

MS4-NPDES Permit FL00004 Sarasota County & Co-Applicants Seasonal Loadings and EMC Estimates

Introduction

In accordance with 40 CFR 122.26(d)(2)(iii)(C) Sarasota County's Municipal Separate Storm Sewer (MS4) NPDES permit (FLS000004) requires the County to complete an estimate of seasonal pollutant load estimates and the event mean concentrations (EMC) for a representative storm. Specific requirements of the permit include the following from the Code of Federal Register.

(C) A proposed schedule to provide estimates for each major outfall identified in either paragraph (d)(2) (ii) or (d)(1)(iii)(B)(1) of this section of the seasonal pollutant load and of the event mean concentration of a representative storm for any constituent detected in any sample required under paragraph (d)(2)(iii)(A) of this section:

The permit was subsequently modified (Public Notice 95F10081) to report pollutant load and concentrations for each *major watershed* rather than each *major outfall*. This report describes the methodology used to estimate seasonal loads and EMCs and provides the requisite output in accordance with the County's permit.

Background

Estimates of annual pollutant loading were submitted to USEPA in 1993 with Part 2 of the NPDES application (CDM, 1993). These estimates were made based on 1990 land use information using a spreadsheet model developed by Camp Dresser & McKee Inc. (CDM) called Watershed Management Model (WMM). The model is based the observation that stormwater runoff characteristics vary with land use. In practice, the stormwater loading is calculated as the sum of loadings from various land-uses within a watershed. The land use specific loadings are the product of a land-use specific pollutant concentration and runoff. Details of the calculations can be found in the permit application. The model has been reviewed by EPA (USEPA, 1992) and placed in public domain with the Florida Department of Environmental Protection.

For the present evaluation, the current Windows based version (4.14) of the WMM was used. The Windows version was developed for USEPA's Rouge River Wet Weather Demonstration project and retains all of the functionality of the original DOS-based spreadsheet version. Unlike the previous version, the present WMM is available as an executable model requiring no additional software.

The present evaluation consisted of verifying the 1993 loading estimates using the new version of WMM, followed by estimating the seasonal loads and seasonal event loadings using updated land use and BMP coverage. EMCs were derived from the event loadings by dividing the loadings by the typical event runoff.

Validation of 1993 Estimates

The input data contained in the 1993 permit application was entered in WMM version 4.14 to establish a base model. Land use, EMCs, and hydrology (rainfall, baseflow and runoff coefficients) were taken from the Part 2 application (ibid.). The results are shown in Table 1 and match the 1993 NPDES permit application within rounding error. See Exhibit A for Table 10 of the 1993 NPDES permit application.

Updated Land Use

Over the past decade, the County has been conducting stormwater master plans for the basins. To date, 16 basins have been studied. As part of the master planning process, a water quality assessment using WMM has been conducted for each of the basins. The County provided master plans that were completed after the 1993 NPDES permit application. Those plans, which had updated land use information summarized¹ in tabular format, were used to update the land use for the present evaluation.

Land use changes were directly input in cases where the master plans used the same land use classifications as the 1993 NPDES permit application. Master plans for North Creek, Curry Creek, Hatchett Creek, and Matheny Creek were used as reported.

In other cases, the land use classifications in the master plans were different than those previously used. In several cases, low-density land use was grouped with medium density land use. In another example of consolidation, several of the master plans evaluated industrial and commercial land uses as a single classification. Single classifications were matched to the closest land use classification from the 1993 NPDES permit application. For cases where land uses were consolidated, it was assumed that the ratio of the two land uses within the master plan's grouping remained the same as existed in the previous loading estimate. Table 2 lists all of the land use changes and conversions incorporated into the present evaluation.

Updated BMP Coverage

The County is presently constructing a 392 acre regional extended dry detention facility known as the Celery Fields Regional Stormwater Facility (CFRSF). This facility serves as flood attenuation and water quality treatment for 3,598 acres in upper Phillippi Creek basin. The upstream land uses served by the CFRSF were taken directly from the facility's design report by Boyle Engineering and included with the existing BMPs in the County.

Impact of Land Use Changes

After incorporating the land use changes and the CFRSF in the model, the model was run with all other conditions that were used in the 1993 evaluation. The resultant pollutant loads are shown in Table 3. The total pollutant loads increased slightly despite the additional BMP coverage. This can be attributed to the 6,096 acre increase in watershed area reflected in the master plans and the increased urbanization. In the absence of the new BMP coverage, the loadings would be even greater.

¹ Some of the plans lacked summary tables and/or were too detailed to be useful for the present evaluation. For example, the Gottfried Master Plan listed 31 sub-basins averaging 0.4 mi² each.

Table 1
Total Pollutant Load Estimates from Stormwater and Baseflow
Using WMM v 4.14 and Input from the 1993 NPDES Permit Application

Basin Name	BOD (lbs/yr)	Cd (lbs/yr)	COD (lbs/yr)	Cu (lbs/yr)	DP (lbs/yr)	NO23 (lbs/yr)	Pb (lbs/yr)	TDS (lbs/yr)	TKN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Zn (lbs/yr)
Direct to Bay	21,680	7	120,000	237	973	3,225	64	1,100,000	4,341	1,411	560,000	944
Whitaker Bay.	300,000	58	2,100,000	1,208	4,512	8,714	3,313	4,700,000	40,921	9,112	3,600,000	2,451
Hudson Bay.	67,299	13	470,000	284	1,013	1,969	713	950,000	9,229	2,130	770,000	503
Phillippi Cr.	1,600,000	276	10,000,000	5,527	26,194	56,583	7,629	31,000,000	220,000	55,190	21,000,000	10,253
Matheney Cr.	99,987	19	700,000	407	1,548	3,079	935	1,500,000	13,819	3,231	1,200,000	731
Clowers Cr.	48,820	8	320,000	160	699	1,401	343	860,000	6,635	1,478	580,000	337
Catfish Cr.	130,000	20	810,000	371	2,347	5,109	884	3,200,000	18,980	4,458	2,100,000	1,102
North Cr.	56,804	7	350,000	109	1,111	2,493	116	1,700,000	8,868	2,176	1,100,000	376
South Cr.	280,000	36	1,700,000	659	6,169	14,945	534	9,300,000	44,778	11,346	5,800,000	2,656
Shakett Cr.	190,000	30	1,200,000	580	3,895	8,990	628	5,300,000	29,692	7,544	3,400,000	1,573
Curry Cr.	160,000	28	1,000,000	523	2,912	6,526	610	3,800,000	22,999	5,744	2,400,000	1,193
Hatchett Cr.	120,000	21	800,000	438	2,182	4,787	948	2,700,000	17,684	4,171	1,800,000	1,146
Alligator Cr.	240,000	42	1,700,000	879	4,208	9,217	1,234	4,900,000	36,527	9,046	3,400,000	1,668
Woodmere	81,551	14	560,000	293	1,586	3,577	324	1,800,000	12,346	3,187	1,300,000	584
Forked Cr.	170,000	28	1,200,000	578	3,502	8,070	707	4,500,000	26,415	6,726	3,100,000	1,458
Godfrey Cr.	160,000	26	1,100,000	521	3,309	7,641	699	4,300,000	25,222	6,374	2,900,000	1,388
Ainger Cr.	200,000	25	1,200,000	454	4,661	11,292	284	7,000,000	32,715	8,417	4,500,000	1,898
Cow Pen Sl.	710,000	103	4,200,000	1,943	16,115	39,904	1,451	24,000,000	110,000	28,603	15,000,000	7,556
Myakka	2,100,000	329	12,000,000	7,191	51,977	140,000	3,557	73,000,000	340,000	90,139	44,000,000	28,255
Deer Pr.	380,000	61	2,200,000	1,443	10,935	30,097	430	16,000,000	65,605	17,997	9,400,000	6,569
Big Sough	1,700,000	216	10,000,000	3,955	38,877	94,709	4,182	60,000,000	270,000	68,660	38,000,000	17,531
Little Salt	120,000	19	810,000	406	2,317	5,208	543	2,800,000	17,822	4,517	2,000,000	915
Braden River	190,000	37	760,000	378	2,363	5,221	408	4,700,000	17,570	4,057	1,900,000	1,281
City of Sara.	240,000	50	1,700,000	1,203	4,363	10,032	2,586	4,300,000	33,714	8,156	3,200,000	2,867
County N.	170,000	34	1,200,000	816	3,378	8,191	948	3,400,000	25,423	6,686	2,400,000	1,806
City of Ven.	210,000	42	1,700,000	942	3,124	5,870	3,070	3,200,000	27,782	5,861	2,800,000	2,079
County S.	120,000	25	870,000	599	2,660	6,528	526	2,800,000	19,552	5,275	1,900,000	1,284
Longboat	66,873	13	450,000	308	1,496	3,699	349	1,700,000	10,216	2,712	1,100,000	810
City Island	61,153	14	410,000	366	1,513	4,122	401	1,600,000	9,710	2,630	1,000,000	1,096
Siesta Key	130,000	26	930,000	626	2,486	5,769	760	2,300,000	18,855	4,976	1,800,000	1,155
Casey Key	28,932	6	190,000	161	732	1,972	104	800,000	4,779	1,337	510,000	446
Manasota Key	26,787	5	180,000	125	638	1,612	87	730,000	4,389	1,202	470,000	323
TOTAL (1999)	10,179,886	1,638	62,930,000	33,690	213,795	520,552	39,367	289,940,000	1,546,588	394,549	184,990,000	104,234
TOTAL (1993)	10,128,500	1,630	63,644,500	33,610	213,510	516,900	38,310	288,945,600	1,548,300	394,600	184,546,500	105,930

Table 2
Basins within Sarasota County with Reported Land Use Changes
Since the 1993 NPDES Permit Application

Basin:	Curry Creek (acres)		Hatchett Cr. (acres)		Matheny Cr. (acres)		North Cr. (acres)		Cow Pen Sl. (acres)		Ainger Cr. (acres)	
	1990	Present ¹	1990	Present ¹	1990	Present ¹	1990	Present ¹	1990	Present ¹	1990	Present ¹
Forest/Open	1,221	1,907	1,424	1,485	245	163	1,649	644	9,697	7,730	6,255	3,861
Pasture/Range Land	1,140	1,575	115	70	-	-	100	151	12,299	3,924	1,147	-
Agriculture/Cropland	-	-	-	-	-	-	-	-	-	17,018	-	-
LDSF Residential	554	696	241	118	84	70	174	704	2,239	2,230	604	697
MDSF Residential/Instit.	610	227	408	14	913	966	179	230	143	245	65	-
HDSF/MF Residential	361	768	387	743	164	206	29	125	122	121	7	-
Commercial/CBD	7	59	192	233	200	143	-	20	-	-	-	-
Light Industrial	43	46	85	95	95	129	27	97	154	-	27	188
Water	567	867	539	544	31	8	200	337	6,914	9,075	1,654	562
Major Highway	83	260	14	73	-	38	-	24	54	115	-	-
Extractive	79	-	-	-	-	-	-	-	197	13	-	-
TOTAL	4,665	6,405	3,405	3,375	1,732	1,723	2,358	2,332	31,819	40,471	9,759	5,308

Basin:	Godfrey Cr. (acres)		Forked Cr. (acres)		South Cr. (acres)		Hudson Bay. (acres)		Woodmere Cr. (acres)		TOTAL (acres)		
	1990	Present ¹	1990	Present ¹	1990	Present ¹	1990	Present ¹	1990	Present ¹	1990	Present ¹	Change
Forest/Open	3,266	4,347	2,483	3,490	5,815	9,008	37	104	1,071	167	33,163	32,906	-257
Pasture/Range Land	160	-	891	-	3,464	-	-	-	101	-	19,417	5,720	-13,697
Agriculture/Cropland	-	-	-	-	-	-	-	-	-	-	-	17,018	17,018
LDSF Residential	338	286	813	487	223	122	-	-	119	105	5,389	5,515	126
MDSF Residential/Instit.	926	782	556	333	905	495	741	608	619	546	6,065	4,446	-1,619
HDSF/MF Residential	30	228	147	336	42	104	53	70	174	187	1,516	2,888	1,372
Commercial/CBD	131	275	42	175	30	210	197	227	13	30	812	1,372	560
Light Industrial	20	42	-	-	31	217	9	10	12	10	503	834	331
Water	832	1,295	873	1,035	2,262	2,550	1	2	266	148	14,139	16,423	2,284
Major Highway	-	-	83	-	18	-	-	-	-	-	252	510	258
Extractive	-	-	17	-	-	-	-	-	-	-	293	13	-280
TOTAL	5,703	7,255	5,905	5,856	12,790	12,706	1,038	1,021	2,375	1,193	81,549	87,645	6,096

¹Present is defined as the land uses according to the most recent basin master plan.

Table 3
WMM 4.14 Loading Estimates (Stormwater and Baseflow)
Using 1993 NPDES Part II Permit Application Data with Updated Land Use and the CFRSF

Basin Name	BOD (lbs/yr)	Cd (lbs/yr)	COD (lbs/yr)	Cu (lbs/yr)	DP (lbs/yr)	NO23 (lbs/yr)	Pb (lbs/yr)	TDS (lbs/yr)	TKN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Zn (lbs/yr)
Direct to Bay	21,680	7	120,000	237	973	3,225	64	1,100,000	4,341	1,411	560,000	944
Whitaker Bay.	300,000	58	2,100,000	1,208	4,512	8,714	3,313	4,700,000	40,921	9,112	3,600,000	2,451
Hudson Bay.	67,299	13	470,000	284	1,013	1,969	713	950,000	9,229	2,130	770,000	503
Phillippi Cr.	1,500,000	263	10,000,000	5,282	26,194	56,583	6,969	31,000,000	220,000	54,204	19,000,000	9,893
Matheney Cr.	100,000	20	750,000	435	1,600	3,154	991	1,500,000	14,362	3,354	1,300,000	752
Clowers Cr.	48,820	8	320,000	160	699	1,401	343	860,000	6,635	1,478	580,000	337
Catfish Cr.	130,000	20	810,000	371	2,347	5,109	884	3,200,000	18,980	4,458	2,100,000	1,102
North Cr.	83,943	15	570,000	313	1,528	3,412	478	1,900,000	12,573	3,091	1,200,000	716
South Cr.	280,000	36	1,700,000	659	6,169	14,945	534	9,300,000	44,778	11,346	5,800,000	2,656
Shakett Cr.	190,000	30	1,200,000	580	3,895	8,990	628	5,300,000	29,692	7,544	3,400,000	1,573
Curry Cr.	210,000	33	1,400,000	662	3,808	8,593	928	5,000,000	30,252	7,363	3,400,000	1,701
Hatchett Cr.	130,000	23	890,000	493	2,293	4,905	1,231	2,700,000	18,045	4,166	2,000,000	1,281
Alligator Cr.	240,000	42	1,700,000	879	4,208	9,217	1,234	4,900,000	36,527	9,046	3,400,000	1,668
Woodmere	81,551	14	560,000	293	1,586	3,577	324	1,800,000	12,346	3,187	1,300,000	584
Forked Cr.	170,000	28	1,200,000	578	3,502	8,070	707	4,500,000	26,415	6,726	3,100,000	1,458
Godfrey Cr.	160,000	26	1,100,000	521	3,309	7,641	699	4,300,000	25,222	6,374	2,900,000	1,388
Ainger Cr.	200,000	25	1,200,000	454	4,661	11,292	284	7,000,000	32,715	8,417	4,500,000	1,898
Cow Pen Sl.	830,000	115	5,000,000	2,294	32,833	69,903	1,407	30,000,000	210,000	69,795	19,000,000	9,400
Myakka	2,100,000	329	12,000,000	7,191	51,977	140,000	3,557	73,000,000	340,000	90,139	44,000,000	28,255
Deer Pr.	380,000	61	2,200,000	1,443	10,935	30,097	430	16,000,000	65,605	17,997	9,400,000	6,569
Big Sough	1,700,000	216	10,000,000	3,955	38,877	94,709	4,182	60,000,000	270,000	68,660	38,000,000	17,531
Little Salt	120,000	19	810,000	406	2,317	5,208	543	2,800,000	17,822	4,517	2,000,000	915
Braden River	190,000	37	760,000	378	2,363	5,221	408	4,700,000	17,570	4,057	1,900,000	1,281
City of Sara.	240,000	50	1,700,000	1,203	4,363	10,032	2,586	4,300,000	33,714	8,156	3,200,000	2,867
County N.	170,000	34	1,200,000	816	3,378	8,191	948	3,400,000	25,423	6,686	2,400,000	1,806
City of Ven.	210,000	42	1,700,000	942	3,124	5,870	3,070	3,200,000	27,782	5,861	2,800,000	2,079
County S.	120,000	25	870,000	599	2,660	6,528	526	2,800,000	19,552	5,275	1,900,000	1,284
Longboat	66,873	13	450,000	308	1,496	3,699	349	1,700,000	10,216	2,712	1,100,000	810
City Island	61,153	14	410,000	366	1,513	4,122	401	1,600,000	9,710	2,630	1,000,000	1,096
Siesta Key	130,000	26	930,000	626	2,486	5,769	760	2,300,000	18,855	4,976	1,800,000	1,155
Casey Key	28,932	6	190,000	161	732	1,972	104	800,000	4,779	1,337	510,000	446
Manasota Key	26,787	5	180,000	125	638	1,612	87	730,000	4,389	1,202	470,000	323
TOTAL (1999)	10,287,038	1,653	64,490,000	34,222	231,989	553,730	39,682	297,340,000	1,658,450	437,407	188,390,000	106,722
TOTAL (1993)	10,128,500	1,630	63,644,500	33,610	213,510	516,900	38,310	288,945,600	1,548,300	394,600	184,546,500	105,930

Seasonal Loads

In order to evaluate seasonal loads, four gages with long-term (ca. >30 years) rainfall records were identified. Daily rainfall data from 01/01/68 to 12/31/97 was obtained from SWFWMD for the following stations; Bradenton ESE, Myakka River State Park, Sarasota-Bradenton International Airport (no 1968 data), and Venice NWS. The number of days with usable data within the evaluation period was totaled for each month and each station. Each station's total was then divided by the number of days in the time frame to obtain the percentage of record completeness. Inspection of the records indicated fair to good completeness as shown in Table 4. The total number of rain events for each station is listed in Table 4, as well as the calculated average number of events per month.

The data was then tabulated into annual totals and monthly averages for each station. Initially, it was planned to area weight the results (e.g. Theisson polygons), but the results among the stations were within 10 percent of the average and weighting was considered unnecessary. Also, despite the fair data completeness, the Venice station data was retained due to the similarity with the other stations in all subsequent calculations. Given the close similarities, the station averages were combined to yield average rainfall totals for each month. Based on the results, the "wet" season was defined as June through September (31.7 inches), while the "dry" season consists of the remaining 8 months which produce 21.6 inches of rainfall on average. Table 5 displays the annual, seasonal and monthly average rainfall for the four stations and the 30-year period of record.

The total annual baseflow was assumed to remain the same (5.8 inches per year) as reported in 1993. This total was proportioned between the dry and wet seasons by multiplying the total yearly baseflow by the ratio of average seasonal rainfall to average yearly rainfall. This resulted in a wet season baseflow of 3.5 inches and a dry season baseflow of 2.3 inches.

Using the seasonal rainfall as previously described, baseflow, updated land use and updated BMP coverage, the seasonal loads were estimated. The estimated dry season pollutant loads are given in Table 6, while Table 7 illustrates the corresponding wet season loads. As only the rainfall and baseflow varies, the loadings are proportional to the seasonal rainfall totals with approximately 60 percent of the annual loading being produced during the four month wet season.

Seasonal Event Loads and EMCs

In order to estimate "representative" storm loadings and EMCs, the number of storm events must be determined. The total number of days with rain was taken as a surrogate for a rain "event". Results for each station and month were previously developed in Table 4. The average number of events per month was determined for each station by dividing the total number of events per month, by the total number of days with data per month, and multiplying by the number of days in that month as shown below.

Calculation of the average number of events at the Bradenton station for January.

$$\text{Avg \# Jan events} = \frac{197 \text{ events in Jan}}{930 \text{ days w/ data in Jan}} * 31 \text{ days in Jan} = 6.6 \text{ events/January}$$

Table 4
Total Number of Days with Usable Rainfall Data, Rain Events,
and Average Number of Rain Events Per Month

Month	Station												Average
	Bradenton			Myakka			SaraBrad			Venice			
	Data	Events	Avg. # of Events	Data	Events	Avg. # of Events	Data	Events	Avg. # of Events	Data	Events	Avg. # of Events	
Jan	930	197	6.6	930	161	5.4	899	178	6.1	720	163	7.0	6.3
Feb	822	169	5.8	847	153	5.1	819	167	5.8	684	144	5.9	5.7
Mar	930	182	6.1	929	164	5.5	899	182	6.3	690	144	6.5	6.1
Apr	900	139	4.6	870	114	3.9	870	117	4.0	668	101	4.5	4.3
May	930	185	6.2	899	165	5.7	899	157	5.4	689	152	6.8	6.0
Jun	900	367	12.2	885	385	13.1	870	298	10.3	637	244	11.5	11.8
Jul	930	450	15.0	930	472	15.7	899	377	13.0	660	294	13.8	14.4
Aug	930	480	16.0	928	471	15.7	899	423	14.6	689	334	15.0	15.3
Sep	900	385	12.8	900	363	12.1	870	358	12.3	667	306	13.8	12.8
Oct	930	204	6.8	929	194	6.5	837	170	6.3	720	189	8.1	6.9
Nov	900	170	5.7	900	136	4.5	870	146	5.0	668	134	6.0	5.3
Dec	930	174	5.8	929	129	4.3	806	155	6.0	720	128	5.5	5.4
Total Days of Usable Data	10,932	3,102	104	10,876	2,907	97	10,437	2,728	95	8,212	2,333	104.6	100.2
Days of Operation	10,959	-	-	10,959	-	-	10,593	-	-	10,959	-	-	-
% Complete	99.75%	-	-	99.24%	-	-	95.24%	-	-	74.93%	-	-	-
Dry Season	-	-	47.5	-	-	40.9	-	-	44.9	-	-	50.5	45.9
Wet Season	-	-	56.1	-	-	56.6	-	-	50.2	-	-	54.1	54.2

Table 5
Average Rainfall in Inches Per Month From 01/01/68 to 12/31/97
Wet Season Defined as June Through September
Dry Season Defined as October Through May

Month	Station				Average
	Bradenton	Myakka	SaraBrad	Venice	
Jan	2.7	2.9	2.6	2.5	2.7
Feb	2.6	2.6	2.6	2.3	2.5
Mar	3.6	3.5	3.6	3.5	3.6
Apr	1.8	2.1	2.2	1.9	2.0
May	3.2	3.5	2.4	2.5	2.9
Jun	8.0	9.3	6.1	6.6	7.5
Jul	8.8	9.6	6.8	6.8	8.0
Aug	9.3	9.3	7.9	8.4	8.7
Sep	7.1	7.9	7.6	7.2	7.5
Oct	3.2	3.2	2.8	3.5	3.2
Nov	2.3	2.2	2.2	2.1	2.2
Dec	2.5	2.4	2.9	2.3	2.5
TOTAL	55.1	58.6	49.7	49.6	53.2
Wet - Avg	33.2	36.1	28.3	29.0	31.7
Dry - Avg	21.8	22.5	21.3	20.7	21.6

Table 6
Estimated Total Dry Season (Oct - May)
Pollutant Loads from Stormwater and Baseflow with Updated Land Use and BMPs Included

Basin Name	BOD (lbs/season)	Cd (lbs/season)	COD (lbs/season)	Cu (lbs/season)	DP (lbs/season)	NO23 (lbs/season)	Pb (lbs/season)	TDS (lbs/season)	TKN (lbs/season)	TP (lbs/season)	TSS (lbs/season)	Zn (lbs/season)
Direct to Bay	8,143	3	45,910	88	369	1,212	24	410,000	1,649	535	210,000	353
Whitaker Bay.	110,000	22	790,000	450	1,703	3,280	1,235	1,800,000	15,358	3,428	1,400,000	919
Hudson Bay.	24,441	5	170,000	100	363	686	285	350,000	3,303	741	280,000	193
Phillippi Cr.	570,000	99	3,800,000	1,970	9,946	21,364	2,600	12,000,000	82,901	20,477	7,100,000	3,733
Matheney Cr.	39,006	8	280,000	162	603	1,186	369	590,000	5,387	1,261	470,000	282
Clowers Cr.	18,240	3	120,000	60	265	529	128	330,000	2,495	557	220,000	127
Catfish Cr.	48,346	8	300,000	138	897	1,938	330	1,200,000	7,188	1,696	800,000	417
North Cr.	31,406	6	210,000	117	581	1,289	179	710,000	4,745	1,170	450,000	270
South Cr.	110,000	16	650,000	290	2,437	5,802	478	3,600,000	17,298	4,295	2,200,000	1,196
Shakett Cr.	71,815	11	460,000	216	1,491	3,410	235	2,000,000	11,263	2,870	1,300,000	596
Curry Cr.	77,440	12	520,000	247	1,453	3,253	346	1,900,000	11,443	2,794	1,300,000	642
Hatchett Cr.	49,306	9	330,000	184	870	1,852	459	1,000,000	6,806	1,577	740,000	481
Alligator Cr.	91,089	16	620,000	328	1,598	3,480	460	1,900,000	13,764	3,417	1,300,000	629
Woodmere	21,508	4	150,000	95	395	874	114	380,000	3,179	822	290,000	158
Forked Cr.	60,722	10	390,000	191	1,271	2,976	213	1,700,000	9,392	2,380	1,100,000	563
Godfrey Cr.	76,751	12	480,000	240	1,556	3,597	401	2,100,000	11,772	2,905	1,300,000	747
Ainger Cr.	48,936	7	300,000	112	1,015	2,264	177	1,500,000	7,658	1,892	940,000	387
Cow Pen Sl.	270,000	39	1,600,000	725	6,189	15,147	544	9,200,000	42,064	10,935	5,400,000	2,862
Myakka	770,000	126	4,600,000	2,683	19,924	51,662	1,334	28,000,000	130,000	34,424	17,000,000	10,669
Deer Pr.	140,000	23	820,000	538	4,195	11,397	162	6,000,000	25,050	6,887	3,500,000	2,478
Big Sough	640,000	83	3,900,000	1,476	14,965	36,012	1,566	23,000,000	100,000	26,303	14,000,000	6,653
Little Salt	44,750	7	300,000	151	883	1,970	203	1,100,000	6,740	1,713	750,000	346
Braden River	71,495	14	280,000	141	905	1,982	153	1,800,000	6,668	1,548	720,000	483
City of Sara.	88,825	19	620,000	448	1,646	3,768	964	1,600,000	12,663	3,069	1,200,000	1,074
County N.	62,058	13	430,000	304	1,278	3,081	353	1,300,000	9,570	2,520	880,000	678
City of Ven.	79,884	16	630,000	351	1,177	2,207	1,145	1,200,000	10,420	2,204	1,100,000	778
County S.	46,422	9	330,000	223	1,009	2,458	196	1,100,000	7,372	1,992	710,000	483
Longboat	25,035	5	170,000	115	568	1,395	130	650,000	3,862	1,027	430,000	305
City Island	22,886	5	150,000	137	573	1,550	150	630,000	3,665	994	380,000	411
Siesta Key	47,783	10	350,000	233	939	2,168	283	880,000	7,088	1,873	670,000	433
Casey Key	10,834	2	72,507	60	278	743	39	310,000	1,806	506	190,000	167
Manasota Key	10,035	2	67,382	47	243	608	33	280,000	1,661	456	170,000	122
TOTAL	3,787,156	624	23,935,799	12,620	81,585	195,140	15,288	110,520,000	584,230	149,268	68,500,000	39,635

Table 7
Estimated Total Wet Season (June - Sept)
Pollutant Loads from Stormwater and Baseflow with Updated Land Use and BMPs Included

Basin Name	BOD (lbs/season)	Cd (lbs/season)	COD (lbs/season)	Cu (lbs/season)	DP (lbs/season)	NO23 (lbs/season)	Pb (lbs/season)	TDS (lbs/season)	TKN (lbs/season)	TP (lbs/season)	TSS (lbs/season)	Zn (lbs/season)
Direct to Bay	12,007	4	67,490	130	547	1,787	35	620,000	2,448	794	310,000	520
Whitaker Bay.	170,000	32	1,200,000	661	2,518	4,841	1,813	2,700,000	22,633	5,059	2,000,000	1,353
Hudson Bay.	35,903	7	250,000	147	535	1,012	418	530,000	4,865	1,093	410,000	284
Phillippi Cr.	830,000	146	5,500,000	2,891	14,761	31,600	3,819	18,000,000	120,000	30,299	10,000,000	5,520
Matheney Cr.	57,307	11	410,000	238	891	1,749	542	870,000	7,937	1,859	680,000	415
Clowers Cr.	26,809	5	170,000	87	393	782	188	490,000	3,681	824	320,000	187
Catfish Cr.	71,156	11	440,000	203	1,337	2,875	485	1,900,000	10,651	2,519	1,200,000	616
North Cr.	46,197	8	310,000	172	864	1,908	262	1,100,000	7,017	1,732	660,000	398
South Cr.	160,000	23	950,000	426	3,642	8,612	702	5,500,000	25,709	6,401	3,200,000	1,772
Shakett Cr.	110,000	17	680,000	318	2,223	5,057	345	3,100,000	16,706	4,266	1,900,000	884
Curry Cr.	110,000	18	770,000	363	2,162	4,819	509	2,900,000	16,943	4,146	1,800,000	950
Hatchett Cr.	72,505	13	490,000	270	1,292	2,740	674	1,600,000	10,060	2,336	1,100,000	710
Alligator Cr.	130,000	24	910,000	481	2,372	5,148	676	2,800,000	20,335	5,055	1,800,000	930
Woodmere	31,613	6	230,000	139	584	1,290	168	570,000	4,690	1,214	420,000	234
Forked Cr.	89,403	14	570,000	281	1,894	4,410	313	2,600,000	13,927	3,535	1,600,000	834
Godfrey Cr.	110,000	18	700,000	352	2,318	5,332	588	3,200,000	17,453	4,317	2,000,000	1,105
Ainger Cr.	72,092	10	440,000	165	1,517	3,363	260	2,300,000	11,376	2,818	1,400,000	574
Cow Pen Sl.	390,000	58	2,300,000	1,065	9,247	22,476	800	14,000,000	62,554	16,294	8,000,000	4,241
Myakka	1,100,000	187	6,700,000	3,940	29,737	76,563	1,966	43,000,000	190,000	51,265	24,000,000	15,782
Deer Pr.	210,000	35	1,200,000	791	6,265	16,888	239	9,100,000	37,302	10,269	5,100,000	3,664
Big Sough	950,000	124	5,700,000	2,169	22,390	53,493	2,305	35,000,000	150,000	39,243	21,000,000	9,871
Little Salt	65,850	11	440,000	222	1,313	2,918	298	1,600,000	9,980	2,540	1,100,000	512
Braden River	110,000	20	420,000	207	1,349	2,941	224	2,700,000	9,894	2,304	1,100,000	715
City of Sara.	130,000	28	920,000	658	2,433	5,557	1,415	2,400,000	18,672	4,531	1,700,000	1,580
County N.	91,244	19	640,000	446	1,892	4,547	519	2,000,000	14,128	3,724	1,300,000	999
City of Ven.	120,000	23	920,000	515	1,739	3,257	1,680	1,800,000	15,350	3,252	1,500,000	1,145
County S.	68,281	14	480,000	328	1,495	3,631	288	1,600,000	10,896	2,946	1,000,000	713
Longboat	36,839	7	250,000	169	844	2,062	191	970,000	5,717	1,522	630,000	450
City Island	33,670	8	220,000	201	850	2,287	220	940,000	5,420	1,471	560,000	605
Siesta Key	70,234	14	510,000	343	1,388	3,198	416	1,300,000	10,456	2,765	980,000	639
Casey Key	15,946	3	110,000	88	412	1,097	57	460,000	2,674	749	280,000	247
Manasota Key	14,773	3	98,980	68	361	900	48	420,000	2,461	675	260,000	180
TOTAL	5,541,829	921	34,996,470	18,534	121,565	289,140	22,463	168,070,000	861,935	221,817	99,310,000	58,629

From Table 4 it is apparent that the June through September wet season has more rain events, which corresponds to the higher total rainfall previously reported in Table 5. The wet season average for all four stations was 54.2 events, totaling 31.7 inches of rain per season, while the dry season (October through May) average was 45.9 events, totaling 21.6 inches of rain per season.

The seasonal event pollutant loads are the pollutant loads attributed to a typical seasonal “event”. These were calculated by dividing the seasonal loads (Table 6 or 7) by the average number of events per corresponding season (Table 4). Table 8 contains the flows and pollutant loads per event for the dry season and Table 9 is the corresponding table for the wet season. The results indicate that the typical wet season event contributes approximately 20 percent more pollutants than the typical dry season event. This can be attributed to the roughly 20 percent greater rainfall per event in the wet season.

In turn, the EMCs were determined by dividing the seasonal loads by the seasonal flows (Table 8 or 9). The results can be seen in Table 10 for the dry season and Table 11 for the wet season. An EMC calculation for wet season BOD is illustrated below.

Example calculation for the Direct to Bay BOD EMC for the wet season.

$$\frac{222 \text{ lb BOD/event}}{33 * 10^6 \text{ L/event}} * \frac{10^6 \text{ mg}}{2.204 \text{ lb}} = 3.0 \text{ mg/L BOD}$$

As expected, a comparison of the dry and wet season results indicates that the EMC is approximately the same in both seasons. More sophisticated models capable of simulating individual events are required to further resolve individual EMC differences. However, it should be noted that one of the conclusions of the Nationwide Urban Runoff Program (USEPA, 1983) was that there is no significant relationship between EMCs and runoff volume. Within the context of those findings, the WMM results are reasonable for seasonal estimates.

Summary

In accordance with permit requirements, the seasonal load and EMC of a typical storm event have been estimated for each basin in Sarasota County. The results indicate that for every basin the wet season produces a higher seasonal pollutant load than the dry season. This can largely be attributed to the wet season’s larger number of events and its greater rainfall per event.

Table 8
Estimated Dry Season (Oct. - May)
Event Pollutant Loads from Stormwater and Baseflow with Updated Land Uses and BMPs Included

Basin Name	Flow (ac-ft/event)	BOD (lbs/event)	Cd (lbs/event)	COD (lbs/event)	Cu (lbs/event)	DP (lbs/event)	NO23 (lbs/event)	Pb (lbs/event)	TDS (lbs/event)	TKN (lbs/event)	TP (lbs/event)	TSS (lbs/event)	Zn (lbs/event)
Direct to Bay	1,006	177	0.07	1,000	1.9	8	26	0.5	8,932	36	12	4,575	7.7
Whitaker Bay.	4,841	2,397	0.48	17,211	9.8	37	71	26.9	39,216	335	75	30,501	20.0
Hudson Bay.	1,001	532	0.11	3,704	2.2	8	15	6.2	7,625	72	16	6,100	4.2
Phillippi Cr.	26,824	12,418	2.16	82,789	42.9	217	465	56.6	261,438	1,806	446	154,684	81.3
Matheney Cr.	1,589	850	0.17	6,100	3.5	13	26	8.0	12,854	117	27	10,240	6.1
Clowers Cr.	850	397	0.07	2,614	1.3	6	12	2.8	7,190	54	12	4,793	2.8
Catfish Cr.	2,717	1,053	0.17	6,536	3.0	20	42	7.2	26,144	157	37	17,429	9.1
North Cr.	1,649	684	0.13	4,575	2.5	13	28	3.9	15,468	103	25	9,804	5.9
South Cr.	7,221	2,397	0.35	14,161	6.3	53	126	10.4	78,431	377	94	47,930	26.1
Shakett Cr.	4,208	1,565	0.24	10,022	4.7	32	74	5.1	43,573	245	63	28,322	13.0
Curry Cr.	4,308	1,687	0.26	11,329	5.4	32	71	7.5	41,394	249	61	28,322	14.0
Hatchett Cr.	2,536	1,074	0.20	7,190	4.0	19	40	10.0	21,786	148	34	16,122	10.5
Alligator Cr.	4,417	1,985	0.35	13,508	7.1	35	76	10.0	41,394	300	74	28,322	13.7
Woodmere	1,567	469	0.09	3,268	2.1	9	19	2.5	8,279	69	18	6,318	3.4
Forked Cr.	3,672	1,323	0.22	8,497	4.2	28	65	4.6	37,037	205	52	23,965	12.3
Godfrey Cr.	3,538	1,672	0.26	10,458	5.2	34	78	8.7	45,752	256	63	28,322	16.3
Ainger Cr.	5,316	1,066	0.15	6,536	2.4	22	49	3.9	32,680	167	41	20,479	8.4
Cow Pen Sl.	22,719	5,882	0.85	34,858	15.8	135	330	11.9	200,436	916	238	117,647	62.4
Myakka	57,738	16,776	2.75	100,218	58.5	434	1,126	29.1	610,022	2,832	750	370,370	232.4
Deer Pr.	12,327	3,050	0.50	17,865	11.7	91	248	3.5	130,719	546	150	76,253	54.0
Big Sough	45,583	13,943	1.81	84,967	32.2	326	785	34.1	501,089	2,179	573	305,011	144.9
Little Salt	2,391	975	0.15	6,536	3.3	19	43	4.4	23,965	147	37	16,340	7.5
Braden River	2,729	1,558	0.31	6,100	3.1	20	43	3.3	39,216	145	34	15,686	10.5
City of Sara.	4,388	1,935	0.41	13,508	9.8	36	82	21.0	34,858	276	67	26,144	23.4
County N.	3,271	1,352	0.28	9,368	6.6	28	67	7.7	28,322	208	55	19,172	14.8
City of Ven.	3,417	1,740	0.35	13,725	7.6	26	48	24.9	26,144	227	48	23,965	16.9
County S.	2,500	1,011	0.20	7,190	4.9	22	54	4.3	23,965	161	43	15,468	10.5
Longboat	1,492	545	0.11	3,704	2.5	12	30	2.8	14,161	84	22	9,368	6.6
City Island	1,546	499	0.11	3,268	3.0	12	34	3.3	13,725	80	22	8,279	9.0
Siesta Key	2,240	1,041	0.22	7,625	5.1	20	47	6.2	19,172	154	41	14,597	9.4
Casey Key	718	236	0.04	1,580	1.3	6	16	0.8	6,754	39	11	4,139	3.6
Manasota Key	621	219	0.04	1,468	1.0	5	13	0.7	6,100	36	10	3,704	2.7
TOTAL	240,940	82,509	13.59	521,477	274.9	1,777	4,251	333.1	2,407,843	12,728	3,252	1,492,375	863.5

Table 9
Estimated Wet Season (June-Sept)
Event Pollutant Loads from Stormwater and Baseflow with Updated Land Uses and BMPs Included

Basin Name	Flow (ac-ft/event)	BOD (lbs/event)	Cd (lbs/event)	COD (lbs/event)	Cu (lbs/event)	DP (lbs/event)	NO23 (lbs/event)	Pb (lbs/event)	TDS (lbs/event)	TKN (lbs/event)	TP (lbs/event)	TSS (lbs/event)	Zn (lbs/event)
Direct to Bay	1,487	222	0.07	1,245	2.4	10	33	0.6	11,439	45	15	5,720	9.6
Whitaker Bay.	7,140	3,137	0.59	22,140	12.2	46	89	33.5	49,815	418	93	36,900	25.0
Hudson Bay.	1,453	662	0.13	4,613	2.7	10	19	7.7	9,779	90	20	7,565	5.2
Phillippi Cr.	39,669	15,314	2.69	101,476	53.3	272	583	70.5	332,103	2,214	559	184,502	101.8
Matheney Cr.	2,344	1,057	0.20	7,565	4.4	16	32	10.0	16,052	146	34	12,546	7.7
Clowers Cr.	1,255	495	0.09	3,137	1.6	7	14	3.5	9,041	68	15	5,904	3.5
Catfish Cr.	4,026	1,313	0.20	8,118	3.7	25	53	8.9	35,055	197	46	22,140	11.4
North Cr.	2,439	852	0.15	5,720	3.2	16	35	4.8	20,295	129	32	12,177	7.3
South Cr.	11,059	2,952	0.42	17,528	7.9	67	159	13.0	101,476	474	118	59,041	32.7
Shakett Cr.	6,240	2,030	0.31	12,546	5.9	41	93	6.4	57,196	308	79	35,055	16.3
Curry Cr.	6,378	2,030	0.33	14,207	6.7	40	89	9.4	53,506	313	76	33,210	17.5
Hatchett Cr.	3,749	1,338	0.24	9,041	5.0	24	51	12.4	29,520	186	43	20,295	13.1
Alligator Cr.	6,532	2,399	0.44	16,790	8.9	44	95	12.5	51,661	375	93	33,210	17.2
Woodmere	1,423	583	0.11	4,244	2.6	11	24	3.1	10,517	87	22	7,749	4.3
Forked Cr.	5,438	1,650	0.26	10,517	5.2	35	81	5.8	47,970	257	65	29,520	15.4
Godfrey Cr.	6,837	2,030	0.33	12,915	6.5	43	98	10.8	59,041	322	80	36,900	20.4
Ainger Cr.	4,471	1,330	0.18	8,118	3.0	28	62	4.8	42,435	210	52	25,830	10.6
Cow Pen Sl.	26,850	7,196	1.07	42,435	19.6	171	415	14.8	258,303	1,154	301	147,601	78.2
Myakka	85,648	20,295	3.45	123,616	72.7	549	1,413	36.3	793,358	3,506	946	442,804	291.2
Deer Pr.	18,288	3,875	0.65	22,140	14.6	116	312	4.4	167,897	688	189	94,096	67.6
Big Sough	67,684	17,528	2.29	105,166	40.0	413	987	42.5	645,756	2,768	724	387,454	182.1
Little Salt	3,541	1,215	0.20	8,118	4.1	24	54	5.5	29,520	184	47	20,295	9.4
Braden River	4,045	2,030	0.37	7,749	3.8	25	54	4.1	49,815	183	43	20,295	13.2
City of Sara.	6,472	2,399	0.52	16,974	12.1	45	103	26.1	44,280	345	84	31,365	29.2
County N.	4,831	1,683	0.35	11,808	8.2	35	84	9.6	36,900	261	69	23,985	18.4
City of Ven.	5,036	2,214	0.42	16,974	9.5	32	60	31.0	33,210	283	60	27,675	21.1
County S.	3,697	1,260	0.26	8,856	6.1	28	67	5.3	29,520	201	54	18,450	13.2
Longboat	2,207	680	0.13	4,613	3.1	16	38	3.5	17,897	105	28	11,624	8.3
City Island	2,285	621	0.15	4,059	3.7	16	42	4.1	17,343	100	27	10,332	11.2
Siesta Key	3,308	1,296	0.26	9,410	6.3	26	59	7.7	23,985	193	51	18,081	11.8
Casey Key	1,063	294	0.06	2,030	1.6	8	20	1.1	8,487	49	14	5,166	4.6
Manasota Key	920	273	0.06	1,826	1.3	7	17	0.9	7,749	45	12	4,797	3.3
TOTAL	347,815	102,248	16.99	645,691	342.0	2,243	5,335	414.4	3,100,923	15,903	4,093	1,832,288	1,081.7

Table 10
Estimated Dry Season (Oct. - May)
EMCs Due to Stormwater and Baseflow with Updated Land Uses and BMPs Included

Table 10 - Estimated dry season (Oct. - May) EMCs due to stormwater and baseflow with updated land uses and BMPs included.

Basin Name	BOD (mg/L)	Cd (mg/L)	COD (mg/L)	Cu (mg/L)	DP (mg/L)	NO23 (mg/L)	Pb (mg/L)	TDS (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)	Zn (mg/L)
Direct to Bay	3.0	0.001	17	0.03	0.13	0.44	0.01	150	0.60	0.20	77	0.13
Whitaker Bay.	8.4	0.002	60	0.03	0.13	0.25	0.09	137	1.17	0.26	106	0.07
Hudson Bay.	9.1	0.002	63	0.04	0.14	0.26	0.11	131	1.23	0.28	104	0.07
Phillippi Cr.	7.8	0.001	52	0.03	0.14	0.29	0.04	164	1.14	0.28	97	0.05
Matheney Cr.	9.0	0.002	65	0.04	0.14	0.27	0.09	137	1.25	0.29	109	0.07
Clowers Cr.	7.9	0.001	52	0.03	0.11	0.23	0.06	143	1.08	0.24	95	0.05
Catfish Cr.	6.5	0.001	41	0.02	0.12	0.26	0.04	162	0.97	0.23	108	0.06
North Cr.	7.0	0.001	47	0.03	0.13	0.29	0.04	158	1.06	0.26	100	0.06
South Cr.	5.4	0.001	32	0.01	0.12	0.29	0.02	178	0.85	0.21	109	0.06
Shakett Cr.	6.3	0.001	40	0.02	0.13	0.30	0.02	175	0.98	0.25	114	0.05
Curry Cr.	6.6	0.001	44	0.02	0.12	0.28	0.03	162	0.98	0.24	111	0.05
Hatchett Cr.	7.1	0.001	48	0.03	0.13	0.27	0.07	145	0.99	0.23	107	0.07
Alligator Cr.	7.6	0.001	52	0.03	0.13	0.29	0.04	158	1.15	0.28	108	0.05
Woodmere	8.2	0.002	57	0.04	0.15	0.33	0.04	145	1.21	0.31	111	0.06
Forked Cr.	6.1	0.001	39	0.02	0.13	0.30	0.02	170	0.94	0.24	110	0.06
Godfrey Cr.	6.1	0.001	38	0.02	0.12	0.29	0.03	167	0.94	0.23	104	0.06
Ainger Cr.	6.0	0.001	37	0.01	0.12	0.28	0.02	183	0.93	0.23	115	0.05
Cow Pen Sl.	5.5	0.001	33	0.01	0.13	0.31	0.01	187	0.85	0.22	110	0.06
Myakka	4.9	0.001	29	0.02	0.13	0.33	0.01	178	0.83	0.22	108	0.07
Deer Pr.	4.2	0.001	24	0.02	0.13	0.34	0.00	179	0.75	0.21	104	0.07
Big Sough	5.2	0.001	31	0.01	0.12	0.29	0.01	186	0.81	0.21	113	0.05
Little Salt	6.9	0.001	46	0.02	0.14	0.30	0.03	169	1.04	0.26	115	0.05
Braden River	9.6	0.002	38	0.02	0.12	0.27	0.02	243	0.90	0.21	97	0.07
City of Sara.	7.4	0.002	52	0.04	0.14	0.32	0.08	134	1.06	0.26	101	0.09
County N.	7.0	0.001	48	0.03	0.14	0.35	0.04	146	1.08	0.28	99	0.08
City of Ven.	8.6	0.002	68	0.04	0.13	0.24	0.12	129	1.12	0.24	118	0.08
County S.	6.8	0.001	49	0.03	0.15	0.36	0.03	162	1.08	0.29	104	0.07
Longboat	6.2	0.001	42	0.03	0.14	0.34	0.03	160	0.95	0.25	106	0.08
City Island	5.4	0.001	36	0.03	0.14	0.37	0.04	150	0.87	0.24	90	0.10
Siesta Key	7.8	0.002	57	0.04	0.15	0.36	0.05	144	1.16	0.31	110	0.07
Casey Key	5.5	0.001	37	0.03	0.14	0.38	0.02	159	0.92	0.26	97	0.09
Manasota Key	5.9	0.001	40	0.03	0.14	0.36	0.02	166	0.98	0.27	101	0.07
AVERAGE	6.7	0.001	44	0.03	0.13	0.31	0.04	161	1.00	0.25	105	0.07

Table 11
Estimated Wet Season (June - Sept)
EMCs Due to Stormwater and Baseflow with Updated Land Uses and BMPs Included

Basin Name	BOD (mg/L)	Cd (mg/L)	COD (mg/L)	Cu (mg/L)	DP (mg/L)	NO23 (mg/L)	Pb (mg/L)	TDS (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)	Zn (mg/L)
Direct to Bay	3.0	0.001	17	0.03	0.14	0.44	0.01	153	0.61	0.20	77	0.13
Whitaker Bay.	8.8	0.002	62	0.03	0.13	0.25	0.09	139	1.17	0.26	103	0.07
Hudson Bay.	9.1	0.002	63	0.04	0.14	0.26	0.11	134	1.23	0.28	104	0.07
Phillippi Cr.	7.7	0.001	51	0.03	0.14	0.29	0.04	167	1.11	0.28	93	0.05
Matheney Cr.	9.0	0.002	64	0.04	0.14	0.27	0.09	136	1.24	0.29	107	0.07
Clowers Cr.	7.9	0.001	50	0.03	0.12	0.23	0.06	144	1.08	0.24	94	0.05
Catfish Cr.	6.5	0.001	40	0.02	0.12	0.26	0.04	174	0.97	0.23	110	0.06
North Cr.	7.0	0.001	47	0.03	0.13	0.29	0.04	166	1.06	0.26	99	0.06
South Cr.	5.3	0.001	32	0.01	0.12	0.29	0.02	183	0.85	0.21	106	0.06
Shakett Cr.	6.5	0.001	40	0.02	0.13	0.30	0.02	183	0.98	0.25	112	0.05
Curry Cr.	6.3	0.001	44	0.02	0.12	0.28	0.03	167	0.98	0.24	104	0.05
Hatchett Cr.	7.1	0.001	48	0.03	0.13	0.27	0.07	157	0.99	0.23	108	0.07
Alligator Cr.	7.3	0.001	51	0.03	0.13	0.29	0.04	158	1.14	0.28	101	0.05
Woodmere	8.2	0.002	59	0.04	0.15	0.33	0.04	147	1.21	0.31	109	0.06
Forked Cr.	6.0	0.001	39	0.02	0.13	0.30	0.02	176	0.94	0.24	108	0.06
Godfrey Cr.	5.9	0.001	38	0.02	0.12	0.29	0.03	172	0.94	0.23	108	0.06
Ainger Cr.	5.9	0.001	36	0.01	0.12	0.28	0.02	189	0.94	0.23	115	0.05
Cow Pen Sl.	5.3	0.001	31	0.01	0.13	0.31	0.01	192	0.86	0.22	110	0.06
Myakka	4.7	0.001	29	0.02	0.13	0.33	0.01	185	0.82	0.22	103	0.07
Deer Pr.	4.2	0.001	24	0.02	0.13	0.34	0.00	183	0.75	0.21	103	0.07
Big Sough	5.2	0.001	31	0.01	0.12	0.29	0.01	190	0.81	0.21	114	0.05
Little Salt	6.8	0.001	46	0.02	0.14	0.30	0.03	166	1.04	0.26	114	0.05
Braden River	10.0	0.002	38	0.02	0.12	0.27	0.02	245	0.90	0.21	100	0.06
City of Sara.	7.4	0.002	52	0.04	0.14	0.32	0.08	136	1.06	0.26	97	0.09
County N.	6.9	0.001	49	0.03	0.14	0.35	0.04	152	1.08	0.28	99	0.08
City of Ven.	8.8	0.002	67	0.04	0.13	0.24	0.12	131	1.12	0.24	110	0.08
County S.	6.8	0.001	48	0.03	0.15	0.36	0.03	159	1.08	0.29	99	0.07
Longboat	6.1	0.001	42	0.03	0.14	0.34	0.03	162	0.95	0.25	105	0.07
City Island	5.4	0.001	35	0.03	0.14	0.37	0.04	151	0.87	0.24	90	0.10
Siesta Key	7.8	0.002	57	0.04	0.15	0.36	0.05	144	1.16	0.31	109	0.07
Casey Key	5.5	0.001	38	0.03	0.14	0.38	0.02	159	0.92	0.26	97	0.09
Manasota Key	5.9	0.001	40	0.03	0.14	0.36	0.02	168	0.98	0.27	104	0.07
AVERAGE	6.7	0.001	44	0.03	0.13	0.31	0.04	165	1.00	0.25	103	0.07

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