

Sarasota Bay Estuary Program Outfall Prioritization Project

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Sarasota Bay Estuary Program



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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 Introduction	1-1
2.0 Tributary Major Basin Scoring.....	2-1
3.0 Outfall Prioritization	3-1
4.0 Conceptual Retrofit Designs for the Top 25 Ranked Outfalls	4-1

Appendix A Conceptual Stormwater Plans

List of Tables

<u>Table</u>	<u>Page</u>
Table 2-1 SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-1
Table 2-2 SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-2
Table 2-3 SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-3
Table 2-4 SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-4
Table 2-5 SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-5
Table 2-6 SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-6
Table 2-7 Summary of SBEP Outfall Prioritization Study Tributary Scoring Matrix	2-7
Table 3-1 Summary of Sarasota Bay Manatee County Outfall Cross Sectional Area Scores	3-1
Table 3-3 Summary of Sarasota Bay Sarasota County Outfall Cross Section Scores	3-5
Table 3-4 Summary of Sarasota Bay Sarasota County Outfall Distance Scores	3-7
Table 3-5 Summary of Sarasota Bay Outfall Scores and Rank	3-10
Table 4-1 Conceptual Stormwater Retrofit Unit Construction Costs	4-9
Table 4-2 Example Conceptual Stormwater Retrofit Construction Costs	4-9

List of Figures

<u>Figure</u>	<u>Page</u>
Figure 3-1 Manatee County Outfall Rankings.....	3-16
Figure 3-2 Northern Portion of Sarasota County Outfall Rankings.....	3-17
Figure 3-3 Southern Portion of Sarasota County Outfall Rankings	3-18
Figure 4-1 Diagram of a Landscape Swale.....	4-1
Figure 4-2 Example of Multifunctional Swale.....	4-2
Figure 4-3 Example of Landscape Swale	4-2
Figure 4-4 Diagram of Landscape Infiltration.....	4-3
Figure 4-5 Buckman Heights Courtyard with Infiltration Green	4-3
Figure 4-6 Example of Bioretention Landscaping Parking Lot.....	4-4
Figure 4-7 Example Second Generation Baffle Box from Suntree Technologies.....	4-5
Figure 4-8 Diagram of a Typical Swale System.....	4-6
Figure 4-9 Diagram of a Typical Dry Retention System	4-6
Figure 4-10 Diagram of a Typical Exfiltration System.....	4-7
Figure 4-11 Diagram of a Typical Wet Detention System.....	4-7

1.0 Introduction

Non-point source discharges from stormwater outfalls represent a significant source of pollutant load to Sarasota Bay. Most of these outfalls are direct discharges of untreated stormwater from development which occurred before the implementation of current stormwater treatment requirements. The objectives of this project was to identify all major stormwater outfalls in the Sarasota Bay watershed, prioritize the outfalls in terms of importance to the bay and to develop practical retrofit alternatives for the top 25 ranked outfalls.

The first step in the evaluation process involved developing a tributary score for each of the 22 major tributary drainage sub-basins which outfall to the bay. The score was based on total pollutant loads, areal pollutant loads, adjacent bay submerged aquatic vegetation trends, adjacent bay secchi disk trend and total maximum daily load (TMDL) verified impairment status. The second step involved developing a score for all major outfalls in the Sarasota Bay watershed based on the tributary score, the size of the outfall and the flow path distance from the outfall to the bay proper. The third step involved developing conceptual stormwater retrofit plans for each of the 25 outfalls with the highest total score.

This report includes a summary of the outfall evaluation process including prioritization and conceptual retrofit design. Section 1 includes a summary of the tributary scoring process and results. Section 2 provides a summary of the outfall prioritization process and results and Section 3 includes conceptual designs for retrofitting the top 25 ranked outfalls.

This evaluation could not have been completed without the tributary and outfall information provided by Sarasota Bay Estuary Program (SBEP), Sarasota County, Manatee County, Jones Edmunds and Associates (JEA), Longboat Key and Holmes Beach.

2.0 Tributary Major Basin Scoring

In December 2005, JEA published a report titled “Sarasota Bay Pollutant Loading Model” for the SBEP. This report included calculated total and areal pollutant loadings for 16 parameters including nutrients, metals, demand parameters, oil and grease and fecal coliform based on a spreadsheet hydrologic and pollutant loading model. For the outfall prioritization project, 6 of the 16 parameters including annual total nitrogen (TN) load, areal TN load, annual total lead (TPb) load, areal TPb load, annual fecal coliform (FC) load and areal FC load were selected to develop pollutant loading scores for 22 major drainage tributaries. A summary of the pollutant loading values and associated basin scores are provided in Tables 2-1, 2-2 and 2-3 for TN, TPb and FC. In each case, a score of 100 was given to the basin with the largest pollutant load and the other basins were assigned a score less than 100 based on a ratio of that basin load to the largest basin load.

Table 2-1
SBEP Outfall Prioritization Study Tributary Scoring Matrix

Major Basin	Total N Loadings				Areal N Loading			
	(lb/yr)	Rank	%	Score	(lb/ac/yr)	Rank	%	Score
Phillippi Creek	696,424	1	48.5	100	19.8	3	7.9	83
Sarasota Bay Coastal	103,007	2	7.2	15	15.6	5	6.2	65
Little Sarasota Bay Coastal	87,334	3	6.1	13	24	1	9.6	100
Sarasota Bay	71,863	4	5	10	8	15	3.2	33
Whitaker Bayou	70,281	5	4.9	10	15.5	6	6.2	65
Curry Creek	63,695	6	4.4	9	10	11	4	42
South Creek	55,179	7	3.8	8	4.4	20	1.8	18
Bowlees Creek	53,335	8	3.7	8	9.4	14	3.8	39
Cedar Hammock	49,916	9	3.5	7	10.2	10	4.1	43
Catfish Creek	43,454	10	3	6	10.9	9	4.4	45
Matheny Creek	32,541	11	2.3	5	18.9	4	7.6	79
Hudson Bayou	31,857	12	2.2	5	13.3	7	5.3	55
Longboat Key	16,375	13	1.1	2	9.6	13	3.8	40
North Creek	16,316	14	1.1	2	7	18	2.8	29
Anna Maria Isl.	14,630	15	1	2	7.9	16	3.2	33
Palma Sola Drain	12,128	16	0.8	2	5.8	19	2.3	24
Elligraw Bayou	5,245	17	0.4	1	11.1	8	4.4	46
Holiday Bayou	4,618	18	0.3	1	23	2	9.2	96
Whitaker Bayou (Man)	4,427	19	0.3	1	7.8	17	3.1	33
Clower Creek	2,745	20	0.2	0	9.8	12	3.9	41
Phillippi Creek (Man)	1,377	21	0.1	0	4	21	1.6	17
Pearce Drain	290	22	0	0	3.7	22	1.5	15

Table 2-2
SBEP Outfall Prioritization Study Tributary Scoring Matrix

Major Basin	Total Pb Loading				Areal Pb Loading			
	(lb/yr)	Rank	%	Score	(lb/ac/yr)	Rank	%	Score
Phillippi Creek	7,644	1	31.6	100	0.22	10	3.9	32
Sarasota Bay Coastal	2,042	3	8.4	27	0.31	7	5.5	46
Little Sarasota Bay Coastal	677	9	2.8	9	0.19	12	3.4	28
Sarasota Bay	1,353	7	5.6	18	0.15	17	2.7	22
Whitaker Bayou	1,841	5	7.6	24	0.41	4	7.3	60
Curry Creek	681	8	2.8	9	0.11	20	1.9	16
South Creek	548	12	2.3	7	0.04	22	0.7	6
Bowlees Creek	2,653	2	11	35	0.47	3	8.3	69
Cedar Hammock	1,961	4	8.1	26	0.4	5	7.1	59
Cattfish Creek	590	11	2.4	8	0.15	15	2.7	22
Matheny Creek	444	14	1.8	6	0.26	9	4.6	38
Hudson Bayou	1,632	6	6.7	21	0.68	1	12	100
Longboat Key	630	10	2.6	8	0.37	6	6.5	54
North Creek	96	17	0.4	1	0.04	21	0.7	6
Anna Maria Isl.	494	13	2	6	0.27	8	4.8	40
Palma Sola Drain	375	15	1.5	5	0.18	13	3.2	26
Elligraw Bayou	55	18	0.2	1	0.12	19	2.1	18
Holiday Bayou	29	21	0.1	0	0.15	16	2.7	22
Whitaker Bayou (Man)	351	16	1.4	5	0.62	2	11	91
Clower Creek	49	19	0.2	1	0.17	14	3	25
Phillippi Creek (Man)	47	20	0.2	1	0.14	18	2.5	21
Pearce Drain	16	22	0.1	0	0.2	11	3.5	29

Table 2-3
SBEP Outfall Prioritization Study Tributary Scoring Matrix

Major Basin	Total Fecal Col. Loading				Areal Fecal Col. Loading					
	(bill.col./yr)	Rank	%	Score	(bill.col./ac/yr)	Rank	%	Score	%	Score
Phillippi Creek	11,591,348	1	43.2	100	330	6	6.2	57	6.2	57
Sarasota Bay Coastal	2,155,587	2	8	19	327	7	6.1	57	6.1	57
Little Sarasota Bay Coastal	1,079,956	7	4	9	297	9	5.6	51	5.6	51
Sarasota Bay	1,260,717	6	4.7	11	141	16	2.6	24	2.6	24
Whitaker Bayou	1,862,644	4	6.9	16	411	3	7.7	71	7.7	71
Curry Creek	756,382	9	2.8	7	119	18	2.2	21	2.2	21
South Creek	494,872	12	1.8	4	39	22	0.7	7	0.7	7
Bowlees Creek	2,147,859	3	8	19	377	4	7.1	65	7.1	65
Cedar Hammock	1,496,556	5	5.6	13	304	8	5.7	53	5.7	53
Catfish Creek	639,424	10	2.4	6	161	14	3	28	3	28
Matheny Creek	579,971	11	2.2	5	336	5	6.3	58	6.3	58
Hudson Bayou	1,011,295	8	3.8	9	423	2	7.9	73	7.9	73
Longboat Key	421,119	13	1.6	4	247	11	4.6	43	4.6	43
North Creek	164,171	17	0.6	1	71	21	1.3	12	1.3	12
Anna Maria Isl.	396,215	14	1.5	3	214	12	4	37	4	37
Palma Sola Drain	241,647	16	0.9	2	116	19	2.2	20	2.2	20
Elligraw Bayou	69,507	18	0.3	1	147	15	2.8	25	2.8	25
Holiday Bayou	51,147	19	0.2	0	255	10	4.8	44	4.8	44
Whitaker Bayou (Man)	329,055	15	1.2	3	578	1	10.8	100	10.8	100
Clower Creek	36,417	21	0.1	0	130	17	2.4	22	2.4	22
Phillippi Creek (Man)	38,333	20	0.1	0	112	20	2.1	19	2.1	19
Pearce Drain	15,407	22	0.1	0	199	13	3.7	34	3.7	34

Each of the major tributaries discharge into a segment of Sarasota Bay. Seagrass mapping efforts conducted by the SWFWMD over the years 1988 to 2004 were examined to determine the status and trends in seagrass coverage in each adjacent receiving water bay segment as provided in Table 2-4. All bay segments had increases in seagrass coverage over this time period, and as the purpose of this assessment was to prioritize areas needing water quality improvements, a score of 100 was given to a bay area in the bottom 20% of relative increases, a score of 40 or 50 was given to a bay area in the middle and a score of 0 was given to a bay area in the top 20% of bay segments in terms of increases in seagrass coverage.

Table 2-4
SBEP Outfall Prioritization Study Tributary Scoring Matrix

Major Basin	Adjacent Bay SAV Trend (1988-2004)			
	% Increase	Category	Rank	Score
Phillippi Creek	11	Middle	2	50
Sarasota Bay Coastal	13	Middle	2	50
Little Sarasota Bay Coastal	43	Top 20%	4	0
Sarasota Bay	0	Bottom 20%	1	100
Whitaker Bayou	13	Middle	2	50
Curry Creek	Outside	NA	4	NA
South Creek	43	Top 20%	4	0
Bowlees Creek	13	Middle	2	50
Cedar Hammock	0	Bottom 20%	1	100
Catfish Creek	43	Top 20%	4	0
Matheny Creek	43	Top 20%	4	0
Hudson Bayou	13	Middle	2	50
Longboat Key	13	Middle	2	50
North Creek	43	Top 20%	4	0
Anna Maria Isl.	0	Bottom 20%	1	100
Palma Sola Drain	0	Bottom 20%	1	100
Elligraw Bayou	43	Top 20%	4	0
Holiday Bayou	43	Top 20%	4	0
Whitaker Bayou (Man)	13	Middle	3	40
Clower Creek	43	Top 20%	4	0
Phillippi Creek (Man)	11	Middle	3	40
Pearce Drain	Outside	NA	4	NA

As an additional assessment, trends in water clarity, expressed in units of Secchi disk depths, were examined for each bay segment. Data were summarized from the 2002 Sarasota Bay SWIM Plan. The purpose of this assessment was to prioritize areas needing water quality improvements. As all relevant bay segments had trends of increasing water clarity, a score of 100 was given to a bay area with a small improvement and a score of 50 was given to a receiving bay area with more improvements in water clarity. Lastly, a major tributary basin with a substantial FDEP or EPA identified water quality impairment was given a score of 100 and a major tributary basin with an impairment on the planning list was given a score of 25 as shown in Table 2-6.

Table 2-5
SBEP Outfall Prioritization Study Tributary Scoring Matrix

Major Basin	Adjacent Bay Secchi Trend (2002 SWIM Plan)		
	Improve, Degrade, or No trend	Rank	Score
Phillippi Creek	Small Improve	1	100
Sarasota Bay Coastal	Improve	2	50
Little Sarasota Bay Coastal	Small Improve	2	50
Sarasota Bay	Improve	2	50
Whitaker Bayou	Improve	2	50
Curry Creek	Outside	3	NA
South Creek	Small Improve	1	100
Bowlees Creek	Improve	2	50
Cedar Hammock	Small Improve	1	100
Catfish Creek	Small Improve	1	100
Matheny Creek	Small Improve	1	100
Hudson Bayou	Improve	2	50
Longboat Key	Improve	2	50
North Creek	Small Improve	1	100
Anna Maria Isl.	Improve	2	50
Palma Sola Drain	Improve	2	50
Elligraw Bayou	Small Improve	1	100
Holiday Bayou	Small Improve	1	100
Whitaker Bayou (Man)	Improve	2	50
Clower Creek	Small Improve	1	100
Phillippi Creek (Man)	Improve	2	50
Pearce Drain	Outside	3	NA

Table 2-6
SBEP Outfall Prioritization Study Tributary Scoring Matrix

Major Basin	Verified Impaired Parameter		
	Parameter	Rank	Score
Phillippi Creek			
Sarasota Bay Coastal			0
Little Sarasota Bay Coastal			0
Sarasota Bay			0
Whitaker Bayou			0
Curry Creek	Nutrients*	2	25
South Creek	Nutrients*	2	25
Bowlees Creek	Nutrients (chl a) T&F	1	100
Cedar Hammock	Nutrients, bacteria	1	100
Catfish Creek	Nutrients*	2	25
Matheny Creek	Nutrients (RB)*	2	25
Hudson Bayou			0
Longboat Key			0
North Creek	Nutrients*	2	25
Anna Maria Isl.			0
Palma Sola Drain	Nutrients (T&F), bacteria	1	100
Elligraw Bayou	Nutrients, DO, Coliforms*	2	25
Holiday Bayou			
Whitaker Bayou (Man)			
Clower Creek	Coliforms	1	100
Phillippi Creek (Man)			
Pearce Drain			0

The individual scores for the various categories were then summed to give an overall score for each major tributary basin as provided in Table 2-7. The basin with the highest score would be considered the most important in terms of pollutant loads to the bay. The top 5 ranked basins in order are Phillippi Creek, Cedar Hammock, Bowlees Creek, Hudson bayou and Whitaker Bayou.

Table 2-7
Summary of SBEP Outfall Prioritization Study Tributary Scoring Matrix

Basin	Total Score	Rank
Phillippi Creek	722	1
Cedar Hammock	500	2
Bowlees Creek	434	3
Hudson Bayou	363	4
Whitaker Bayou	346	5
Palma Sola Drain	329	6
Sarasota Bay Coastal	327	7
Whitaker Bayou (Man)	322	8
Matheny Creek	316	9
Clower Creek	290	10
Anna Maria Isl.	272	11
Sarasota Bay	269	12
Holiday Bayou	263	13
Little Sarasota Bay Coastal	260	14
Longboat Key	251	15
Phillippi Creek (Man)	248	16
Catfish Creek	240	17
Elligraw Bayou	216	18
North Creek	177	19
South Creek	175	20
Curry Creek	128	21
Pearce Drain	80	22

3.0 Outfall Prioritization

The location and size of all major outfalls in Sarasota County were obtained in the form of GIS shapefiles from Sarasota County, and the location and size of all major outfalls in Manatee County were obtained in the form of GIS shapefiles from Manatee County. For the purposes of this study, only those outfalls with a diameter of at least 36-inches were included. Maps with outfall locations are given in Figure 3-1 for Manatee County and in Figures 3-2 and 3-3 for Sarasota County. Outfalls with a cross sectional area of approximately 7000 square inches or greater were given a score of 100. Only 10 outfalls had a cross sectional area of 7000 square inches or greater, all of which were located in Sarasota County. Outfalls with a cross sectional area less than 7000 square inches were given a score less than 100 using the ratio of the outfall area to 7000 multiplied by 100. The cross section area scoring for Manatee County outfalls is provided in Table 3-1.

Table 3-1
Summary of Sarasota Bay Manatee County Outfall Cross Sectional Area Scores

Location/ Basin	Object ID	Pipe Shape	Depth	Width	Outfall Cross Section Area (in ²)	Outfall Cross Section Area Score
Bowlees Creek	558	Round	50	50	1963	28.06
Sarasota Bay	403	Round	60	60	2827	40.41
Bowless Creek Oneco Drain	544	Round	36	36	1018	14.55
Palma Sola Drain	495	Round	60	60	2827	40.41
Cedar Hammock West	339	Round	36	36	1018	14.55
Sarasota Bay	48	Round	36	36	1018	14.55
Sarasota Bay	119	Round	36	36	1018	14.55
BRADENTON BEACH/Sarasota Bay	523	Round	36	36	1018	14.55
Sarasota Bay	580	Round	36	36	1018	14.55
Cedar Hammock South	153	Round	48	48	1810	25.86
Cedar Hammock South	420	Round	48	48	1810	25.86
BPD AIRPORT DRAIN/Bowlees Creek	36	Round	54	54	2290	32.73
BPD AIRPORT DRAIN/Bowlees Creek	211	Elliptical	48	60	2262	32.33
BPD AIRPORT DRAIN/Bowlees Creek	317	Round	50	50	1963	28.06
Sarasota Bay	161	Round	48	48	1810	25.86

Table 3-1
Summary of Sarasota Bay Manatee County Outfall Cross Sectional Area Scores

Location/ Basin	Object ID	Pipe Shape	Depth	Width	Outfall Cross Section Area (in ²)	Outfall Cross Section Area Score
BPD AIRPORT DRAIN/Bowlees Creek	85	Round	48	48	1810	25.86
Cedar Hammock South	375	Round	36	36	1018	14.55
Bowlees Creek	347	Elliptical	36	48	1357	19.40
Bowlees Creek Oneco Drain	451	Elliptical	36	48	1357	19.40
Bowlees Creek	528	Elliptical	36	48	1357	19.40
BPD AIRPORT DRAIN/Bowlees Creek	10	Round	36	36	1018	14.55
BPD AIRPORT DRAIN/Bowlees Creek	147	Round	36	36	1018	14.54
BPD AIRPORT DRAIN/Bowlees Creek	360	Round	36	36	1018	14.54
Bowlees Creek Oneco Drain	380	Round	36	36	1018	14.54
Bowlees Creek	398	Round	36	36	1018	14.54
Cedar Hammock West	67	Round	48	48	1810	25.86
Bowlees Creek	535	Round	54	54	2290	32.73
Bowlees Creek	132	Round	48	48	1810	25.86
Cedar Hammock West	86	Round	36	36	1018	14.54
Cedar Hammock South	133	Round	36	36	1018	14.54
Cedar Hammock South	350	Round	36	36	1018	14.54
Pearce Drain	345	Round	36	36	1018	14.54
Bowlees Creek	173	Round	36	36	1018	14.54
Bowlees Creek Oneco Drain	301	Round	36	36	1018	14.54
Bowlees Creek	393	Round	36	36	1018	14.54
Bowlees Creek	460	Round	36	36	1018	14.54
Bowlees Creek	540	Round	36	36	1018	14.54
BPD AIRPORT DRAIN/Bowlees Creek	30	Round	48	48	1810	25.86
Cedar Hammock East	276	Round	36	36	1018	14.54
Cedar Hammock East	453	Round	36	36	1018	14.54

Table 3-1
Summary of Sarasota Bay Manatee County Outfall Cross Sectional Area Scores

Location/ Basin	Object ID	Pipe Shape	Depth	Width	Outfall Cross Section Area (in ²)	Outfall Cross Section Area Score
Bowlees Creek Oneco Drain	243	Round	36	36	1018	14.54
Pearce Drain	484	Rectangular	60	60	3600	51.43
Pearce Drain	407	Round	48	48	1810	25.86
Pearce Drain	322	Elliptical	36	48	1357	19.39
Pearce Drain	108	Round	36	36	1018	14.54
Pearce Drain	162	Round	36	36	1018	14.54
Pearce Drain	238	Round	36	36	1018	14.54
Pearce Drain	364	Round	36	36	1018	14.54
Pearce Drain	454	Round	36	36	1018	14.54

A distance score was also calculated for each outfall. Outfalls discharging within 1000 feet of the bay were given a score of 100; outfalls discharging within 1000 to 5000 feet of the bay were given a score of 75; outfalls discharging within 5000 to 10,000 feet of the bay were given a score of 50; outfalls discharging within 10,000 to 15,000 feet of the bay were given a score of 25 and outfalls greater than 15,000 feet from the bay were given a score of 0. The distance scoring for Manatee County outfalls is provided in Table 3-2.

Table 3-2
Summary of Sarasota Bay Manatee County Outfall Distance Scores

Location/Basin	Object ID	Distance to Bay (ft)	Distance Score
Bowlees Creek	558	165	100
Sarasota Bay	403	773	100
Bowless Creek Oneco Drain	544	2	100
Palma Sola Drain	495	1324.8	75
Cedar Hammock West	339	1806.5	75
Sarasota Bay	48	131	100
Sarasota Bay	119	383	100
BRADENTON BEACH/Sarasota Bay	523	1	100
Sarasota Bay	580	214.9	100
Cedar Hammock South	153	7408.9	50
Cedar Hammock South	420	6458.2	50
BPD AIRPORT DRAIN/Bowlees Creek	36	7586.5	50
BPD AIRPORT DRAIN/Bowlees Creek	211	5808.7	50
BPD AIRPORT DRAIN/Bowlees Creek	317	5721.1	50
Sarasota Bay	161	2405.5	75
BPD AIRPORT DRAIN/Bowlees Creek	85	6599.7	50
Cedar Hammock South	375	8144.2	50
Bowlees Creek	347	8000	50
Bowlees Creek Oneco Drain	451	7360.7	50

Table 3-2
Summary of Sarasota Bay Manatee County Outfall Distance Scores

Location/Basin	Object ID	Distance to Bay (ft)	Distance Score
Bowlees Creek	528	8154.5	50
BPD AIRPORT DRAIN/Bowlees Creek	10	6926.97	50
BPD AIRPORT DRAIN/Bowlees Creek	147	6256.5	50
BPD AIRPORT DRAIN/Bowlees Creek	360	8277.3	50
Bowless Creek Oneco Drain	380	7964.4	50
Bowlees Creek	398	9264.3	50
Cedar Hammock West	67	13378.8	25
Bowlees Creek	535	14706	25
Bowlees Creek	132	11473.96	25
Cedar Hammock West	86	11812	25
Cedar Hammock South	133	11310	25
Cedar Hammock South	350	11775.7	25
Pearce Drain	345	1639.8	75
Bowlees Creek	173	14160.8	25
Bowlees Creek Oneco Drain	301	11338.6	25
Bowlees Creek	393	14706	25
Bowlees Creek	460	10709	25
Bowlees Creek	540	12391.8	25
BPD AIRPORT DRAIN/Bowlees Creek	30	21617.4	0
Cedar Hammock East	276	18529.9	0
Cedar Hammock East	453	19833.3	0
Bowlees Creek Oneco Drain	243	25390	0
Pearce Drain	484	33026.6	0
Pearce Drain	407	26501.7	0
Pearce Drain	322	15888.2	0
Pearce Drain	108	25094	0
Pearce Drain	162	24415.7	0
Pearce Drain	238	33333	0
Pearce Drain	364	19261.3	0
Pearce Drain	454	36946.5	0

Similar scoring results for Sarasota County outfalls based on cross sectional area and distance to bay are given in Tables 3-3 and 3-4.

Table 3-2
Summary of Sarasota Bay Sarasota County Outfall Cross Section Scores

Location/ Basin	Object ID	Pipe Shape	Depth	Width	Outfall Cross Section Area (in ²)	Outfall Cross Section Area Score
Phillippi Creek	362	Round	84	84	5542	79.2
Hudson Bayou	409	Rectangular	60	120	7200	100
Phillippi Creek	329	Rectangular	108	180	19440	100
Little Sarasota Bay Coastal	357	Rectangular	96	144	13824	100
Sarasota Bay Coastal	8	Rectangular	72	72	5184	74.1
Phillippi Creek	342	Rectangular	72	96	6912	98.7
Hudson Bayou	407	Round	66	66	3421	48.9
Sarasota Bay Coastal	4	Rectangular	96	48	4608	65.8
Curry Creek	416	Rectangular	120	132	15840	100
Phillippi Creek	330	Round	48	48	1810	25.9
Little Sarasota Bay Coastal	358	Rectangular	84	144	12096	100
Clower Creek	354	Round	72	72	4072	58.2
Phillippi Creek	328	Elliptical	79	117	7259	100
Sarasota Bay Coastal	3	Round	54	54	2290	32.7
Matheny Creek	361	Elliptical	83	128	8344	100
Hudson Bayou	963	Elliptical	52	77	3145	44.9
Elligraw Bayou	471	Round	72	72	4072	58.2
Phillippi Creek	451	Round	48	48	1810	25.9
Phillippi Creek	457	Round	72	72	4072	58.2
Hudson Bayou	661	Round	60	60	2827	40.4
Sarasota Bay Coastal	7	Rectangular	48.5	48	2328	33.3
Sarasota Bay Coastal	13	Round	48	48	1810	25.9
Catfish Creek	365	Rectangular	120	72	8640	100
Whitaker Bayou	24	Round	60	60	2827	40.4
Hudson Bayou	401	Rectangular	84	84	7056	100
Sarasota Bay Coastal	6	Round	38	38	1134	16.2
Whitaker Bayou	961	Rectangular	60	96	5760	82.3
Sarasota Bay Coastal	1	Round	36	36	1018	14.5
Sarasota Bay Coastal	5	Rectangular	24	48	1152	16.5
Hudson Bayou	477	Round	48	48	1810	25.9
Hudson Bayou	402	Round	48	48	1810	25.9
Phillippi Creek	340	Elliptical	38	60	1791	25.6
Phillippi Creek	454	Elliptical	38	60	1791	25.6
Phillippi Creek	453	Elliptical	48	76	2865	40.9
Phillippi Creek	28	Elliptical	48	76	2865	40.9
North Creek	465	Elliptical	48	76	2865	40.9
Phillippi Creek	674	Round	60	60	2827	40.4

Table 3-2
Summary of Sarasota Bay Sarasota County Outfall Cross Section Scores

Location/ Basin	Object ID	Pipe Shape	Depth	Width	Outfall Cross Section Area (in ²)	Outfall Cross Section Area Score
Phillippi Creek	322	Round	60	60	2827	40.4
Little Sarasota Bay Coastal	356	Round	36	36	1018	14.5
Little Sarasota Bay Coastal	355	Round	36	36	1018	14.5
Phillippi Creek	343	Round	42	42	1385	19.8
Phillippi Creek	31	Elliptical	43	68	2297	32.8
Phillippi Creek	452	Round	54	54	2290	32.7
Phillippi Creek	321	Round	54	54	2290	32.7
Phillippi Creek	331	Round	48	48	1810	25.9
Hudson Bayou	411	Elliptical	58	91	4145	59.2
Phillippi Creek	669	Elliptical	38	60	1791	25.6
Little Sarasota Bay Coastal	464	Round	36	36	1018	14.5
Hudson Bayou	408	Elliptical	34	53	1415	20.2
Phillippi Creek	681	Elliptical	34	53	1415	20.2
Phillippi Creek	29	Round	42	42	1385	19.8
South Creek	351	Rectangular	96	108	10368	100
Hudson Bayou	702	Round	36	36	1018	14.5
Phillippi Creek	683	Elliptical	29	45	1025	14.6
Phillippi Creek	461	Round	36	36	1018	14.5
Phillippi Creek	341	Round	36	36	1018	14.5
North Creek	463	Elliptical	29	45	1025	14.6
North Creek	348	Round	36	36	1018	14.5
Catfish Creek	367	Round	60	60	2827	40.4
Phillippi Creek	676	Elliptical	24	38	716	10.2
Phillippi Creek	668	Elliptical	24	38	716	10.2
Catfish Creek	691	Round	18	18	255	3.6
Whitaker Bayou	482	Round	30	30	707	10.1
Phillippi Creek	688	Round	24	24	452	6.5
Phillippi Creek	667	Elliptical	19	30	448	6.4
Phillippi Creek	673	Elliptical	19	30	448	6.4
Whitaker Bayou	709	Round	24	24	452	6.5
Phillippi Creek	684	Round	18	18	255	3.6
Phillippi Creek	671	Round	18	18	255	3.6
South Creek	664	Elliptical	14	23	253	3.6
Phillippi Creek	670	Elliptical	12	18	170	2.4
Catfish Creek	368	Round	48	48	1810	25.9
Catfish Creek	366	Round	42	42	1385	19.8

Table 3-2
Summary of Sarasota Bay Sarasota County Outfall Cross Section Scores

Location/ Basin	Object ID	Pipe Shape	Depth	Width	Outfall Cross Section Area (in ²)	Outfall Cross Section Area Score
North Creek	665	Round	18	18	255	3.6
Whitaker Bayou	647	Round	42	42	1385	19.8
South Creek	352	Round	48	48	1810	25.9
Catfish Creek	690	Round	36	36	1018	14.5
Catfish Creek	689	Round	18	18	255	3.6

Table 3-3
Summary of Sarasota Bay Sarasota County Outfall Distance Scores

Location/Basin	Object ID	Distance to Bay (ft)	Distance Score
Phillippi Creek	362	5270.2	75
Hudson Bayou	409	84.7	100
Phillippi Creek	329	8291.5	50
Little Sarasota Bay Coastal	357	182.8	100
Sarasota Bay Coastal	8	10	100
Phillippi Creek	342	10447.6	25
Hudson Bayou	407	782.4	100
Sarasota Bay Coastal	4	0	100
Curry Creek	416	13744	100
Phillippi Creek	330	4520.9	75
Little Sarasota Bay Coastal	358	2209	75
Clower Creek	354	2572.7	75
Phillippi Creek	328	25042.2	0
Sarasota Bay Coastal	3	13.2	100
Matheny Creek	361	6373.4	50
Hudson Bayou	963	1750.1	75
Elligraw Bayou	471	4369	75
Phillippi Creek	451	6125.3	50
Phillippi Creek	457	31115	0
Hudson Bayou	661	1984.9	75
Sarasota Bay Coastal	7	12.3	100
Sarasota Bay Coastal	13	0	100
Catfish Creek	365	6995.4	50
Whitaker Bayou	24	4906.7	75
Hudson Bayou	401	13506.3	25
Sarasota Bay Coastal	6	607.9	100
Whitaker Bayou	961	13506.3	25
Sarasota Bay Coastal	1	0	100

Table 3-3
Summary of Sarasota Bay Sarasota County Outfall Distance Scores

Location/Basin	Object ID	Distance to Bay (ft)	Distance Score
Sarasota Bay Coastal	5	526.3	100
Hudson Bayou	477	2401.4	75
Hudson Bayou	402	4031.3	75
Phillippi Creek	340	13705.2	25
Phillippi Creek	454	10773.8	25
Phillippi Creek	453	16275.2	0
Phillippi Creek	28	28331.5	0
North Creek	465	3171.3	75
Phillippi Creek	674	31305.5	0
Phillippi Creek	322	42062.5	0
Little Sarasota Bay Coastal	356	249.4	100
Little Sarasota Bay Coastal	355	249.4	100
Phillippi Creek	343	10427	25
Phillippi Creek	31	18026.9	0
Phillippi Creek	452	15756.6	0
Phillippi Creek	321	37122.3	0
Phillippi Creek	331	45420.9	0
Hudson Bayou	411	84372.4	0
Phillippi Creek	669	45533.8	0
Little Sarasota Bay Coastal	464	1282.9	75
Hudson Bayou	408	6918.6	50
Phillippi Creek	681	34165.7	0
Phillippi Creek	29	25577.4	0
South Creek	351	15737.1	0
Hudson Bayou	702	7179.4	50
Phillippi Creek	683	31354.3	0
Phillippi Creek	461	24431.4	0
Phillippi Creek	341	18417.8	0
North Creek	463	2952.1	75
North Creek	348	4890	75
Catfish Creek	367	13778.9	25
Phillippi Creek	676	41295.9	0
Phillippi Creek	668	45696.1	0
Catfish Creek	691	3230.2	75
Whitaker Bayou	482	7010.8	50
Phillippi Creek	688	17436.6	0
Phillippi Creek	667	43940.6	0
Phillippi Creek	673	43800	0
Whitaker Bayou	709	9651.2	50
Phillippi Creek	684	16414.2	0
Phillippi Creek	671	48398.3	0
South Creek	664	3386.3	75

Table 3-3
Summary of Sarasota Bay Sarasota County Outfall Distance Scores

Location/Basin	Object ID	Distance to Bay (ft)	Distance Score
Phillippi Creek	670	48564.9	0
Catfish Creek	368	13254	25
Catfish Creek	366	13820.9	25
North Creek	665	8800.8	50
Whitaker Bayou	647	14155.5	0
South Creek	352	23781.4	0
Catfish Creek	690	15854.7	0
Catfish Creek	689	19459.8	0

The individual scores based on basin tributary loads, cross sectional area and distance to bay were then summed to determine the total outfall score as shown in Table 3-5. The outfall with the highest score was ranked 1, the outfall with the next highest score was ranked 2 and so on. A total of 127 stormwater outfalls were scored and ranked. Two of the top 25 ranked outfalls were in Manatee County and the remaining 23 outfalls were in Sarasota County. The location of these outfalls is shown in Figures 3-1, 3-2 and 3-3. Conceptual designs for the top 25 ranked outfalls are presented in Section 4.

Table 3-4
Summary of Sarasota Bay Outfall Scores and Rank

Location/Basin	Outfall ID	Size Score	Basin Score	Distance Score	Final Score	Final Rank	County
Phillippi Creek	362	79.2	100	75	254.2	1	S
Hudson Bayou	409	100	50.3	100	250.3	2	S
Phillippi Creek	329	100	100	50	250	3	S
Little Sarasota Bay Coastal	357	100	36	100	236	4	S
Phillippi Creek	342	98.7	100	25	223.7	5	S
Sarasota Bay Coastal	8	74.1	45.3	100	219.4	6	S
Curry Creek	416	100	17.7	100	217.7	7	S
Sarasota Bay Coastal	4	65.8	45.3	100	211.1	8	S
Little Sarasota Bay Coastal	358	100	36	75	211	9	S
Phillippi Creek	330	25.9	100	75	200.9	10	S
Phillippi Creek	328	100	100	0	200	11	S
Matheny Creek	361	100	43.8	50	193.8	12	S
Bowlees Creek	558	28.06	60.1	100	188.16	13	M
Catfish Creek	365	100	33.2	50	183.2	14	S
Sarasota Bay Coastal	7	33.3	45.3	100	178.6	15	S
Sarasota Bay Coastal	3	32.7	45.3	100	178	16	S
Sarasota Bay	403	40.41	37.3	100	177.71	17	M
Hudson Bayou	407	25.86	50.3	100	176.16	18	S
Hudson Bayou	401	100	50.3	25	175.3	19	S
BPD AIRPORT DRAIN/Bowlees Creek	10	14.55	60.1	100	174.65	20	M
Clower Creek	354	58.2	40.2	75	173.4	21	S
Sarasota Bay Coastal	13	25.9	45.3	100	171.2	22	S
Hudson Bayou	963	44.9	50.3	75	170.2	23	S
Phillippi Creek	451	19.4	100	50	169.4	24	S
Hudson Bayou	661	40.4	50.3	75	165.7	25	S

Table 3-5
Summary of Sarasota Bay Outfall Scores and Rank

Location/Basin	Outfall ID	Size Score	Basin Score	Distance Score	Final Score	Final Rank	County
Whitaker Bayou	24	40.4	47.9	75	163.3	26	S
Elligraw Bayou	471	58.2	29.9	75	163.1	27	S
Sarasota Bay Coastal	5	16.5	45.3	100	161.8	28	S
Sarasota Bay Coastal	6	16.2	45.3	100	161.5	29	S
Palma Sola Drain	495	40.41	45.6	75	161.01	30	M
Sarasota Bay Coastal	1	14.5	45.3	100	159.8	31	S
Cedar Hammock West	339	14.55	69.3	75	158.85	32	M
Phillippi Creek	457	58.2	100	0	158.2	33	S
Whitaker Bayou	961	82.3	47.9	25	155.2	34	S
Sarasota Bay	48	14.55	37.3	100	151.85	35	M
Sarasota Bay	119	14.55	37.3	100	151.85	36	M
BRADENTON BEACH/Sarasota Bay	523	14.55	37.3	100	151.85	37	M
Sarasota Bay	580	14.55	37.3	100	151.85	38	M
Hudson Bayou	402	25.9	50.3	75	151.2	39	S
Hudson Bayou	477	25.9	50.3	75	151.2	40	S
Phillippi Creek	340	25.6	100	25	150.6	41	S
Little Sarasota Bay Coastal	355	14.5	36	100	150.5	42	S
Little Sarasota Bay Coastal	356	14.5	36	100	150.5	43	S
Cedar Hammock South	153	25.86	69.3	50	145.16	44	M
Cedar Hammock South	420	25.86	69.3	50	145.16	45	M
Phillippi Creek	343	19.8	100	25	144.8	46	S
BPD AIRPORT DRAIN/Bowlees Creek	36	32.73	60.1	50	142.83	47	M
BPD AIRPORT DRAIN/Bowlees Creek	211	32.33	60.1	50	142.43	48	M
Phillippi Creek	28	40.9	100	0	140.9	49	S

Table 3-5
Summary of Sarasota Bay Outfall Scores and Rank

Location/Basin	Outfall ID	Size Score	Basin Score	Distance Score	Final Score	Final Rank	County
North Creek	465	40.9	24.5	75	140.4	50	S
Phillippi Creek	674	40.4	100	0	140.4	51	S
Pearce Drain	454	14.54	100	25	139.54	52	S
Sarasota Bay	161	25.86	37.3	75	138.16	53	M
BPD AIRPORT DRAIN/Bowlees Creek	317	28.06	60.1	50	138.16	54	M
Phillippi Creek	451	25.9	60.1	50	136	55	M
BPD AIRPORT DRAIN/Bowlees Creek	85	25.86	60.1	50	135.96	56	M
Cedar Hammock South	375	14.55	69.3	50	133.85	57	M
Phillippi Creek	31	32.8	100	0	132.8	58	S
Phillippi Creek	321	32.7	100	0	132.7	59	S
Phillippi Creek	452	32.7	100	0	132.7	60	S
Bowlees Creek	347	19.4	60.1	50	129.5	61	M
Bowlees Creek	528	19.4	60.1	50	129.5	62	M
Phillippi Creek	331	25.9	100	0	125.9	63	S
Phillippi Creek	669	25.6	100	0	125.6	64	S
Little Sarasota Bay Coastal	464	14.5	36	75	125.5	65	S
Bowless Creek Oneco Drain	544	14.55	60.1	50	124.65	66	M
BPD AIRPORT DRAIN/Bowlees Creek	147	14.54	60.1	50	124.64	67	M
BPD AIRPORT DRAIN/Bowlees Creek	360	14.54	60.1	50	124.64	68	M
Bowless Creek Oneco Drain	380	14.54	60.1	50	124.64	69	M

Table 3-5
Summary of Sarasota Bay Outfall Scores and Rank

Location/Basin	Outfall ID	Size Score	Basin Score	Distance Score	Final Score	Final Rank	County
Bowlees Creek	398	14.54	60.1	50	124.64	70	M
South Creek	351	100	24.2	0	124.2	71	S
Hudson Bayou	408	20.2	50.3	50	120.5	72	S
Phillippi Creek	681	20.2	100	0	120.2	73	S
Cedar Hammock West	67	25.86	69.3	25	120.16	74	M
Phillippi Creek	29	19.8	100	0	119.8	75	S
Phillippi Creek	322	19.39	100	0	119.39	76	S
Bowlees Creek	535	32.73	60.1	25	117.83	77	M
Hudson Bayou	702	14.5	50.3	50	114.8	78	S
Phillippi Creek	683	14.6	100	0	114.6	79	S
Phillippi Creek	453	14.54	100	0	114.54	80	S
Phillippi Creek	341	14.5	100	0	114.5	81	S
Phillippi Creek	461	14.5	100	0	114.5	82	S
North Creek	463	14.6	24.5	75	114.1	83	S
North Creek	348	14.5	24.5	75	114	84	S
Catfish Creek	691	3.6	33.2	75	111.8	85	S
Bowlees Creek	132	25.86	60.1	25	110.96	86	M
Phillippi Creek	668	10.2	100	0	110.2	87	S
Phillippi Creek	676	10.2	100	0	110.2	88	S
Phillippi Creek	453	40.9	69.3	0	110.2	89	M
Hudson Bayou	411	59.2	50.3	0	109.5	90	S
Cedar Hammock West	86	14.54	69.3	25	108.84	91	M
Cedar Hammock South	133	14.54	69.3	25	108.84	92	M
Cedar Hammock South	350	14.54	69.3	25	108.84	93	M
Whitaker Bayou	482	10.1	47.9	50	108	94	S
Phillippi Creek	688	6.5	100	0	106.5	95	S
Phillippi Creek	667	6.4	100	0	106.4	96	S

Table 3-5
Summary of Sarasota Bay Outfall Scores and Rank

Location/Basin	Outfall ID	Size Score	Basin Score	Distance Score	Final Score	Final Rank	County
Phillippi Creek	673	6.4	100	0	106.4	97	S
Whitaker Bayou	709	6.5	47.9	50	104.4	98	S
Phillippi Creek	671	3.6	100	0	103.6	99	S
Phillippi Creek	684	3.6	100	0	103.6	100	S
South Creek	664	3.6	24.2	75	102.8	101	S
Phillippi Creek	670	2.4	100	0	102.4	102	S
Pearce Drain	345	14.54	11.1	75	100.64	103	M
Bowlees Creek	173	14.54	60.1	25	99.64	104	M
Bowlees Creek Oneco Drain	301	14.54	60.1	25	99.64	105	M
Bowlees Creek	393	14.54	60.1	25	99.64	106	M
Bowlees Creek	460	14.54	60.1	25	99.64	107	M
Bowlees Creek	540	14.54	60.1	25	99.64	108	M
Catfish Creek	367	40.4	33.2	25	98.6	109	S
BPD AIRPORT DRAIN/Bowlees Creek	30	25.86	60.1	0	85.96	110	M
Catfish Creek	368	25.9	33.2	25	84.1	111	S
Cedar Hammock East	276	14.54	69.3	0	83.84	112	M
North Creek	665	3.6	24.5	50	78.1	113	S
Catfish Creek	366	19.8	33.2	25	78	114	S
Bowlees Creek Oneco Drain	243	14.54	60.1	0	74.64	115	M
Whitaker Bayou	647	19.8	47.9	0	67.7	116	S
Pearce Drain	484	51.43	11.1	0	62.53	117	M
Pearce Drain	407	48.9	11.1	0	60	118	M
Pearce Drain	322	40.4	11.1	0	51.5	119	M
South Creek	352	25.9	24.2	0	50.1	120	S
Catfish Creek	690	14.5	33.2	0	47.7	121	S
Catfish Creek	689	3.6	33.2	0	36.8	122	S

Table 3-5
Summary of Sarasota Bay Outfall Scores and Rank

Location/Basin	Outfall ID	Size Score	Basin Score	Distance Score	Final Score	Final Rank	County
Pearce Drain	454	25.6	11.1	0	36.7	123	M
Pearce Drain	108	14.54	11.1	0	25.64	124	M
Pearce Drain	162	14.54	11.1	0	25.64	125	M
Pearce Drain	238	14.54	11.1	0	25.64	126	M
Pearce Drain	364	14.54	11.1	0	25.64	127	M

Figure 3-1
Manatee County Outfall Rankings

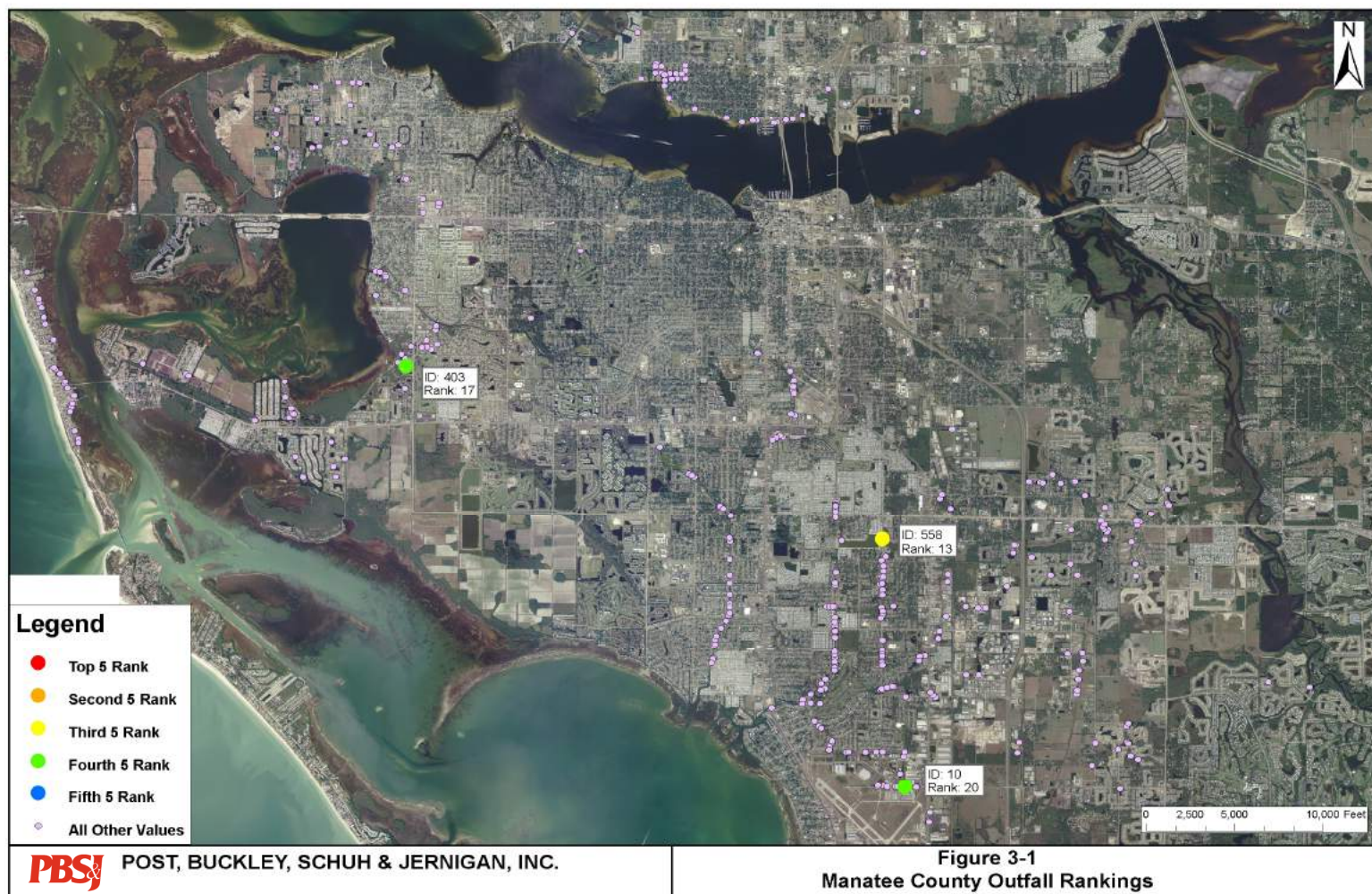


Figure 3-2
Northern Portion of Sarasota County Outfall Rankings

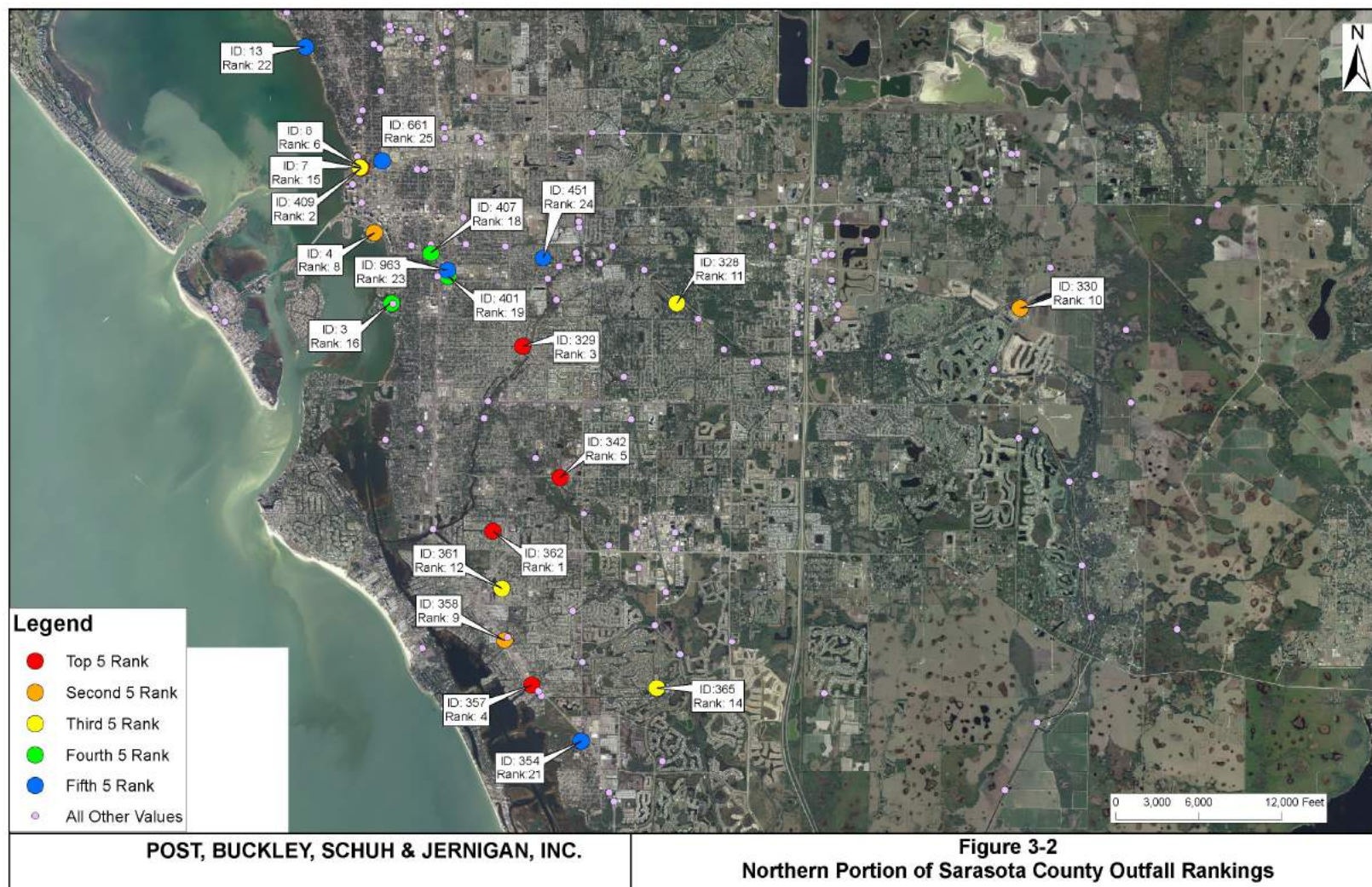
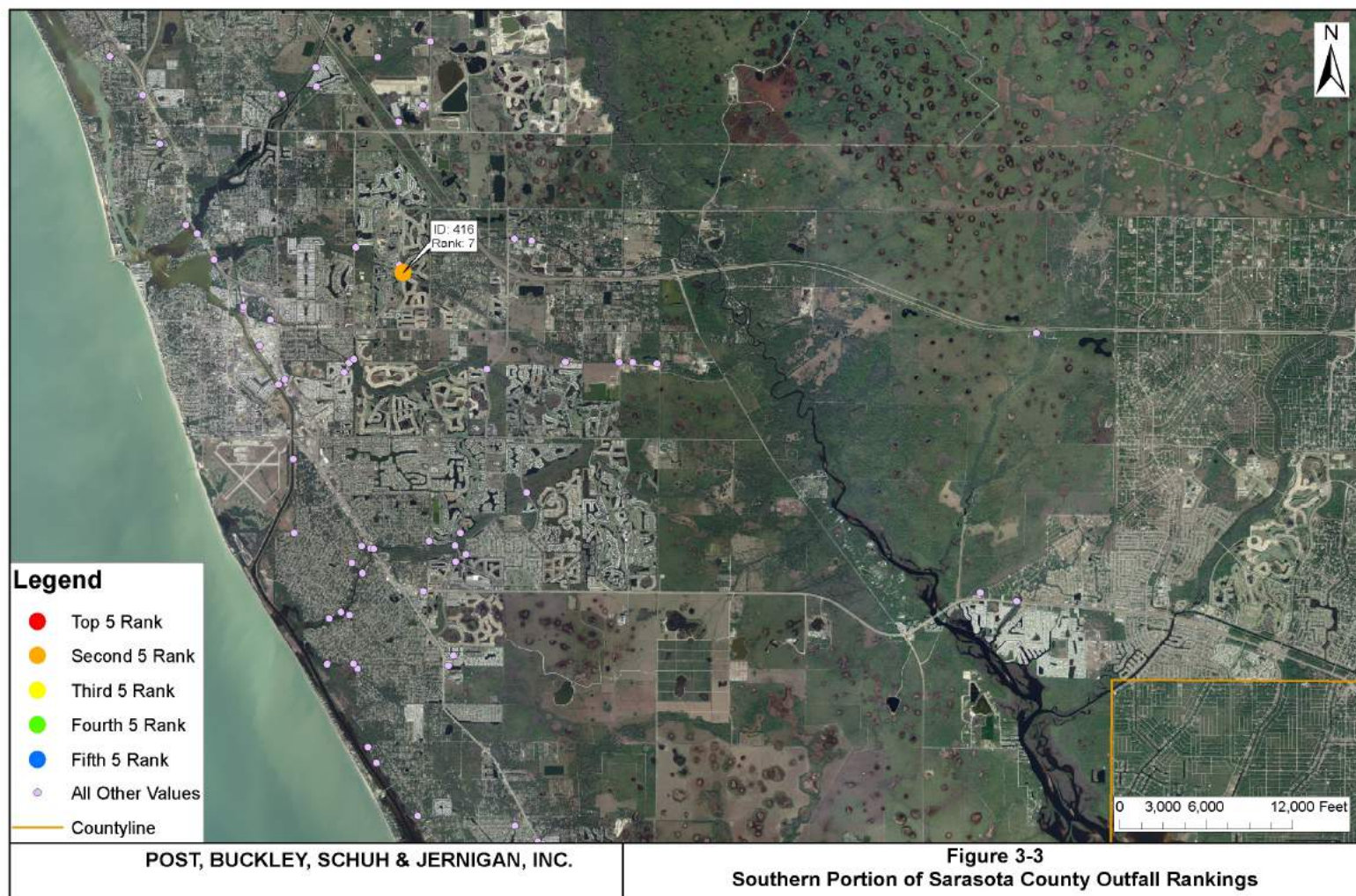


Figure 3-3
Southern Portion of Sarasota County Outfall Rankings



4.0 Conceptual Retrofit Designs for the Top 25 Ranked Outfalls

Much of the Sarasota Bay watershed was developed prior to the implementation of stormwater treatment regulations for new development. Therefore, large quantities of untreated stormwater discharge directly to the bay or to surface water tributaries which discharge directly to the bay. The volume of stormwater runoff produced by a given land use is highly dependent on the amount of directly connected impervious area. If stormwater can flow across or through pervious area, a significant portion of the runoff from common rain events may infiltrate into the soils. This infiltration of runoff provides a direct reduction in the volume of stormwater runoff and the associated pollutant load. One method to reduce stormwater pollutant loads is to disconnect impervious areas and allow runoff to flow across pervious areas. For example, remove curbs and gutters in residential subdivisions and create a shallow swale/bioretention system along the sides of the street. Examples of swales and bioretention are provided in Figures 4-1 through 4-6 courtesy of FDEP.

Figure 4-1
Diagram of a Landscape Swale

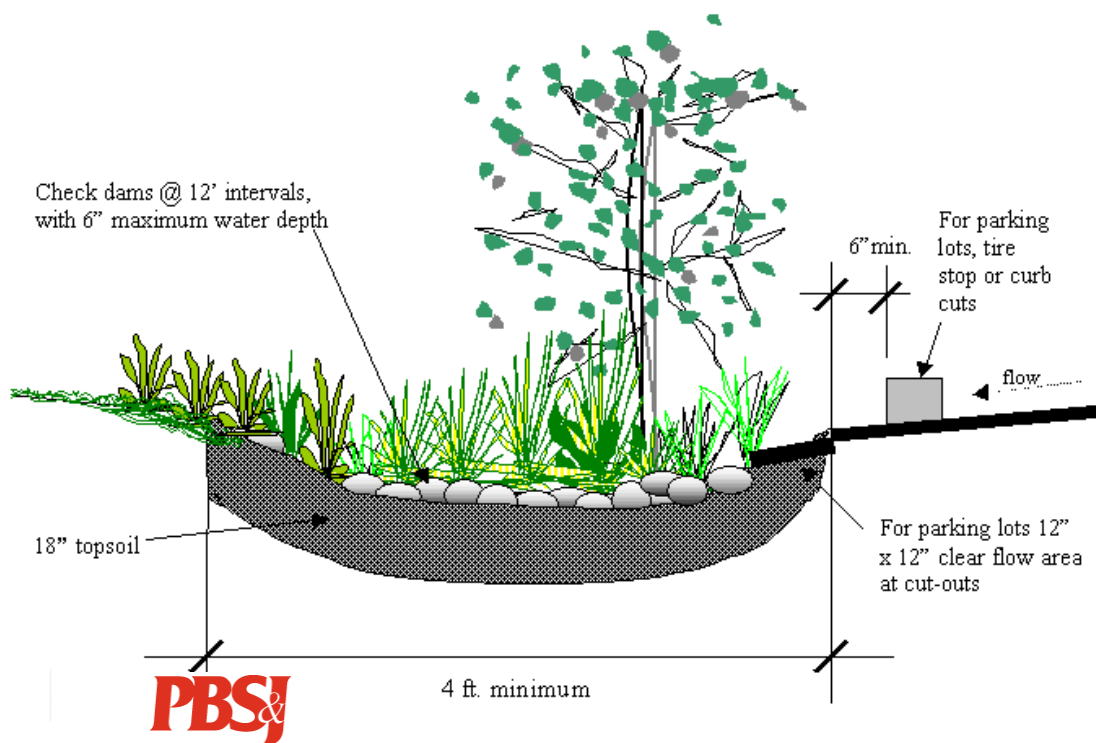


Figure 4-2
Example of Multifunctional Swale



Figure 4-3
Example of Landscape Swale



Figure 4-4
Diagram of Landscape Infiltration

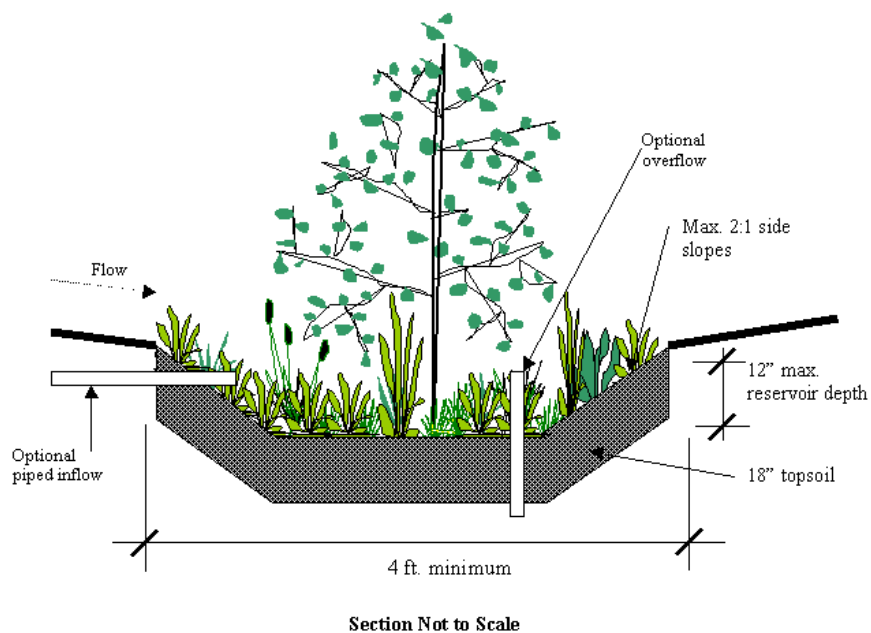


Figure 4-5
Buckman Heights Courtyard with Infiltration Green



Figure 4-6
Example of Bioretention Landscaping Parking Lot



Stormwater pollutants of primary concern to Sarasota Bay include trash, organic debris, sediment, nitrogen and fecal coliform bacteria. Trash, organic debris and sediment are commonly considered gross pollutants and can be removed relatively easily using various types of gross pollutant removal structures (GPRS) or trash/sediment traps. An example of one type of GPRS, a second generation baffle box from Suntree Technologies is given in Figure 4-7. GPRS require minimal land for installation and can normally be located near the outfall discharge and are relatively inexpensive when compared to more land intensive stormwater best management practices (BMPs). The removal of trash, organic debris and sediment is typically very cost effective and should be considered as an important first step in the retrofit process. The conceptual plans include features to remove gross pollutants from stormwater including gross pollutant/sediment removal structures and stormwater treatment areas. For stormwater treatment areas, traps, sumps and skimmers would be placed at the inflow to the stormwater treatment areas to remove gross pollutants.

Figure 4-7
Example Second Generation Baffle Box from Suntree Technologies



The removal of finer sediment, nitrogen and fecal coliform bacteria require more land intensive treatment methods including stormwater treatment areas (retention and detention practices). The type of treatment (retention vs. detention) used will depend on the treatment area soil types and depth to seasonal high groundwater level. Retention provides the highest pollutant removal efficiencies but can only be constructed in areas with well drained soils and space between the bottom of the retention basin and the seasonal high groundwater level. A diagram of a typical dry retention basin is shown in Figures 4-8 and 4-9. Retention practices include swales, bioretention, underground exfiltration systems and dry basins. Underground exfiltration can be installed under pavement and therefore is useful in the absence of available land for the construction of a retention basin as shown in Figure 4-10. Also included in retention practices is the disconnection of impervious areas by directing runoff over grassed areas. Wet detention provides the next highest pollutant removal efficiency and can be constructed in areas with poorly drained soils and high groundwater table as shown in Figure 4-11.

Figure 4-8
Diagram of a Typical Swale System

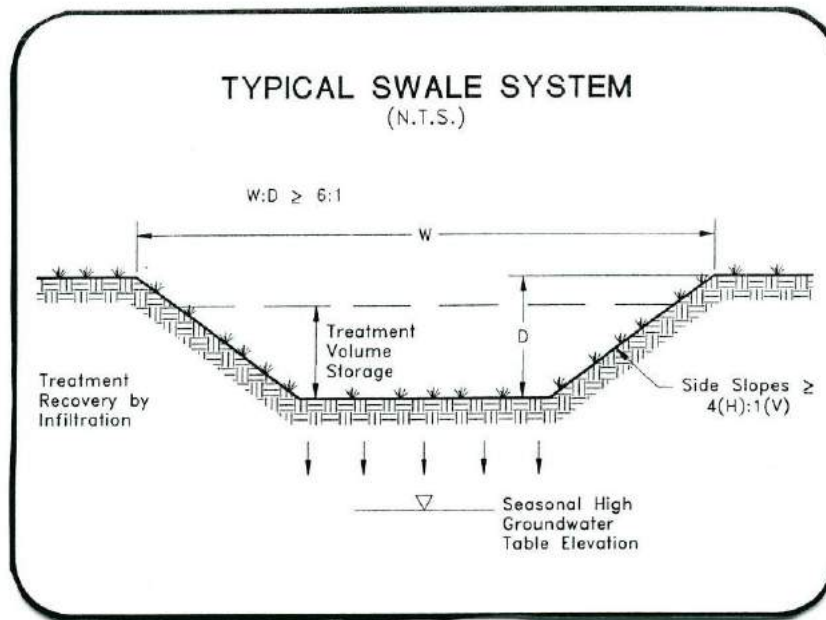


Figure 4-9
Diagram of a Typical Dry Retention System

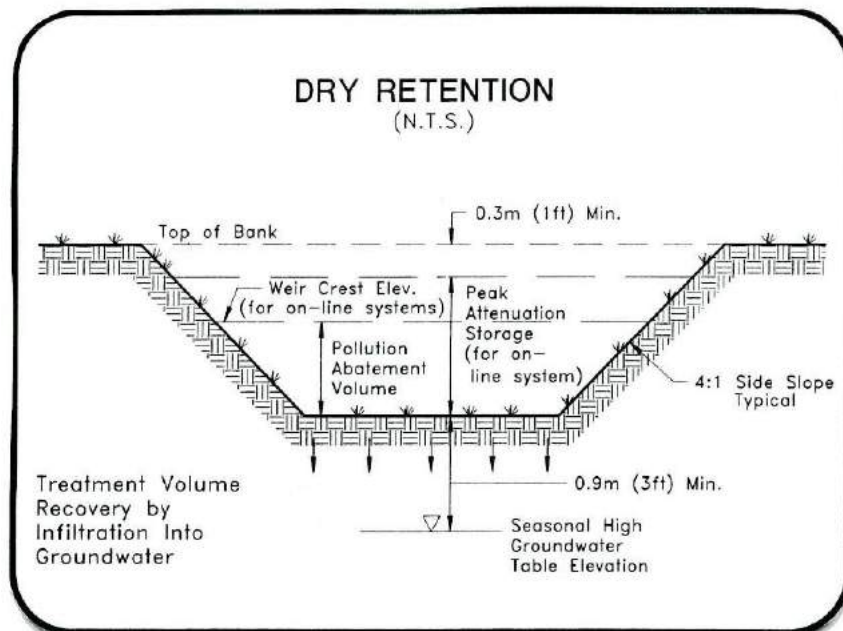


Figure 4-10
Diagram of a Typical Exfiltration System

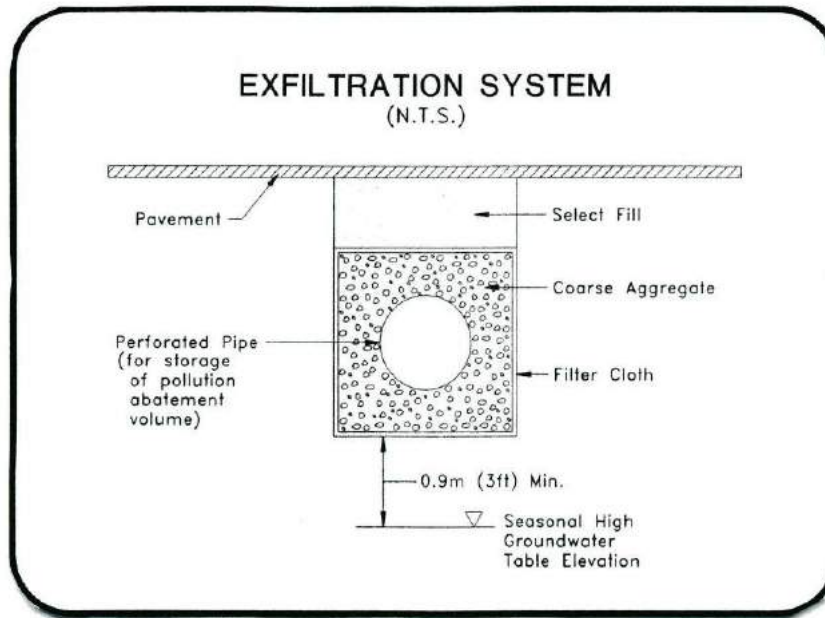
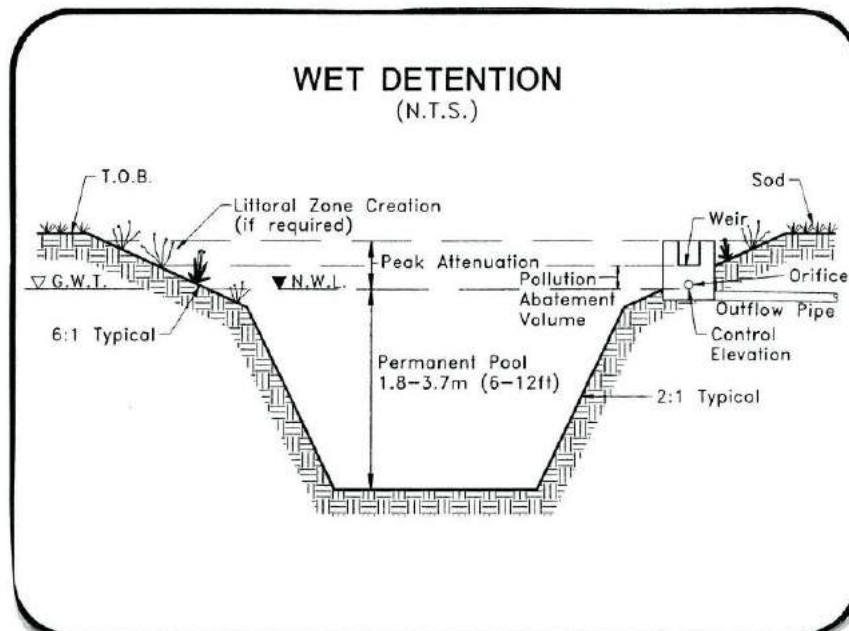


Figure 4-11
Diagram of a Typical Wet Detention System



Conceptual Retrofit Designs for the Top 25 Ranked Outfalls

Conceptual stormwater plans were developed for each of the top 25 ranked outfalls. If vacant land was identified close to the outfall, the plans reflected diversion structures and stormwater treatment areas for treatment. In some cases, multiple parcels were available for the construction of stormwater treatment areas and all were shown. Since the depth to the seasonal high groundwater table was not known, the type of treatment (retention vs. detention) was not specified. This will need to be determined during project design based on subsurface exploration. If no land was available close to the outfall, the plans show a combination of gross pollutant removal structures, underground exfiltration treatment systems and/or the conversion of curb and gutter drainage systems to swales/bioretention. The retrofit plan for each outfall includes the removal of gross pollutants using a gross pollutant removal structure (GPRS) or trash/sediment trap in a stormwater treatment area.

The conceptual stormwater retrofit plans for the top 25 ranked outfalls are provided in Appendix A. These should be considered a general guide for developing preliminary and final construction documents. The actual projects to be constructed will be largely based on sub-basin hydrology and hydraulics, land availability, the specific physical characteristics of selected sites and available construction funding. As a first level of treatment, it is recommended that projects be implemented to remove trash, organic debris and coarse sediment from all outfalls including the installation of gross pollutant removal structures or trash/sediment traps. The second level of treatment could be completed as more funding becomes available for the disconnection of directly connected impervious areas, the construction of swales and bioretention areas, the construction of stormwater treatment areas and the construction of underground exfiltration treatment systems. Priority should be given to the highest ranked outfalls.

The costs to construct stormwater retrofit facilities are highly variable depending on specific site characteristics, land cost, size of system, etc. Detailed construction cost estimates will need to be prepared during the preliminary design phase of each project. Conceptual unit costs for different types of treatment systems are given in Table 4-1. Example conceptual construction costs are provided for several outfall retrofits in Table 4-2.

Conceptual Retrofit Designs for the Top 25 Ranked Outfalls

Table 4-1
Conceptual Stormwater Retrofit Unit Construction Costs

Type of Treatment System	Cost	Comments
Convert to swale/bioretenention	\$8-12/cf of retention	No land required; provides more treatment than a retention basin due to infiltration in swale: 1 lf of 10 ft wide x 12" deep swale will provide 0.5" retention for 130 sf of area; typical lot and road area per lf of subdivision; Effective volume reduction estimated to be > 1" retention, effective cost is < \$4-6/cf
Construct bioretention areas	\$7-12/cf of retention	Cost highly dependent on land cost; 1 acre bioretention are will provide 0.5" retention for ~40 acres of area
Construct exfiltration treatment system	\$12-21/cf of retention	No land required; cost highly dependent on requirement to remove pavement to install; application dependent on depth to GWT
Construct gross pollutant/ sediment removal structure	\$150,000-300,000 each	Primarily provides trash and sediment removal with some removal of particulate forms of nutrients, metals, etc.
Stormwater treatment area	\$200,000-300,000/acre + land cost	Highly variable, retention less costly than wet detention due to earthwork costs

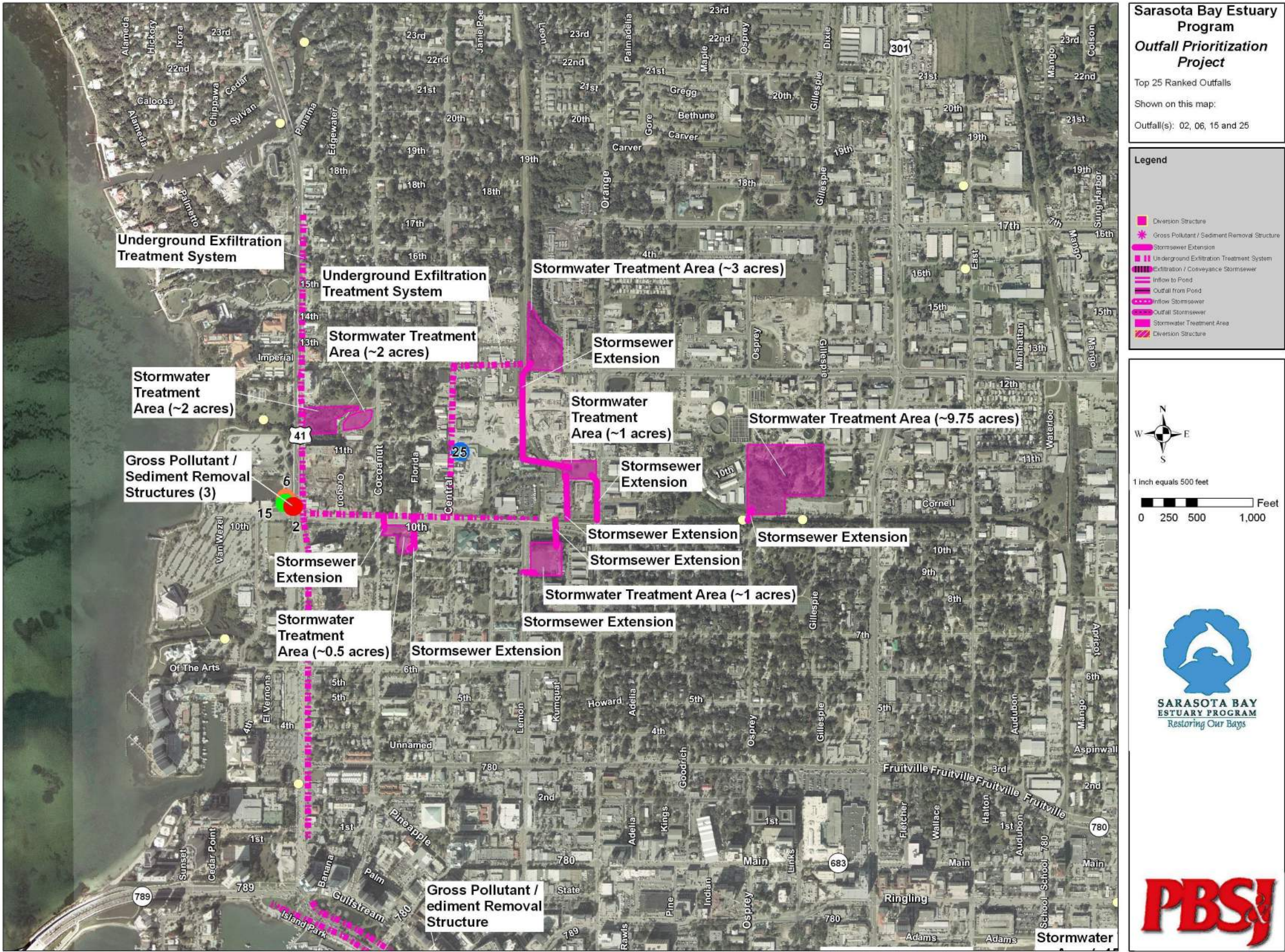
Table 4-2
Example Conceptual Stormwater Retrofit Construction Costs

Outfall Retrofit	Cost	Comments
Outfalls 1/17: Construct 37 acre bioretention area	\$9,250,000 + land cost	Provides 0.5" retention for 1,440 acres
Outfall 2/5: Construct 10 acre bioretention area; Construct 2 gross pollutant removal structures	\$3,100,000 + land cost	Provides 0.5" retention for 390 acres
Outfall 3: Construct gross pollutant removal structure; Convert 50,000 LF to swales/bioretenention	\$2,800,000	Provides 0.5" retention for 138 acres
Outfall 4/13/19: Construct 29 acre bioretention area; Construct gross pollutant removal structure	\$7,550,000	Provides 0.5" retention for 1,100 acres

Appendix A
Conceptual Stormwater Plans

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
A-1 Conceptual Stormwater Plans for Outfall 1	A-1
A-2 Conceptual Stormwater Plans for Outfall 2, 5, 15, 25	A-2
A-3 Conceptual Stormwater Plans for Outfall 3	A-3
A-4 Conceptual Stormwater Plans for Outfall 4, 9, 21	A-4
A-5 Conceptual Stormwater Plans for Outfall 6	A-5
A-6 Conceptual Stormwater Plans for Outfall 7	A-6
A-7 Conceptual Stormwater Plans for Outfall 8	A-7
A-8 Conceptual Stormwater Plans for Outfall 9	A-8
A-9 Conceptual Stormwater Plans for Outfall 10	A-9
A-10 Conceptual Stormwater Plans for Outfall 11	A-10
A-11 Conceptual Stormwater Plans for Outfall 13	A-11
A-12 Conceptual Stormwater Plans for Outfall 14	A-12
A-13 Conceptual Stormwater Plans for Outfall 16	A-13
A-13 Conceptual Stormwater Plans for Outfall 17	A-14
A-14 Conceptual Stormwater Plans for Outfall 18 and 23	A-15
A-15 Conceptual Stormwater Plans for Outfall 22	A-16
A-16 Conceptual Stormwater Plans for Outfall 24	A-17







Sarasota Bay Estuary Program
Outfall Prioritization Project
Top 25 Ranked Outfalls
Shown on this map:
Outfall(s): 05

Legend

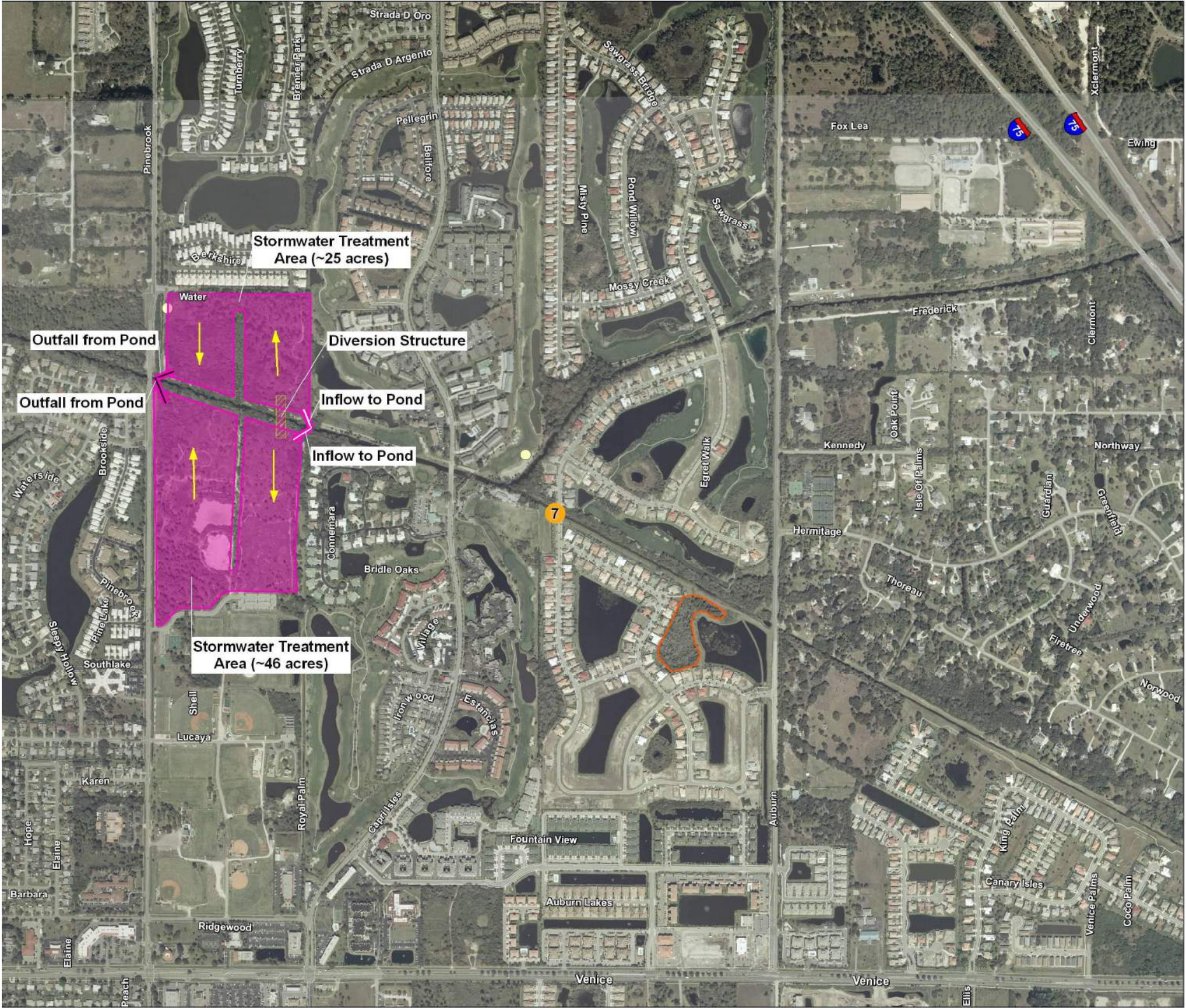
- Diversion Structure
- Gross Pollutant / Sediment Removal Structure
- Stormsewer Extension
- Underground Exfiltration Treatment System
- Exfiltration / Conveyance Stormsewer
- Inflow to Pond
- Outfall from Pond
- Inflow Stormsewer
- Outfall Stormsewer
- Stormwater Treatment Area
- Diversion Structure

North arrow pointing North (N), South (S), East (E), and West (W).

1 inch equals 500 feet

0 250 500 1,000 Feet

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Sarasota Bay Estuary Program
Outfall Prioritization Project

Top 25 Ranked Outfalls
Shown on this map:
Outfall(s): 07

Legend

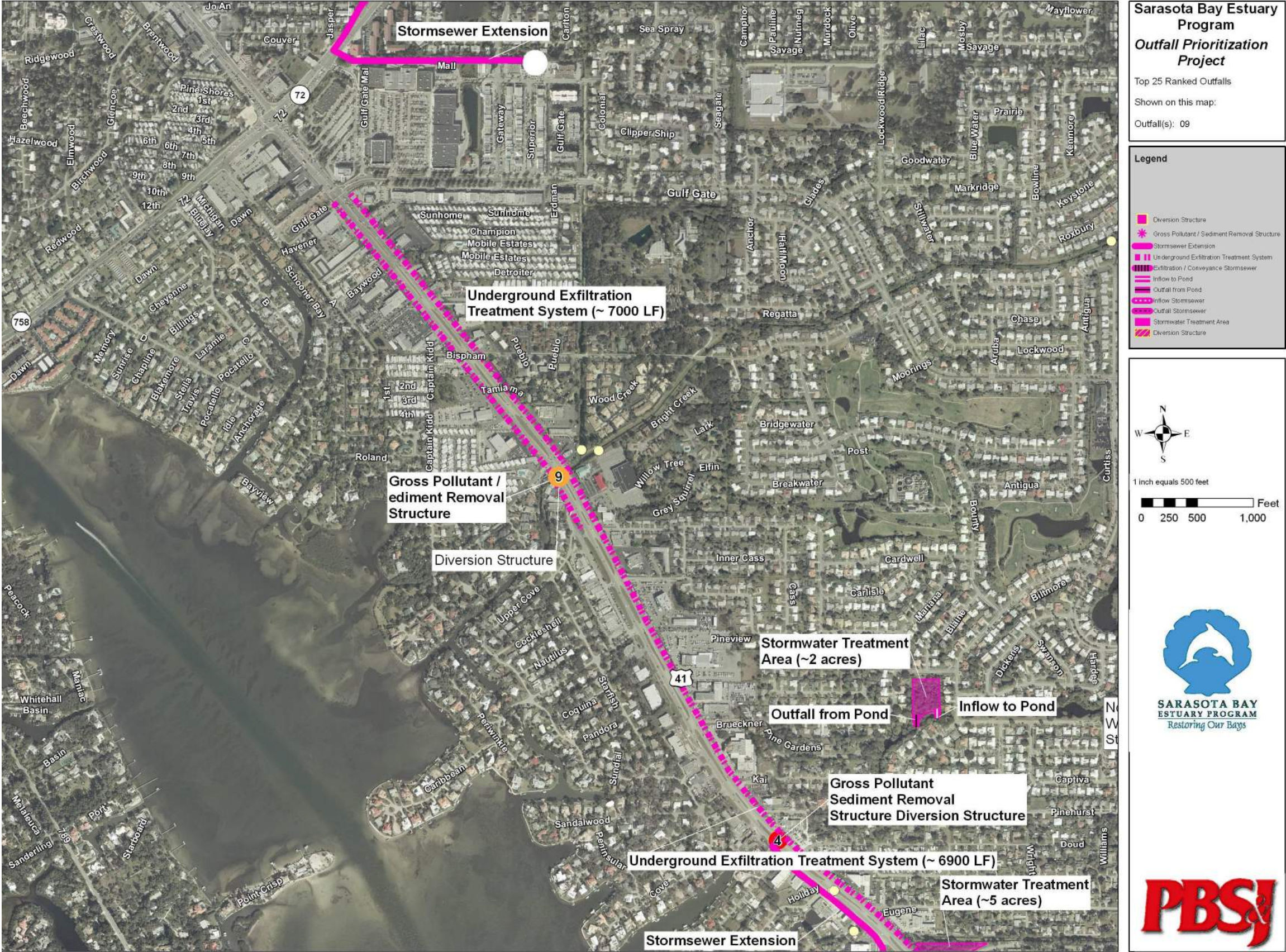
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- Gross Pollutant / Sediment Removal Structure
- Storm sewer Extension
- Underground Exfiltration Treatment System
- Exfiltration / Conveyance Stormsewer
- Inflow to Pond
- Outfall from Pond
- Inflow Stormsewer
- Outfall Stormsewer
- Stormwater Treatment Area
- Diversion Structure

North arrow pointing North (N), South (S), East (E), and West (W).

1 inch equals 500 feet

Scale bar: 0 250 500 1,000 Feet







Sarasota Bay Estuary Program
Outfall Prioritization Project

Top 25 Ranked Outfalls

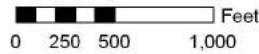
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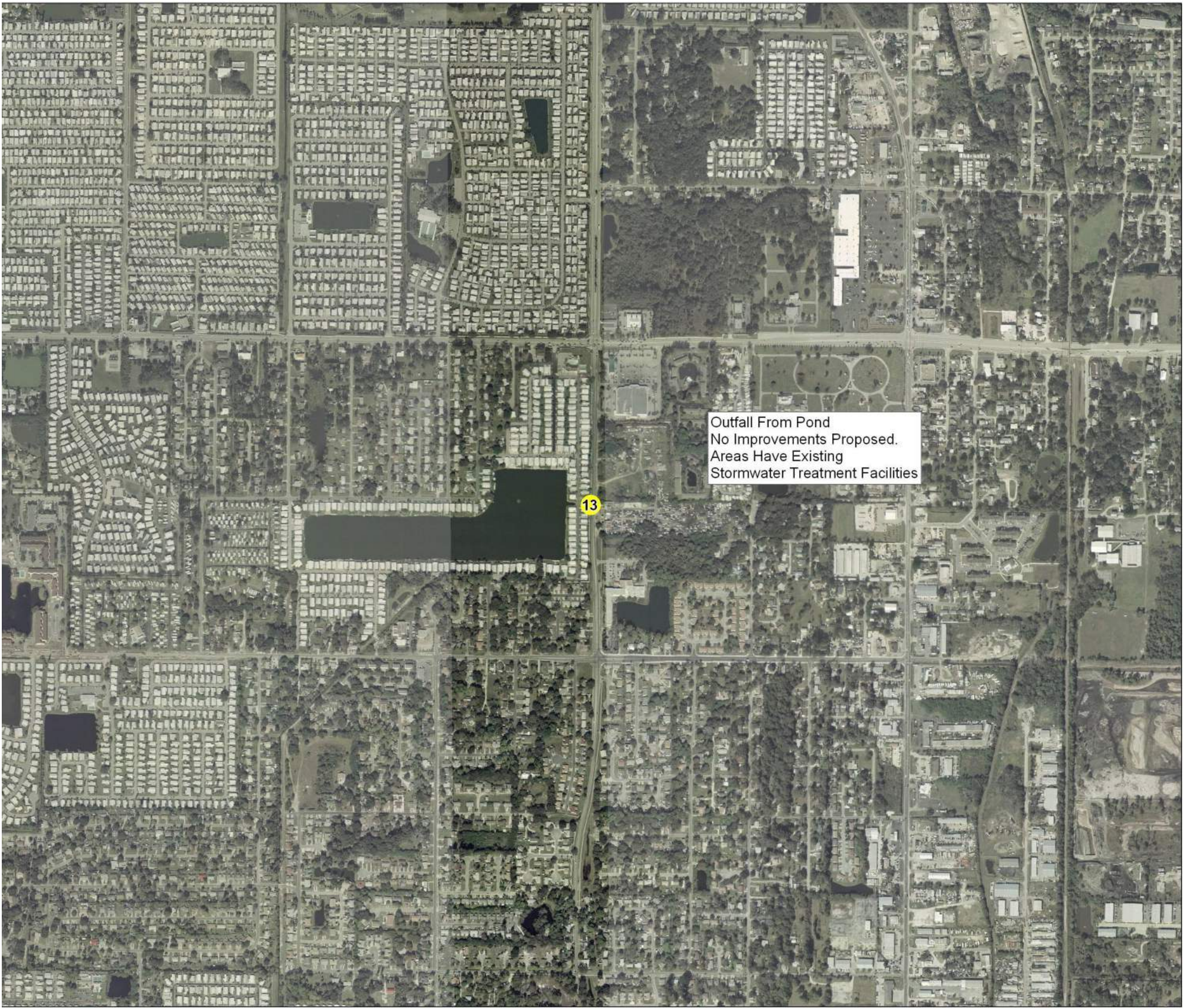


1 inch equals 500 feet



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Outfall Prioritization Project

Top 25 Ranked Outfalls

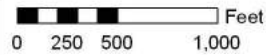
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Outfall(s): 13

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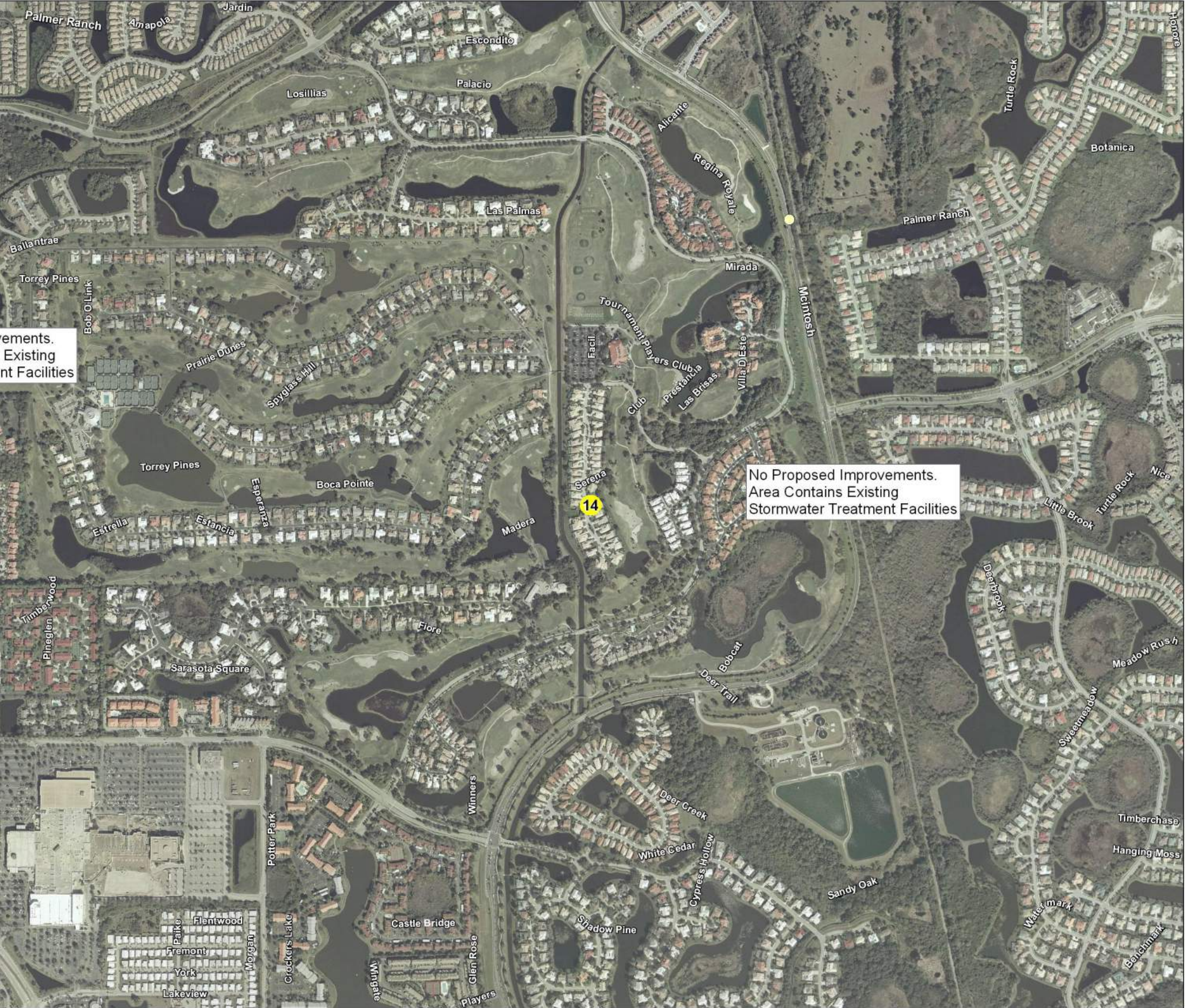


1 inch equals 500 feet

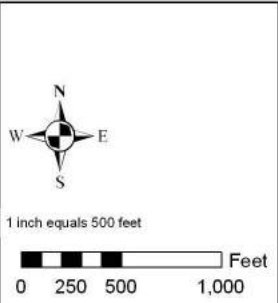
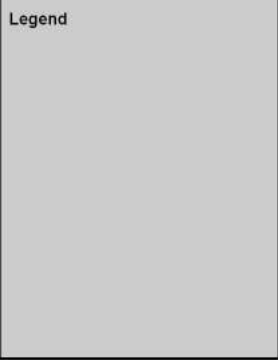


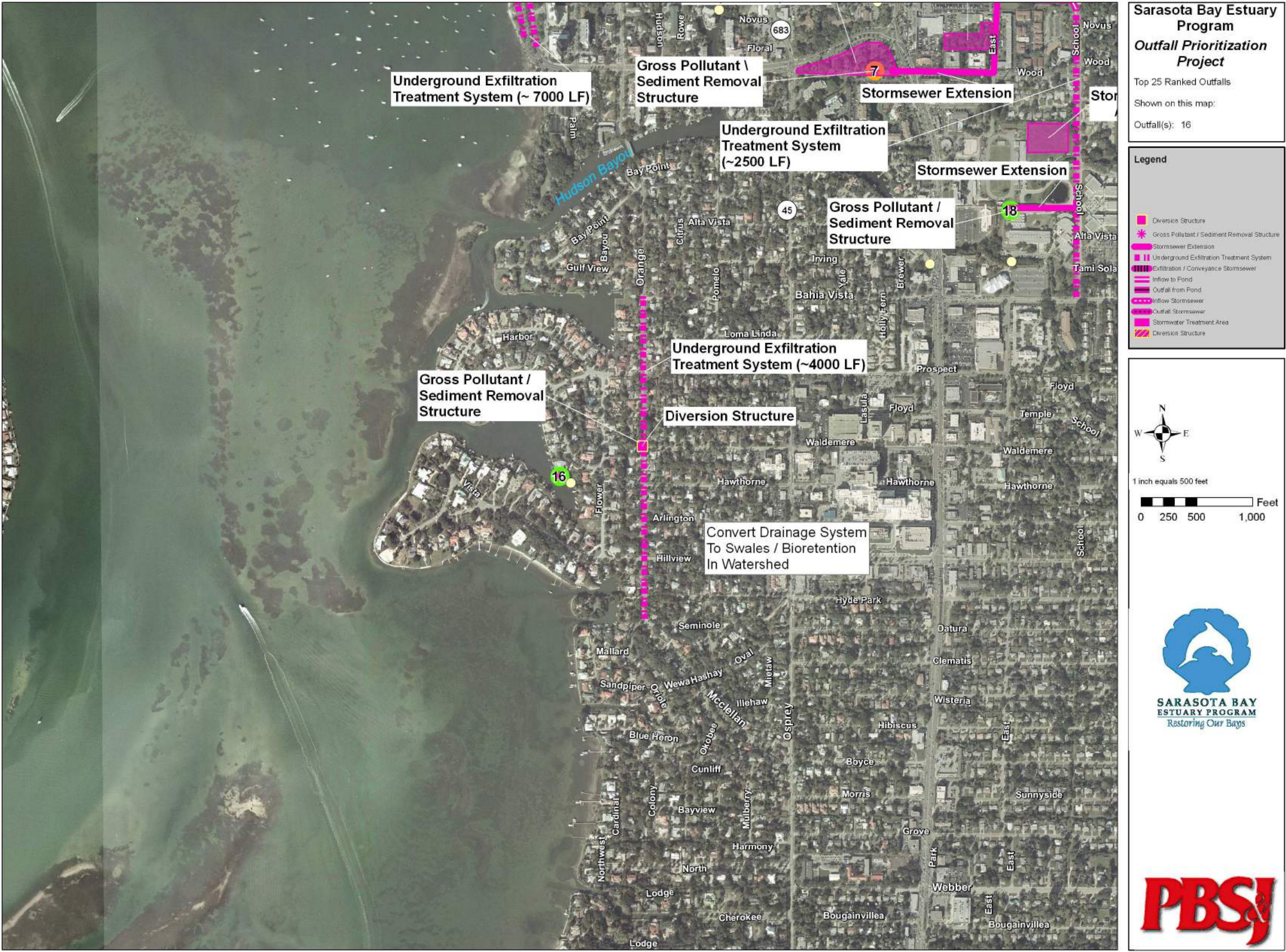
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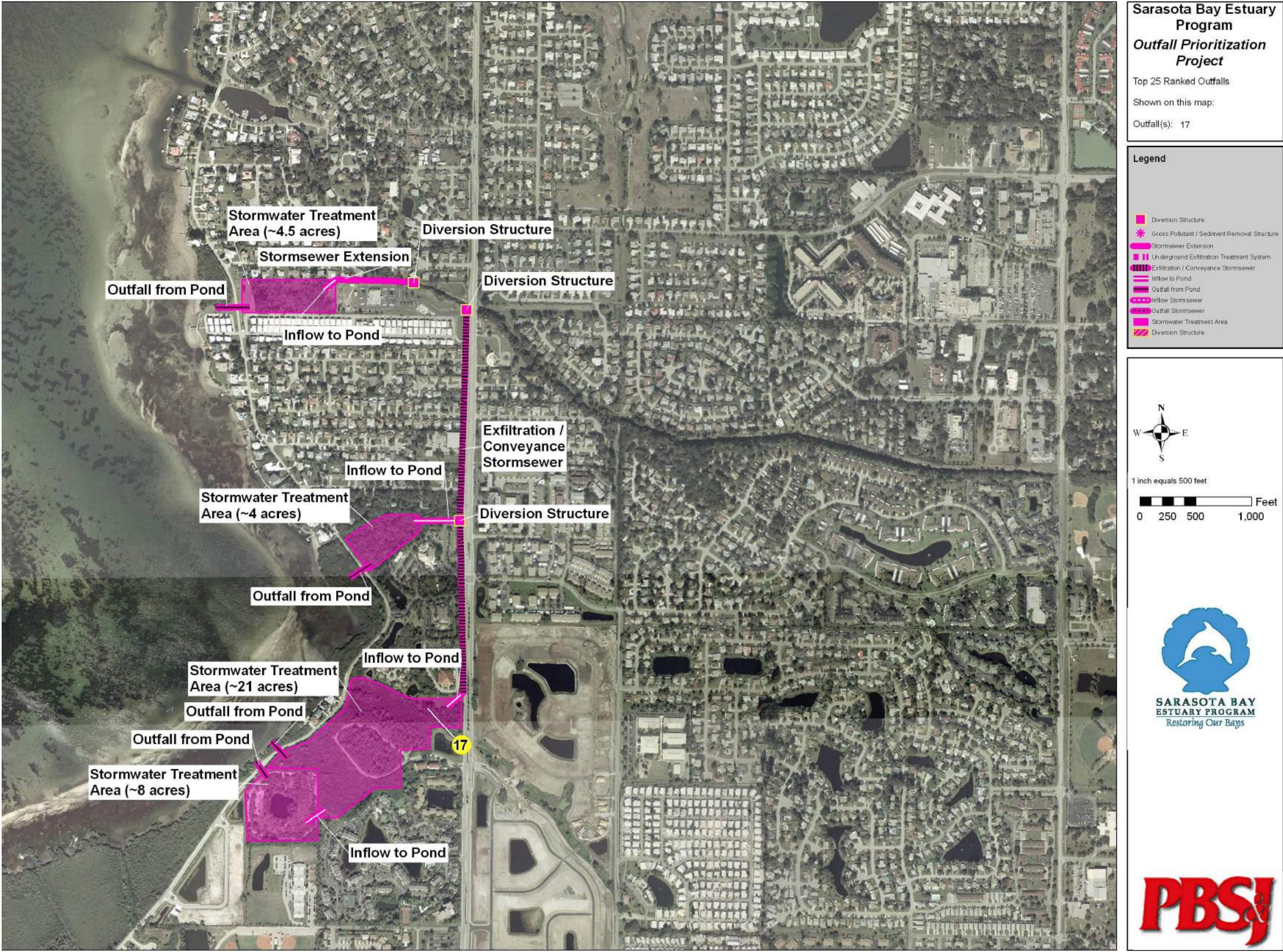


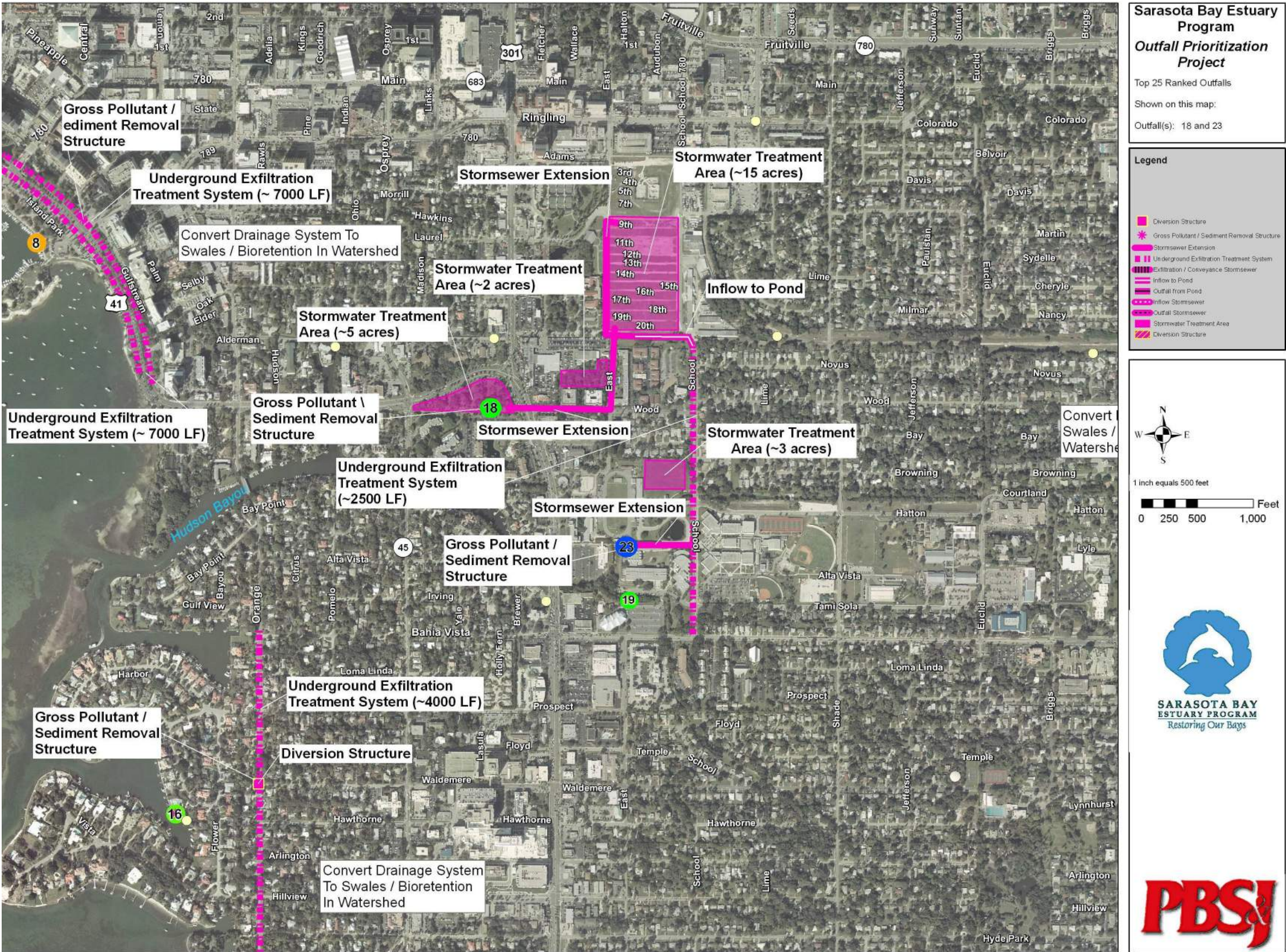


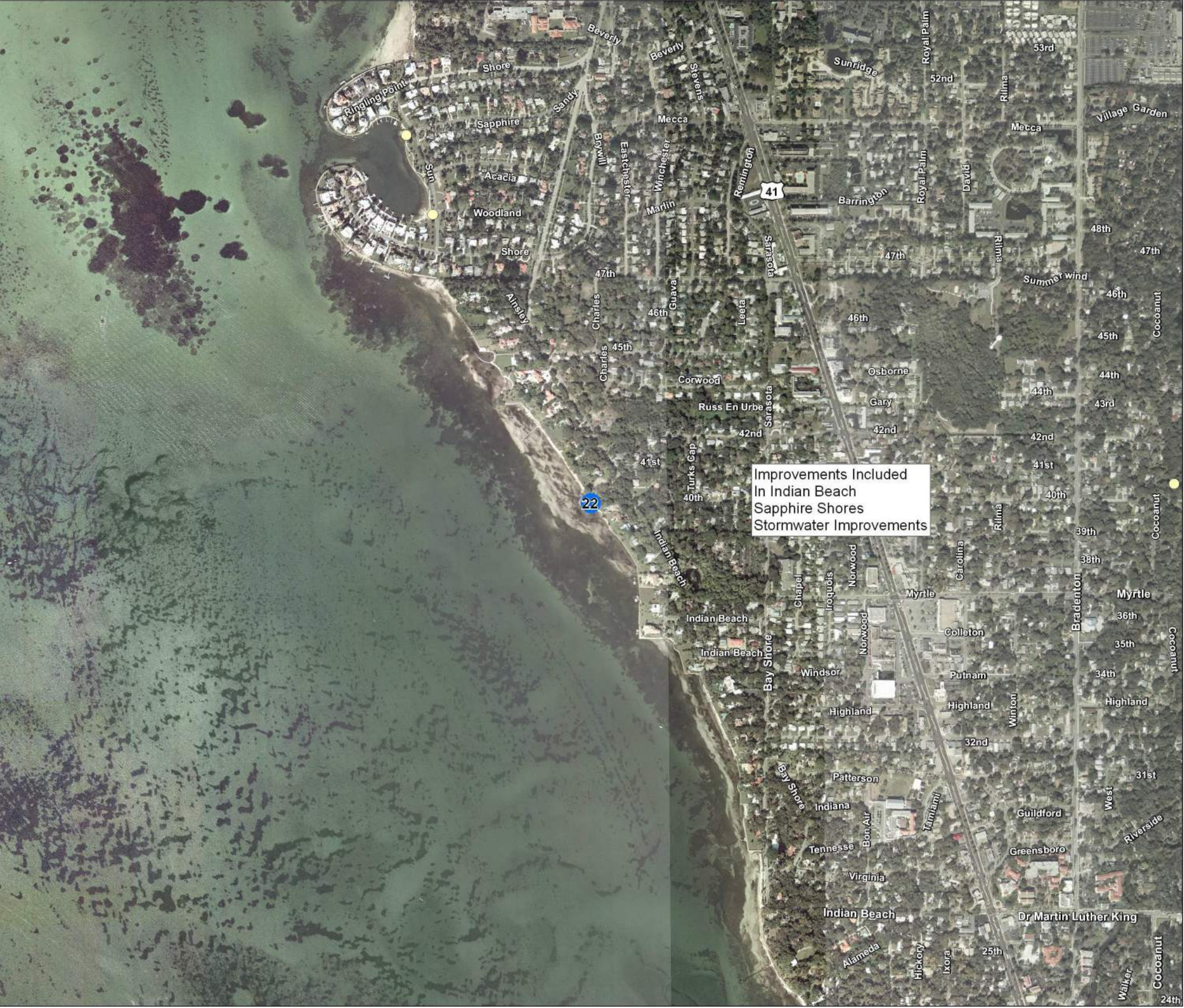
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Outfall Prioritization Project
Top 25 Ranked Outfalls
Shown on this map:
Outfall(s): 14











Sarasota Bay Estuary Program
Outfall Prioritization Project

Top 25 Ranked Outfalls
Shown on this map:
Outfall(s): 22

Legend

- Diversion Structure
- ✱ Gross Pollutant / Sediment Removal Structure
- Stormwater Extension
- ▨ Underground Exfiltration Treatment System
- ▨ Exfiltration / Conveyance Stormsewer
- Inflow to Pond
- Outfall from Pond
- Inflow Stormsewer
- Outfall Stormsewer
- Stormwater Treatment Area
- ▨ Diversion Structure

North arrow pointing North (N), West (W), East (E), and South (S).

1 inch equals 500 feet

Scale bar: 0 250 500 1,000 Feet

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