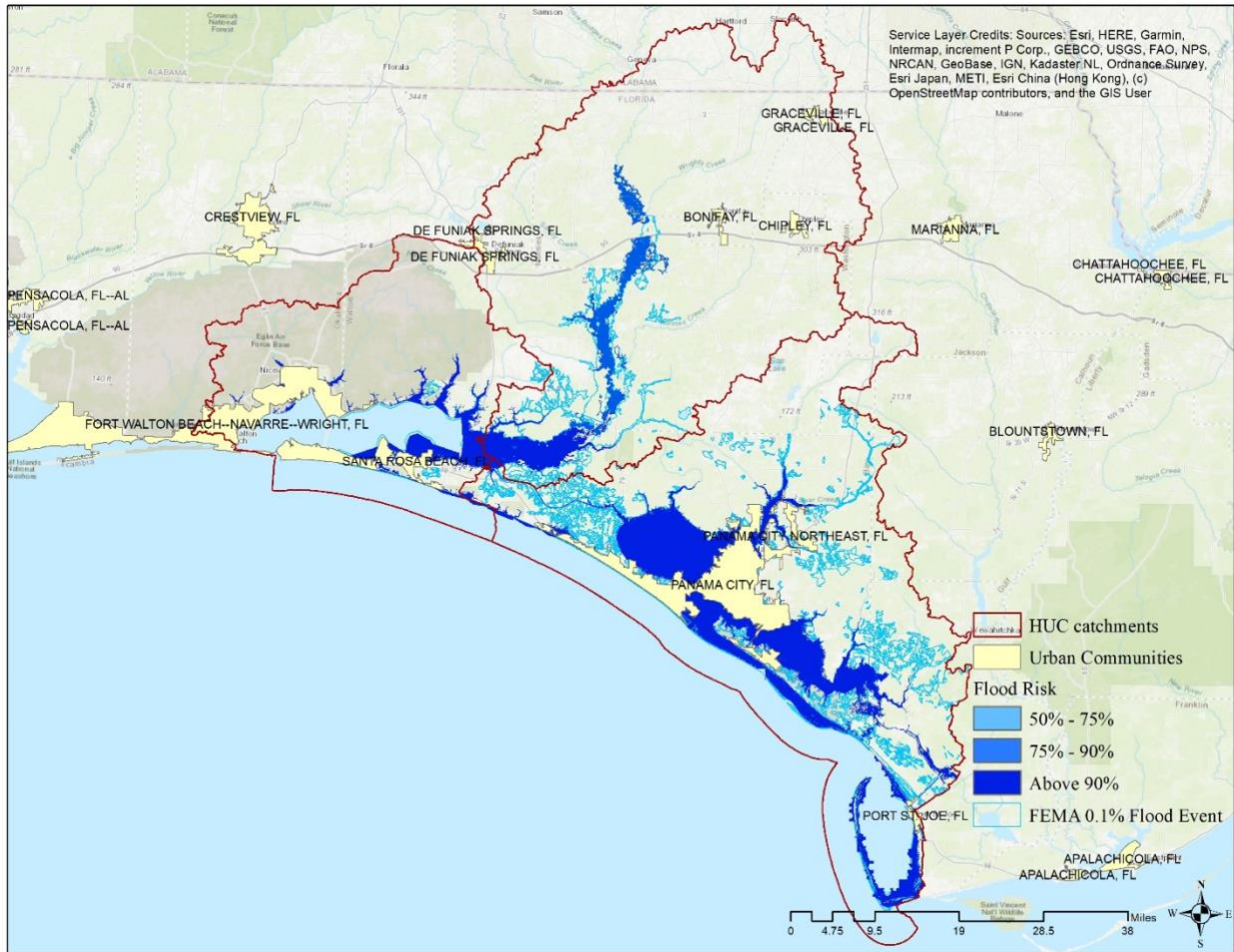

Figure 57. FEMA Flood Map Comparison

Table 5. Comparison between FEMA identified 100-year flood event and the CRT modeled flood region with a high probability for inundation in TMDL Basin #3.

Category	Results
FEMA 1% flooding (total area: km2)	452.7
Modeled flood risk (total area: km2)	318.3
Overlapping area (total area: km2)	205.7
Percent of overlap (FEMA flood zone, in percent)	70.3%
Percent of overlap (estimated flood risk, in percent)	64.6%

3.3.3. *Vulnerability to Flooding*

The Choctawhatchee TMDL Basin drains includes the Panama City Metropolitan Area, which incorporates Panama City (with a population of 36,900, as of 2018) and several unincorporated census-designated places, the largest of which is Santa Rosa (with a population 184,313 as of 2019). The total population of the Pensacola metropolitan area as of 2018 was 202,236. The area is vulnerable to flooding as it drains the Choctawhatchee river. This is also a part of the Choctawhatchee bay estuary system. The maps below (Figures 28, 29 and 30) highlight locations vulnerable to flooding in the western, central and eastern parts of the Pensacola Bay estuarine system.
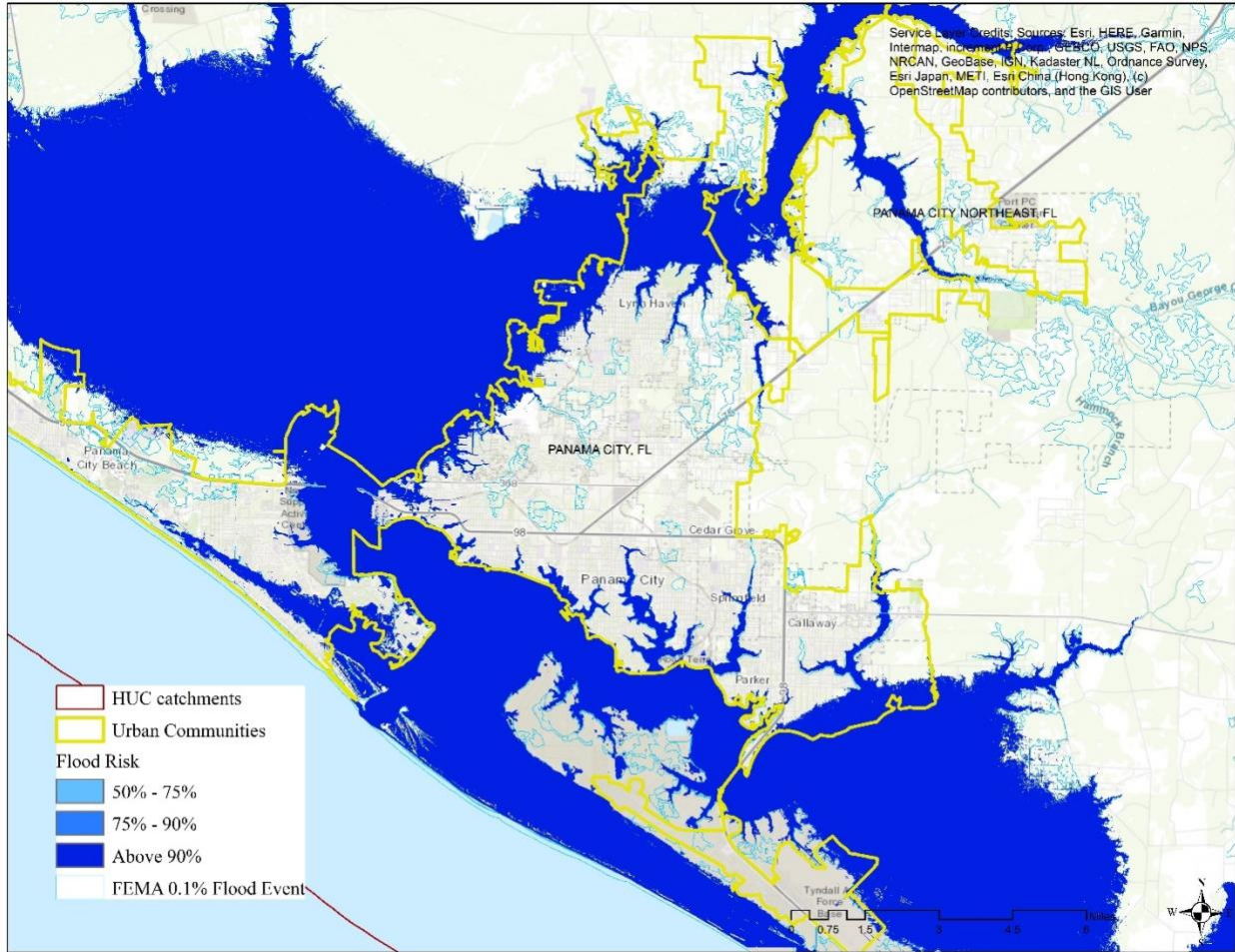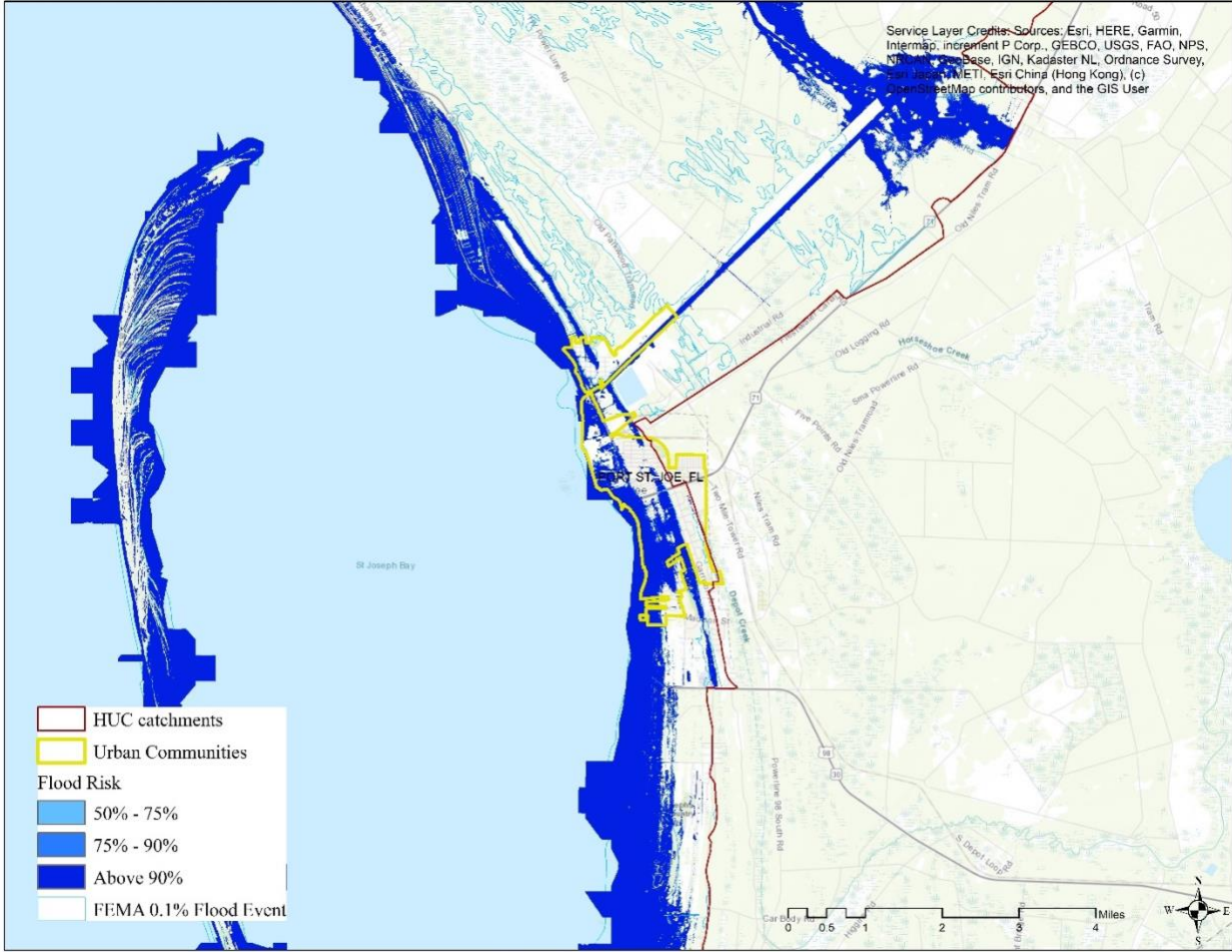
Figure 58 FEMA Flood Map Comparison - Panama City

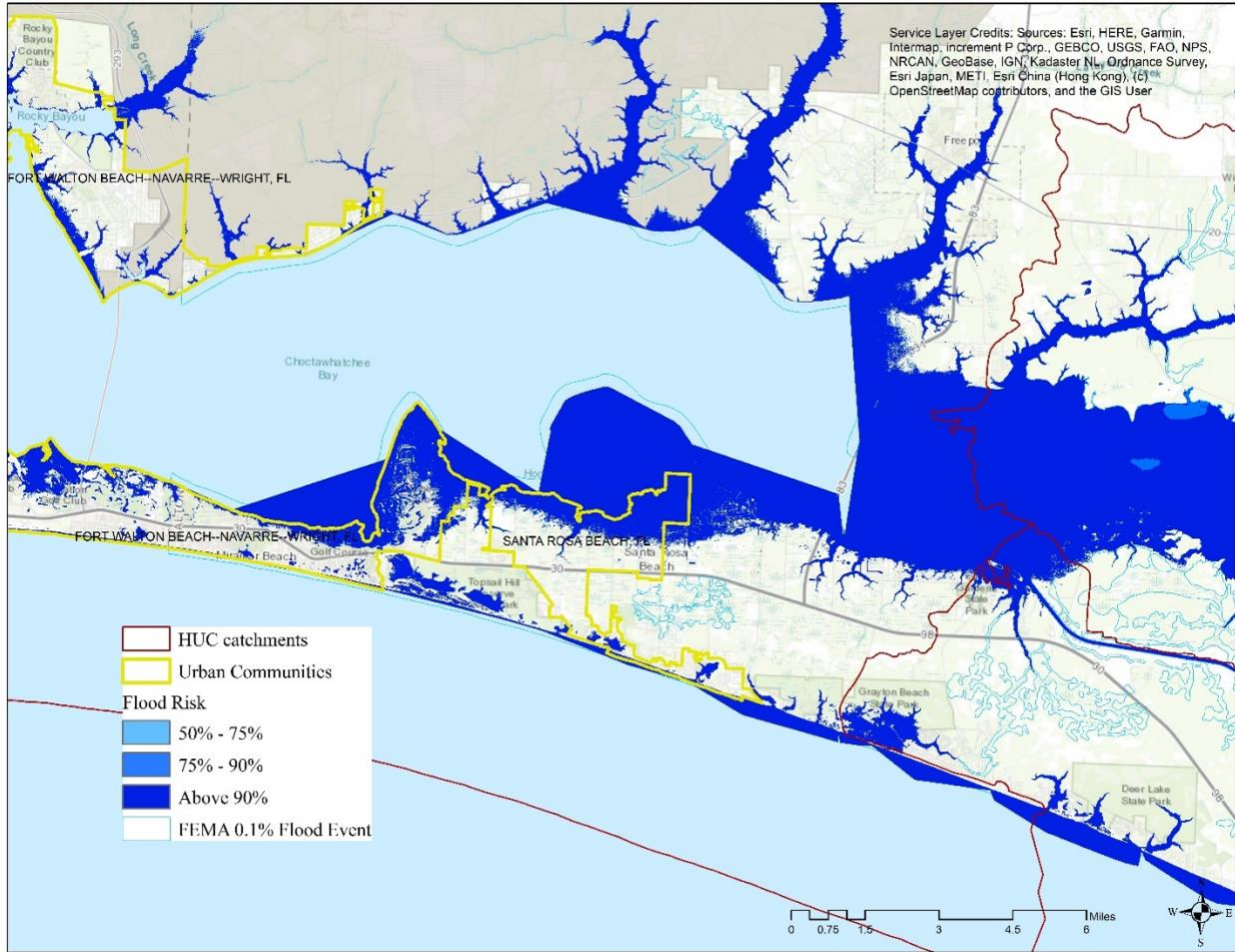Figure 59 FEMA Flood Map Comparison - Port St. Joe

Figure 60 FEMA Flood Map Comparison - Santa Rosa

3.3.4. *Repetitive Loss Comparison*

Figure 31shows a comparison of the flood map and repetitive loss property locations for the basin. The loss areas coincide with the areas predicted by the FAU model as being at risk for flooding.
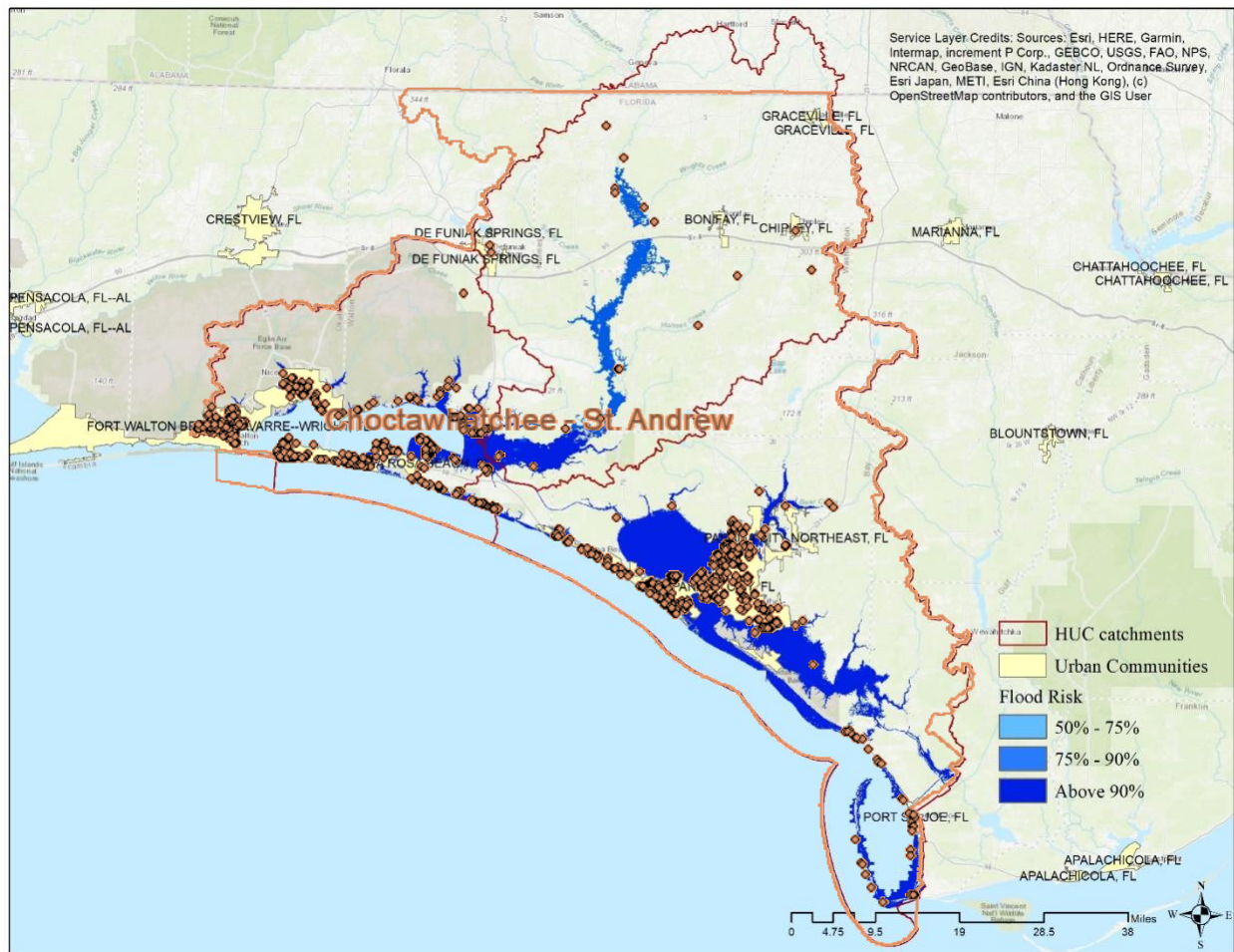

Figure 31. Repetitive loss areas from 2004 -2014 superimposed on the flood risk map created by FAU

4.0   Conclusion

FDEM contracted with FAU to develop a screening tool of flood risk areas for 29 watershed basins. The effort discussed herein focuses on the development procedures for a screening tool to assess risk in the Panhandle area of Florida. The effort discussed herein focusses on the development procedures for a screening tool to assess risk in the Apalachicola watershed basin. The watershed located in Northwest Florida combines readily available data on topography, ground and surface water elevations, tidal data for coastal communities, open space and rainfall to permit an assessment of the risk of inundation of property within the Panhandle Basin.

The basin shows widespread flooding along the beach due to low elevation proximity to the Gulf of Mexico coast and extensive sensitive areas that currently received extensive environmental protection. A drilldown to the local community showed it was are flood prone. The repetitive loss maps confirmed FAU's modeling. Such knowledge permits the development of tools to permit local agencies to develop means to address high risk properties. Solutions to improve flood resiliency in the is basin will yield long term benefits.

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