STORMWATER OUTFALL MONITORING AND MODELING REPORT

Prepared for

City of Venice, Florida

Venice, FL
City on the Gulf

Prepared by

TAYLOR
ENGINEERING, INC.

Taylor Engineering
1800 2nd Street, Suite 714
Sarasota, FL 34231

And

vhb

VHB, Inc.
301 North Cattlemen Road, Suite 105
Sarasota, Florida 34232

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John Loper, P.E.
FL PE # 54623
FL CA # 4815

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1 INTRODUCTION

1.1 BACKGROUND AND AUTHORIZATION

The City of Venice has multiple stormwater outfalls which discharge untreated or partially treated stormwater directly into the Gulf of Mexico, Roberts Bay, and the Intracoastal Waterway. These outfalls are located on the island portion of the City of Venice and are connected to an urban stormwater system that was installed in the 1920s. The persistent red tide off the southwest coast of Florida has generated increased scrutiny of the quality of runoff from these outfalls. The City of Venice has embarked on an aggressive effort to monitor these outfalls, estimate pollutant loads, and develop best management practices (BMPs) to reduce loading from these priority outfalls. This report documents the City's initial approach to a longer-term management strategy.

Under the City of Venice Agreement No. 2019-05ENG, Taylor Engineering, Inc. (Taylor) and subconsultant VHB, Inc. (VHB) is tasked with estimating pollutant loads for 28 outfalls and conducting initial monitoring for 16 primary outfalls. The outfall pollutant loads are estimated using a hybrid approach incorporating components of the *Sarasota County County-Wide Non-Point Source Pollutant Loading Model,* prepared by Jones, Edmunds, & Associates, Inc. in August 2005 and more recent methodology established by the *Approach to Assessing Level-of-Service, Surface Water Resources, and Best Management Practice Alternatives for Watersheds in Citrus County*, *Florida,* prepared by Jones, Edmunds, & Associates, Inc. in July 2017.

The objective of the pollutant load modeling is to evaluate direct runoff loading to 28 City-identified stormwater outfalls. Taylor estimated pollutant loads with the Spatially Integrated Model for Pollutant Loading Estimates at a seasonal time scale (SIMPLE-Seasonal) that runs with ArcGIS 10.5.

The critical outfalls will be prioritized for potential BMPs using the model results in conjunction with the findings of the water quality sampling results. Subconsultant VHB conducted water quality sampling at the 16 designated primary outfalls during or immediately after rainfall events for a range of water quality parameters. The outfall prioritization is intended to provide the basis for best management practices analysis for the island.

1.2 PROJECT LOCATION AND GENERATION DESCRIPTION

The project area encompasses an area of nearly 2500 acres or approximately 3.9 square miles within the City of Venice in west Sarasota County (**Figure 1**). The island of Venice is bordered to the north by Roberts Bay, to the east by the Intracoastal Waterway (ICWW), and to the west by the Gulf of Mexico (gulf). The island is drained by many stormwater outfalls that discharge directly to the bays, ICWW, and gulf. **Figure 2** identifies the model sub-basins and major basins that contribute to the major stormwater outfalls around the island. Elevations within the island increase from the coast to approximately 20 feet North American Vertical Datum of 1988 (NAVD 88). **Figure 3** identifies the 28 stormwater outfalls and the contributing areas or drainage basins.

The dominant land uses at 42% of the island consist of high-density residential. Approximately 18% of the island consists of highway or transportation, 15% high- or low-intensity commercial, 12% of undeveloped rangeland and forest, and 7% medium-density residential. The remaining area consists of wetland, water, and low-density residential land uses. **Figure 4** shows the land use distribution in the Watershed.

Soil groups in the Watershed consist of 3% Type A (well-drained) located mostly in the northern portions of the island. Type B/D (moderately well-drained when dry, not well-drained when wet) make up about

18% of the island and are predominately located centrally. Type C (moderately poor-drained) make up approximately 60% of the island. Lastly, Type D (poorly drained) and water bodies make up the remaining 19% of the island and are predominately located along the western and southern coast. **Figure 5** shows the soils distribution in the Watershed.

Several water body ID (WBID), drainage areas delineated by the Florida Department of Environmental Protection (FDEP), are within the island project area to include six beaches along the gulf, Roberts Bay, the ICWW, and Red Lakes Estuary (**Figure 6).** The water bodies are part of FDEP's Group 2 and 3 basins and is within the Sarasota Bay, Peace, Myakka group. Roberts Bay along with five other estuaries in the Sarasota Bay watershed were designated Estuaries of National Significance by the U.S. Environmental Protection Agency (EPA) and Outstanding Florida Waters (OFWs) by the Florida Department of Environmental Protection (FDEP). While the State of Florida does not have numeric criteria for nutrients, a narrative criterion exists for nutrients and fecal coliform bacteria.

2 WATER QUALITY SAMPLING PROGRAM

The City desired water quality samples from the 16 primary outfalls to evaluate the existing water quality, determine areas of concern, and as a comparison to the concentrations anticipated based upon the pollutant load model. Ten outfalls are located on west side of the Island and drain into the Gulf of Mexico (Outfalls 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10). There are six sites located on the northern and northeastern edge of the Island of Venice, of which five outfalls drain into Roberts Bay (Outfalls 12, 14, 15, 17, and 18). One outfall (Outfall 20) drains into the Gulf Intracoastal Waterway.
Water quality sampling occurred during or immediately after rainfall events to maximize the potential for water being discharged. Some of the outfalls did not discharge from a given storm since the stormwater is captured and retained in dry retention systems. Water quality grab samples were collected and analyzed for the following parameters: nitrate/nitrite nitrogen, ammonia nitrogen, total Kjeldahl nitrogen, total nitrogen, orthophosphorus, total phosphorus, turbidity, total suspended solids, fecal coliform, and enterococcus.

All surface water grab samples were collected from mid-depth at approximately mid-stream, contingent upon the presence of discernable flow. In-situ measurements were made using a multiparameter water quality sonde and field notes were recorded. All collections were in compliance with the FDEP Standard Operating Procedures and analyses are made in accordance with the eighteenth edition of Standard Methods for the Examination of Water and Wastewater (American Public Health Association, 1992) and Methods for the Chemical Analysis of Water and Wastes (USEPA, 1983).

3 WATER QUALITY MODEL

Taylor Engineering calculated pollutant loads from surface water runoff using SIMPLE-Seasonal, originally developed by Jones Edmunds for Sarasota County and Southwest Florida Water Management District (SWFWMD). Complete model development is documented in *Sarasota County County-Wide Non-Point Source Pollutant Loading Model* prepared by Jones Edmunds in August 2005. The model operates within a GIS framework and calculates pollutant loading from non-point and point-sources.

Annual loads for this project were estimated for the following constituents of interest: Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorus (TP), and Fecal Coliform (FC).

3.1 PRIOR MODELING EFFORTS AND EXISTING DATA

In 2005, Jones, Edmunds & Associates, Inc constructed a Sarasota County pollutant loading model as part of its National Discharge Elimination System (NPDES) Phase I Municipal Separate Storm Sewer

System (MS4) permitting requirements. The Sarasota model was based on previous efforts using the Watershed Management Model (WMM) and the Lemon Bay Model (LBM) and was created within a GIS framework. Taylor determined that this previous SIMPLE model was too coarse to detail loadings to individual outfalls within the 3.9-mile City of Venice island. Therefore, the model detail was increased based on more recent ICPR modeling efforts.

In 2011, the Island of Venice 100-Year Floodplain Model (IVM) was approved by SWFMWD, prior to the completion of several construction projects. In 2014, American Infrastructure Development, Inc. updated the Sarasota County model to reflect terrain changes due to construction at the Venice Municipal Airport (VNC). Similarly, in 2015, Amec, Foster, and Wheeler updated the Governing Board approved IVM ICPR model and GIS (dated November 4, 2011) to include Venice High School construction. The model updates were completed independently of each other.

After reviewing the Wastewater Facility Regulation (WAFR) database (downloaded on April 23, 2018), Taylor determined that no wastewater treatment facilities are located within the island. The point source input feature class will not be populated for the model. Taylor obtained the 2018 Florida Department of Health Septic Tank feature class in addition to Sarasota County data. There are 10 septic tanks located within the direct runoff model. **Figure 7** displays the location of septic tanks.

As for SIMPLE-Seasonal, septic tank flow rates throughout the County were assumed to be 100 gallons per day per capita, with an average of 2.5 people per household, resulting in 250 gallons per day or 0.00039 cfs for each tank for residential units. The non-residential flow is higher at 0.00103 cfs for each tank. **Table 1** displays the flow rates by type of septic tank and **Table 2** displays loadings by the condition of the septic tanks.

Table 1 Assumed Septic Tank Flow Rates

OSTDS Type	Wet flow (cfs)	Dry flow (cfs)
Residential	0.00039	0.00039
Non-residential	0.00103	0.00103

Table 2 Assumed Septic Tank Loading Concentrations

OSTDS Condition	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	TDS (mg/L)	TP (mg/L)	DP (mg/L)	TKN (mg/L)	NO2NO3 (mg/L)	Pb (mg/L)	Cu (mg/L)	Zn (mg/L)	Cd (mg/L)	NH3 (mg/L)	N (mg/L)	Oil (mg/L)	FC (mg/100 mL)
Working	15	31.5	10	50	0.5	0.125	36	0.04	0.00030	0.00001	0.00050	0.00001	36	36.04	1.5	10
Failing	150	315	100	500	10	2.5	45	0.05	0.0030	0.0010	0.0500	0.0010	45	45.05	150	1,000,000

3.2 Pollutant Loading Model

3.2.1 Model Description: Direct Runoff Model

A SIMPLE-Seasonal model was created to assess pollutant loads for the City of Venice Island. The direct-runoff model estimates include pollutant loads from direct surface water runoff only. Although SIMPLE will also calculate pollutant loads to groundwater, the direct-runoff model is appropriate for the island because loadings directly to the surface water outfalls are the primary concern.

3.2.2 Mean Annual Runoff Volumes

Runoff volume is an important factor in determining non-point-source pollution loads to surface water bodies. The average annual rainfall depth for Sarasota County is 53 inches based on SWFWMD data. Each hydrologic computational unit in the SIMPLE model was assigned a single land use and hydrologic soil group, which were the basis for determining the average annual runoff coefficients. The soils, land use, and updated Sarasota County model basins were used to develop runoff coefficients, runoff, and event mean concentration (EMC) polygons. Taylor reviewed the soils data from NRCS to ensure that each soil polygon has an assigned hydrologic group.

3.2.3 Land Use and Event Mean Concentrations

Taylor developed the direct-runoff model to estimate the pollutant loading from rainfall to the identified stormwater outfalls for the sub-basins. The direct runoff analysis is computed for all basins. Taylor set up the model following the procedure described in the *Approach to Assessing Level-of-Service, Surface Water Resources, and Best Management Practice Alternatives for Watersheds in Citrus County* (Citrus County, 2017). As described in the Citrus County Approach document, Taylor aggregated land use into the prescribed 13 categories and reviewed the resulting land use table for completeness and consistency. **Table 3** summarizes the land use classifications used in the SIMPLE-Seasonal model for the sub-basins. The areas aggregated to High- or Low-Intensity Commercial are assigned Low-Intensity Commercial values for the other related tables.

Table 3 Sarasota Land Use Aggregation

FLUCCS	FLUCCS Description	Sarasota County Compressed Land Use	Land Use Aggregate
1100	Residential-Low Density	Low-Density Residential	Low-Density Residential
1200	Residential-Med Density	Medium-Density Residential	Medium-Density Residential
1300	Residential-High Density	High-Density Residential, Comm., and Inst.	High-Density Residential
1400	Commercial	Light Industrial	High-or Low-Intensity Commercial
1500	Industrial	Heavy Industrial and Roadways	Light Industrial
1600	Extractive	Heavy Industrial and Roadways	Mining/Extractive
1700	Institutional	Light Industrial	Low-Intensity Commercial
1800	Recreational	Forest, Open, and Park	Undeveloped/Rangeland/Forest
1820	Golf Courses	Forest, Open, and Park	Medium-Density Residential
1900	Open Lands	Forest, Open, and Park	Undeveloped/Rangeland/Forest
2100	Cropland and Pastureland	Forest, Open, and Park	Undeveloped/Rangeland/Forest
2140	Agriculture Row & Field Crops	Forest, Open, and Park	General Agriculture
2200	Tree Crops - Citrus	Forest, Open, and Park	General Agriculture
2300	Feeding Operations	Forest, Open, and Park	General Agriculture
2400	Nurseries and Vineyards	Forest, Open, and Park	General Agriculture
2500	Specialty Farms	Forest, Open, and Park	General Agriculture
2600	Other Open Lands - Rural	Forest, Open, and Park	Undeveloped/Rangeland/Forest
3200	Shrub and Brush Rangeland	Forest, Open, and Park	Undeveloped/Rangeland/Forest
3300	Mixed Rangeland	Forest, Open, and Park	Undeveloped/Rangeland/Forest
4100	Upland Coniferous Forest	Forest, Open, and Park	Undeveloped/Rangeland/Forest
4110	Pine Flatwoods	Forest, Open, and Park	Undeveloped/Rangeland/Forest
4120	Longleaf Pine - Xeric Oak	Forest, Open, and Park	Undeveloped/Rangeland/Forest
4200	Upland Hardwood Forests	Forest, Open, and Park	Undeveloped/Rangeland/Forest
4340	Hardwood - Coniferous Mixed Forest	Forest, Open, and Park	General Agriculture
4400	Tree Plantations	Forest, Open, and Park	General Agriculture
5100	Streams and Waterways	Watercourses/waterbodies	Water
5200	Lakes	Watercourses/waterbodies	Water
5300	Reservoirs	Watercourses/waterbodies	Water
5400	Bays and Estuaries	Watercourses/waterbodies	Water
6110	Bay Swamps	Wetlands	Wetland
6150	Streams and Lake Swamps	Wetlands	Wetland
6200	Wetland Coniferous Forests	Wetlands	Wetland
6210	Cypress	Wetlands	Wetland
6300	Wetland Forested Mixed	Wetlands	Wetland
6400	Vegetated Non-Forested Wetlands	Wetlands	Wetland
6410	Freshwater Marshes	Wetlands	Wetland
6420	Saltwater Marshes	Wetlands	Wetland
6430	Wet Prairies	Wetlands	Wetland
6440	Emergent Aquatic Vegetation	Wetlands	Wetland
6530	Intermittent Ponds	Wetlands	Undeveloped/Rangeland/Forest
7400	Disturbed Lands	Heavy Industrial and Roadways	Undeveloped/Rangeland/Forest
8100	Transportation / Utilities	Heavy Industrial and Roadways	Highway
8200	Communications	Heavy Industrial and Roadways	Light Industrial
8300	Utilities	Heavy Industrial and Roadways	Light Industrial

The SIMPLE-Seasonal model uses an average annual runoff coefficient to generate seasonal and annual runoff. This is a different methodology than that used to generate runoff for the ICPR event-based model used for floodplain mapping. Therefore, the results of these two models will be different. Taylor assigned intermediate runoff potential values for the limited dual hydrologic soil groups A/D and B/D (i.e., A/D soils were assigned a B runoff potential and B/D soils were assigned a C runoff potential). Unlike the typical designation of dual-group soils to D for flood modeling purposes, the intermediate runoff potential value is selected as more suitable because the analysis spans all seasons rather than a single extreme event. The mean annual runoff coefficients for all land use categories discharges to the receiving water and wetlands were developed based on the runoff coefficients for Meteorological Zone 4 in the draft Florida Stormwater Quality Applicant's Handbook (FSQAH) (FDEP, March 2010). The runoff coefficient depends on the percent of directly connected impervious area (DCIA) and the non-DCIA curve number (CN) in each computational unit. Runoff coefficients were calculated for each computational response unit (intersection of land use polygons and soils) based on the FSQAH.

Taylor input Non-DCIA CN values from the updated ICPR models that were provided to Taylor by SWFWMD. As described in the Citrus *Approach* document, Taylor used the following approach to calculate annual runoff coefficients for wetlands and water bodies:

- Runoff coefficients for water and wetland land uses were calculated by subtracting the average annual baseflow coefficient (BF) equal to zero in this case, the ratio of average-annual evapotranspiration to rainfall, referred to as the evapotranspiration coefficient (ET), and the average-annual infiltration coefficient from the precipitation (equal to one).
- Average-annual infiltration coefficients for water and wetland land uses were assumed to be zero.
- The average-annual baseflow coefficients were assumed to be zero.
- Average-annual runoff coefficients were calculated as 1-ET for closed water bodies and wetland land uses.

Pollutant loads from direct runoff were computed by multiplying runoff volumes by EMCs. Direct-runoff EMCs (**Table 4**) that were provided in the 2005 Sarasota County Report document were used in the direct runoff model.

Table 4 Direct Runoff Event Mean Concentrations by Land Use

	Simple Model Sarasota County EMCs, 2005																
Aggregated Land Use	**Land Use**	**TP**	**N**	**TSS**	**BOD**	**COD**	**TDS**	**DP**	**TKN**	**NO2NO3**	**Pb**	**Cu**	**Zn**	**Cd**	**NH3**	**Oil**	**FC_100ml**
Undeveloped/Rangeland/Forest	Forest, Open, and Park	0.16	1.02	216	8	51	100	0.06	0.82	0.2	0	0	0	0	0.2	0.9	37
Pasture	Pasture	0.16	1.02	216	8	51	100	0.06	0.82	0.2	0	0	0	0	0.2	0.5	37
General Agriculture	Agriculture and Golf	1.13	3.74	216	8	51	100	0.42	2.99	0.75	0	0	0	0	0.72	0.5	37
Low-Density Residential	Low Density Residential	0.39	1.87	140	11	83	100	0.16	1.5	0.37	0.05	0.1	0.05	0	0.36	1.08	20,000
Medium-Density Residential	Medium Density Residential	0.39	1.87	140	11	83	100	0.16	1.5	0.37	0.05	0.1	0.05	0	0.36	1.08	20,000
Low-Intensity Commercial	Comm.	0.33	1.65	140	11	83	100	0.16	1.32	0.33	0.08	0.1	0.06	0	0.32	0.07	20,000
High-Density Residential	High Density Res.	0.33	1.65	140	11	83	100	0.16	1.32	0.33	0.08	0.1	0.06	0	0.32	0.07	20,000
Light Industrial	Light Industrial	0.15	1.18	91	10	61	100	0.1	1.06	0.12	0.24	0	0.12	0	0.25	3.66	9,700
Highway	Heavy Industrial and Roadways	0.15	1.18	142	10	103	100	0.1	1.06	0.12	0.24	0.1	0.12	0	0.25	0.4	53,000
Wetlands	Wetlands	0.09	1.44	11	5	51	100	0.12	0.5	0.48	0.03	0	0.01	0	0.12	0	-
Water	Watercourses/Waterbodies	0.17	0.98	91	3	19	100	0.12	0.5	0.48	0.01	0	0.15	0	0.12	0	-

Sarasota County, 2005

3.2.4 Land Use

EMC's were assigned to their corresponding land use coverages. As noted in Section 1.2, the dominant land use is high-density residential (at 42% of the island). Approximately 18% of the island consists of highway or transportation, 15% high- or low-intensity commercial, 12% of undeveloped rangeland and forest, and 7% medium-density residential.

3.2.5 Stormwater Management Areas

Most dry and wet retention basins within the sub-basinswere at the low point in a basin and were, therefore, modeled as receiving features for the direct-runoff model (**Figure 8**). **Table 5** shows the assumed direct runoff BMP removal efficiencies, as provided from the 2005 Sarasota County report. Except for BMP removal efficiencies, biological, geological, physical, and chemical processes occurring in receiving water bodies were not modeled for this project. Ten septic tanks are included in the direct-runoff model. These septic tanks are assumed to contribute nutrient loads to surface water.

Table 5 Assumed BMP Removal Efficiencies for Direct Runoff Loading Calculation

BMP Type	BOD	COD	TSS	TDS	TP	DP	TKN	NO2NO3	Pb	Cu	Zn	Cd	NH3	N	Oil	FC_100ml
No BMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Retention	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Wet Detention	0.3	0.5	0.7	0	0.5	0.8	0.3	0.8	0.8	0.75	0.5	0.5	0.25	0.27	0.37	0.64

Sarasota County, 2005

Taylor identified 57 sub-basins (11 basins) in the sub-basins that contribute to constructed stormwater areas. Taylor identified 16 wet detention and 57 dry retention ponds within the sub-basins. We classified these areas as dry or wet retention BMPs to account for pollutant removal efficiency.

3.3 Water Quality Modeling Results

The SIMPLE-Seasonal direct-runoff model generates results of constituent loads for each catchment basin in the sub-basins that were modeled in ICPR. These results were reported in tables that can be joined to the spatial catchment feature class through the BasinID field. The direct runoff results are reported as direct runoff, septic system loads, and a sub-total load. The results tables are reported as total annual loading and total annual loading normalized by the catchment basin area. **Figures 9** through **12** show the results of the estimated annual pollutant loads normalized over the catchment area for the parameters of concern. **Figures 13** through **16** show results for both the area normalized loading and the total loading. For example, Figure 13 shows the estimated total annual TN loading normalized over the catchment basin area with basin shading and the percent of the total annual loading with the outfalls. The larger outfall symbology corresponds to higher percent of total loading.

Table 6 shows the estimated annual total loads by stormwater outfall. **Table 7** reflects the results of estimated annual total loading by source, separating direct runoff and septic tanks, to attribute substantial loadings. **Table 8** ranks the major basins by annual contribution for the 28 outfalls of interest and for all major basins in the sub-basins. Table 8 and Figures 13 through 16 are useful in tandem for quickly viewing loading distributions such as outfalls that discharge the highest pollutant loads.

Table 6 Watershed Annual Total Loads by Stormwater Outfall

Total Loading by basins (lb/yr)						
Outfall	Acres	Basin	TSS	TP	TN	FC
1	15.6	1	232.1	0.4	2.1	94.6
2	96.9	2	68,191.0	153.8	773.6	41,510.9
3	10.8	3	155.7	0.3	1.8	94.2
4	21.0	4	14,925.9	31.1	158.2	8,063.1
5	196.8	5	154,702.5	348.1	1,759.4	98,398.6
6	20.5	6	290.4	0.7	3.4	185.2
7	23.4	7	330.9	0.8	3.9	214.8
8	446.6	8	286,203.6	550.0	3,039.3	265,123.4
9	26.3	9	267.8	0.4	2.4	100.3
10	75.7	10	10,437.2	19.8	231.2	164,841.9
12	34.0	12	28,272.1	65.3	327.4	17,810.1
13	11.9	13	8,486.7	23.7	212.1	250,687.8
14	138.5	14	104,150.0	230.8	1,163.5	61,747.6
15	82.6	15	58,816.0	132.7	667.3	35,815.9
17	70.0	17	65,575.2	150.6	779.5	101,913.9
18	30.1	18	35,118.3	71.1	363.2	18,206.7
19	15.8	19	20,721.6	42.3	226.8	18,693.5
20	6.6	20	6,975.5	16.4	82.2	4,529.3
21	10.2	21	11,905.4	30.4	214.1	169,675.2
22	153.1	22	95,202.1	214.3	1,088.9	65,641.7
24	67.6	24	44,297.6	104.4	522.1	28,762.8
25	62.7	25	15,736.1	33.7	170.9	8,860.7
26	17.1	26	11,703.9	19.7	103.3	4,422.7
27	120.0	27	79,513.9	180.9	1,084.8	389,039.4
28a	51.6	28a	16,720.4	16.6	126.4	22,453.3
28b	28.1	28b	6,343.6	6.1	46.1	7,639.4
28c	141.8	28c	17,243.4	19.0	142.0	26,014.4
29	483.9	29	195,199.3	278.5	1,781.3	248,045.1
30	30.1	30	27,427.9	57.7	292.7	15,007.0
	Total to Outalls:		**1,385,146**	**2,800**	**15,370**	**2,073,594**

Total Loading by basins (lb/ac/yr)						
Outfall	Acres	Basin	TSS	TP	N	FC
1	15.6	1	14.9	0.0	0.1	6.1
2	96.9	2	704.1	1.6	8.0	428.6
3	10.8	3	14.4	0.0	0.2	8.7
4	21.0	4	711.5	1.5	7.5	384.4
5	196.8	5	786.1	1.8	8.9	500.0
6	20.5	6	14.2	0.0	0.2	9.0
7	23.4	7	14.1	0.0	0.2	9.2
8	446.6	8	640.9	1.2	6.8	593.7
9	26.3	9	10.2	0.0	0.1	3.8
10	75.7	10	137.9	0.3	3.1	2,178.3
12	34.0	12	831.3	1.9	9.6	523.7
13	11.9	13	710.6	2.0	17.8	20,991.3
14	138.5	14	752.2	1.7	8.4	446.0
15	82.6	15	711.8	1.6	8.1	433.4
17	70.0	17	936.4	2.2	11.1	1,455.3
18	30.1	18	1,168.1	2.4	12.1	605.6
19	15.8	19	1,309.2	2.7	14.3	1,181.0
20	6.6	20	1,051.5	2.5	12.4	682.8
21	10.2	21	1,169.9	3.0	21.0	16,674.0
22	153.1	22	621.6	1.4	7.1	428.6
24	67.6	24	655.0	1.5	7.7	425.3
25	62.7	25	250.9	0.5	2.7	141.3
26	17.1	26	683.3	1.1	6.0	258.2
27	120.0	27	662.7	1.5	9.0	3,242.2
28a	51.6	28a	324.0	0.3	2.5	435.1
28b	28.1	28b	225.9	0.2	1.6	272.1
28c	141.8	28c	121.6	0.1	1.0	183.5
29	483.9	29	403.4	0.6	3.7	512.6
30	30.1	30	911.4	1.9	9.7	498.7
	Total to Outalls:		**16,549**	**36**	**201**	**53512**

Table 7 Watershed Annual Total Loads by Source

	Direct Runoff		
	Direct Runoff (lb/yr)	Septic Tanks (lb/yr)	Total (lb/yr)
TSS	1,386,355	240	1,386,595
TP	2,784	18	2,801
TN	14,866	513	15,379
FC	957,760	1,116,027	2,073,787

Table 8 Summary of Top Contributing Outfalls

Annual Total Load (lb/yr) for Stormwater Outfalls											
Outfall	TSS	% Total	Outfall	TP	% Total	Outfall	TN	% Total	Outfall	FC	% Total
8	286,204	21%	8	550	20%	8	3,039	20%	27	389,039	19%
29	195,199	14%	5	348	12%	29	1,781	12%	8	265,123	13%
5	154,703	11%	29	278	10%	5	1,759	11%	13	250,688	12%
14	104,150	8%	14	231	8%	14	1,163	8%	29	248,045	12%
22	95,202	7%	22	214	8%	22	1,089	7%	21	169,675	8%
27	79,514	6%	27	181	6%	27	1,085	7%	10	164,842	8%
2	68,191	5%	2	154	5%	17	780	5%	17	101,914	5%
17	65,575	5%	17	151	5%	2	774	5%	5	98,399	5%
15	58,816	4%	15	133	5%	15	667	4%	22	65,642	3%
24	44,298	3%	24	104	4%	24	522	3%	14	61,748	3%
18	35,118	3%	18	71	3%	18	363	2%	2	41,511	2%
12	28,272	2%	12	65	2%	12	327	2%	15	35,816	2%
30	27,428	2%	30	58	2%	30	293	2%	24	28,763	1%
19	20,722	1%	19	42	2%	10	231	2%	28c	26,014	1%
28c	17,243	1%	25	34	1%	19	227	1%	28a	22,453	1%
28a	16,720	1%	4	31	1%	21	214	1%	19	18,694	1%
25	15,736	1%	21	30	1%	13	212	1%	18	18,207	1%
4	14,926	1%	13	24	1%	25	171	1%	12	17,810	1%
21	11,905	1%	10	20	1%	4	158	1%	30	15,007	1%
26	11,704	1%	26	20	1%	28c	142	1%	25	8,861	0%
10	10,437	1%	28c	19	1%	28a	126	1%	4	8,063	0%
13	8,487	1%	28a	17	1%	26	103	1%	28b	7,639	0%
20	6,976	1%	20	16	1%	20	82	1%	20	4,529	0%
28b	6,344	0%	28b	6.1	0%	28b	46	0%	26	4,423	0%
7	331	0%	7	0.8	0%	7	3.9	0%	7	215	0%
6	290	0%	6	0.7	0%	6	3.4	0%	6	185	0%
9	268	0%	9	0.4	0%	9	2.4	0%	9	100	0%
1	232	0%	1	0.4	0%	1	2.1	0%	1	95	0%
3	156	0%	3	0.3	0%	3	1.8	0%	3	94	0%

Annual Total Load (lb/ac/yr) for Stormwater Outfalls											
Outfall	TSS	% Total	Outfall	TP	% Total	Outfall	TN	% Total	Outfall	FC	% Total
19	1,309.2	8%	21	3.0	8%	21	21.0	10%	13	20,991.3	39%
21	1,169.9	7%	19	2.7	8%	13	17.8	9%	21	16,674.0	31%
18	1,168.1	7%	20	2.5	7%	19	14.3	7%	27	3,242.2	6%
20	1,051.5	6%	18	2.4	7%	20	12.4	6%	10	2,178.3	4%
17	936.4	6%	17	2.2	6%	18	12.1	6%	17	1,455.3	3%
30	911.4	6%	13	2.0	6%	17	11.1	6%	19	1,181.0	2%
12	831.3	5%	12	1.9	5%	30	9.7	5%	20	682.8	1%
5	786.1	5%	30	1.9	5%	12	9.6	5%	18	605.6	1%
14	752.2	5%	5	1.8	5%	27	9.0	4%	8	593.7	1%
15	711.8	4%	14	1.7	5%	5	8.9	4%	12	523.7	1%
4	711.5	4%	15	1.6	5%	14	8.4	4%	29	512.6	1%
13	710.6	4%	2	1.6	4%	15	8.1	4%	5	500.0	1%
2	704.1	4%	24	1.5	4%	2	8.0	4%	30	498.7	1%
26	683.3	4%	27	1.5	4%	24	7.7	4%	14	446.0	1%
27	662.7	4%	4	1.5	4%	4	7.5	4%	28a	435.1	1%
24	655.0	4%	22	1.4	4%	22	7.1	4%	15	433.4	1%
8	640.9	4%	8	1.2	3%	8	6.8	3%	22	428.6	1%
22	621.6	4%	26	1.1	3%	26	6.0	3%	2	428.6	1%
29	403.4	2%	29	0.6	2%	29	3.7	2%	24	425.3	1%
28a	324.0	2%	25	0.5	2%	10	3.1	2%	4	384.4	1%
25	250.9	2%	28a	0.3	1%	25	2.7	1%	28b	272.1	1%
28b	225.9	1%	10	0.3	1%	28a	2.5	1%	26	258.2	0%
10	137.9	1%	28b	0.2	1%	28b	1.6	1%	28c	183.5	0%
28c	121.6	1%	28c	0.1	0%	28c	1.0	0%	25	141.3	0%
1	14.9	0%	7	0.0	0%	7	0.2	0%	7	9.2	0%
3	14.4	0%	6	0.0	0%	6	0.2	0%	6	9.0	0%
6	14.2	0%	3	0.0	0%	3	0.2	0%	3	8.7	0%
7	14.1	0%	1	0.0	0%	1	0.1	0%	1	6.1	0%
9	10.2	0%	9	0.0	0%	9	0.1	0%	9	3.8	0%

3.3.1 CONSTITUENT LOADS

3.3.1.1 Total Nitrogen (TN)

For the direct-runoff model, the area-normalized annual TN loading ranges from 0.1 to 21.0 pounds per acre per year (lb/acre-year) with a mean of 6.2 lb/acre-year. The two highest area-normalized TN loadings occur in largely low-intensity commercial catchment basins. The annual TN loading per catchment basin ranges from 2 to about 3,000 lb/year with a mean of 530 lb/year. From the direct-runoff model, ten sub-basins have an annual TN load of more than 500.0 lb/year. The highest total TN loadings occur in Basin 8 with high density-residential and transportation land use, Basin 29 with the largest land area, and then Basin 5 with high-density residential land use.

3.3.1.2 Total Phosphorus (TP)

For the direct-runoff model, the catchment basin area-normalized TP ranges from <0.01 to 3.0 lb/acre-year with a mean of 1.1 lb/acre-year. The annual TP loading per catchment basin ranges from 0.35 to 550 lb/year with a mean of 96.5 lb/year. Ten sub-basins have a total TP load of more than 100.0 lb/year. Like TN loadings, the highest area-normalized TP loadings occur in low-intensity commercial and the highest total TP loadings occur in transportation or high-density residential land use catchments.

3.3.1.3 Total Suspended Solids (TSS)

The catchment basin area-normalized TSS ranges from 10.2 to 1,309.2 lb/acre-year with a mean of 556.4 lb/acre-year. The total annual TSS loading per catchment basin ranges from 155.7 to about 286,204 lb/year with a mean of 47,763.7 lb/year. The highest area-normalized TSS loadings occurs in Basins 18 through 21 with primarily low-intensity commercial land use, as with TN and TP loadings. The highest annual TSS loadings occur in Basin 8 with high density-residential and transportation land use, Basin 29 with the largest land area, and then Basin 5 with high-density residential land use. The high TSS loads in these catchment basins are likely due to the high runoff coefficients and limited BMPs.

3.3.1.4 Fecal Coliform (FC)

For the direct-runoff model, the catchment basin area-normalized FC ranges from 3.8 to 20,991 colonies/acre-year with a mean of 833.0 colonies/acre-year. The annual FC loading per catchment ranges from 94.2 to 389,039 colonies/year with a mean of 71,503 colonies/year. Seven sub-basins have a total FC load of more than 60,000 colonies/year and seven catchment basins have a total FC load of more than 100,000 colonies/year. Like the nutrient loadings, the highest total FC loadings occur in transportation or high-density residential land use catchment basins. The highest area-normalized FC loadings occur in Basins 13 and 21, which include commercial and services as well as residential high-density land uses.

3.3.2 COMPARISON WITH SAMPLING DATA

The water quality monitoring results were presented in a Sampling Data Report in June 2019. On January 24 and February 13, 2019, in-situ measurements were performed, and surface water quality grab samples were collected at a total of 10 sites. The other sites were dry during the two sampling events.

The results of all *in-situ* measurements and laboratory analysis were in compliance with applicable State Water Quality Standards as specified under Chapter 62-302, Florida Administrative Code (F.A.C) with the exception of Total Nitrogen, Total Phosphorus and Enterococcus at almost all the sites. Total Nitrogen (TN) values at most sites exceed the Estuarine Numeric Nutrient Criteria (NNC) of 0.42 mg/L, with Outfall 18 being the highest at 1.27 mg/L, but were all below the freshwater criterion (1.65 mg/L). Total Phosphorus (TP) concentrations almost all exceeded the estuarine NNC (0.18 mg/L), but only Outfall 18 exceeded the freshwater NNC (0.49 mg/L). For enterococcus, all sites were above the State standard (130 No./100ml), with very high concentrations observed at Outfalls 12 (6,900 No./100ml), 17 (6,800 No./100ml), and 20 (27,000 No./100 ml). Fecal coliform bacteria were above the State standard (800 No./100ml) for 8 of the 10 sites, with the highest concentrations at Outfalls 17, 2 and 8 (2,700, 5,300 and 2,500 No./100 ml, respectively). Additionally, at Outfall 18 the Total Suspended Solids and Turbidity exhibited elevated levels. The high concentrations of suspended particles likely lead to the high TN and TP concentrations recorded at this site and may reflect construction runoff in the basin.

The observed water quality concentrations were compared to modeled results. This comparison is limited since only a single sample was collected and there are no discharge data available to calculate loads. The land use event mean concentrations were prorated based upon the Island's overall land use composition to develop direct runoff concentration estimate. The estimate was then compared to the observed concentrations (though these estimated concentrations did not account for BMPs in the basin).

Most observed concentrations were less than would be expected from direct runoff, likely reflecting some treatment in the basin. TN concentrations were slightly above estimated concentrations at Outfalls 10 and 18, while TP concentrations were at or above estimated concentrations at Outfalls 5, 10, 12, 14 and 18. The observed high TSS likely explains the elevated TN and TP concentrations at Outfall 18. The observed FC levels were all less than expected based upon the land use but were still above the state water quality criterion for all outfalls expect Outfalls 10 and 20.

The storm event monitoring program discussed in the recommendations section will strengthen the concentration values and allow for loading calculations for better comparison.

4 OUTFALL PRIORITIZATION AND RECOMMENDATIONS

4.1.1 Preliminary Outfall Prioritization

The City has indicated that the primary goal is to reduce the level of fecal coliform and enterococci bacteria loadings in order to reduce the frequency of beach closures for beach fronting outfalls. Additional goals are to reduce nutrient and suspended solids loading to the beaches and intracoastal waterway, and to reduce the number of pipes along the beach in order to improve water quality and reduce beach erosion that occurs within those locations. To that end, priority outfalls are those along the beach and those with the largest pollutant loads.

Our findings from the preliminary modeling assessment are as follows:

- Outfall #8 (Deertown Gully) had the highest projected total loads for all four constituents of interest. This is partly because of land uses and lack of BMP coverage, but primarily this is because it has a much larger drainage area than any of the other outfalls.
- Outfall #5 (Flamingo Drive) had the second highest total loads for 3 of the 4 constituents (N, P, and TSS). This outfall has the second highest drainage area and a similar lack of BMPs.
- Outfall #10 had the second-highest total loadings for fecal coliform.
- Outfall #14 had the third-highest loadings for 3 of the 4 constituents (N, P, and TSS)
- Existing BMPs are effective at reducing the loads at several of the smaller outfalls (#1, 3, 6, 7, and 9), which comprise the bottom 5 outfalls for total loadings of all constituents.

From discussions with City staff, outfall #2 is also a priority due to its proximity to the public swimming beach. The combination of outfalls 1 and 2 has been identified as a preliminary priority project to reduce loadings and effectively reduce the number of beach closures. Prioritization of the remaining outfalls listed above will be further refined based on the results of the FY2020 monitoring and analysis.

4.1.2 Potential Best Management Practices

Based on the preliminary data collected to date and discussions with City staff, the following potential projects have been identified to reduce pollutant loadings observed from the sampling and model results:

- Removal of outfall #1 and divert flows to outfall #2 through potential expansion of the outfall ponds and/or evaluate the potential for installation of secondary subsurface chambers to increase capacity.
- Potential inlet treatment basin to improve water quality along Tarpon Drive
- Stabilize outfall #7 under walkover to prevent future erosion and 'blowouts'
- Evaluate possible swale at Outfall #10 to increase capacity as needed from volume calculations.
- Evaluate possible subsurface treatment such as stormwater chambers at Belle Acosta Basin (Outfall # 18), under City-owned parking lot(s).
- Retrofit existing stormwater inlets located for the Tarpon Center Sewer Project to include treatment baskets and/or sediment sumps
- Evaluate feasibility for use of land adjacent to airport to increase capacity/divert flows from beach

It should be noted that the above list is preliminary and not intended to be comprehensive. A second phase of this study is planned for FY2020, which will result in a more comprehensive list of potential BMPs for evaluation and prioritization.

4.1.3 Recommendations for Future Monitoring and Study

A more detailed monitoring effort is proposed in FY2020 to include flowmeters and autosamplers for the top 5 priority outfall sites. Storm event monitoring is recommended for priority outfalls that have the largest potential loads. Based upon the preliminary evaluation, storm event monitoring is recommended at Outfalls 2, 5, 8, 10, and 17. Storm event sampling for at least six events is recommended using autosamplers equipped with rain gages and velocity meters to capture flow-weighted samples. These data will allow for the calculation of loads at these outfalls and better comparison to the modeled loads. From such data, site-specific EMC and C-values can be developed or "calibrated" for use in updating the pollutant loading model. In addition, loads comparison could identify hot spots and areas where stormwater BMPs would be the most effective.

The study effort will further identify and evaluate potential BMPs and associated costs. Based on the projected effectiveness of each BMP (measured in terms of lb/year of pollutants removed), the potential BMPs will be ranked according to cost effectiveness. Recommendations for project implementation will be provided based on the results of the expanded monitoring and modeling analyses.

5 REFERENCES

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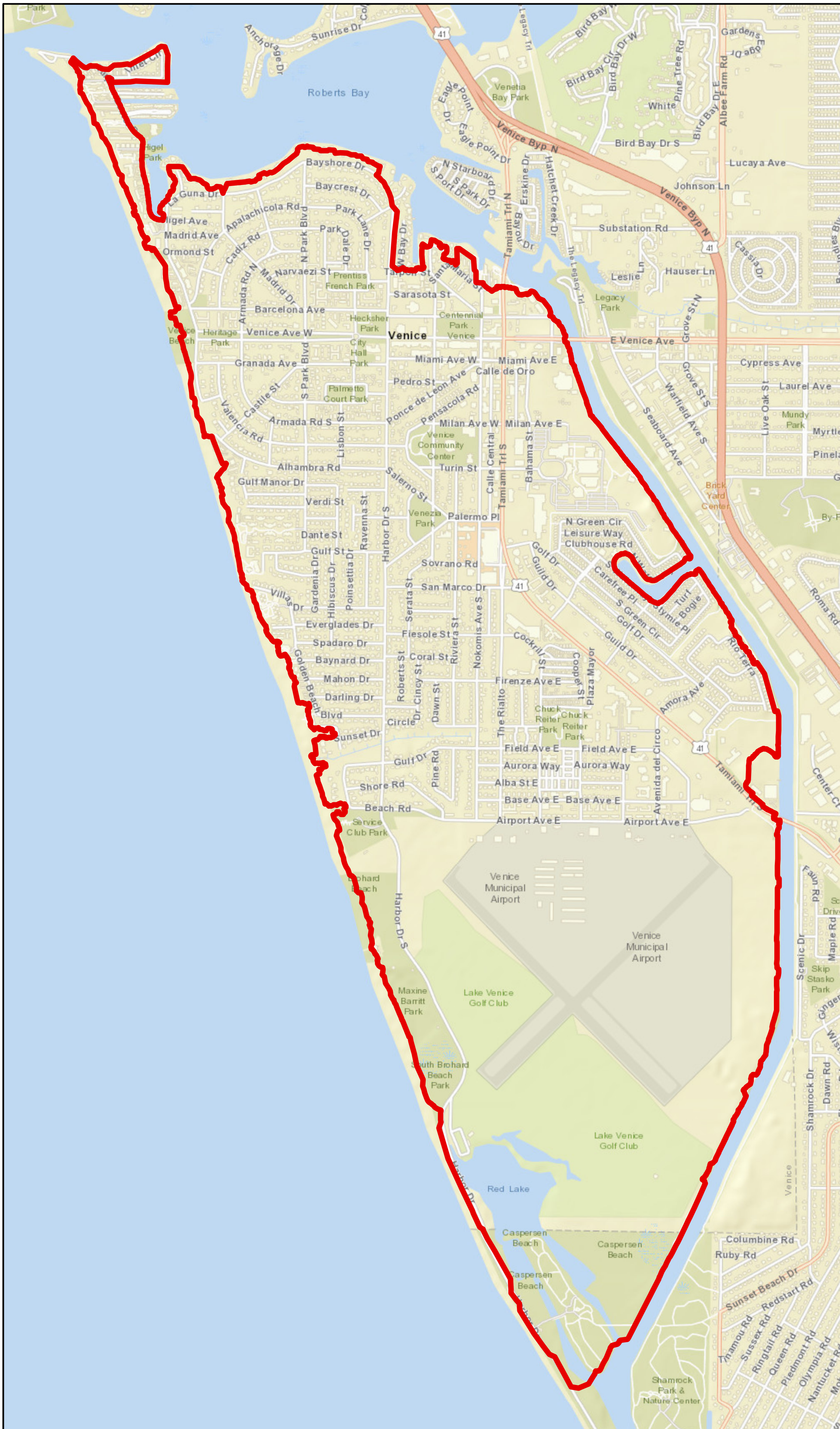
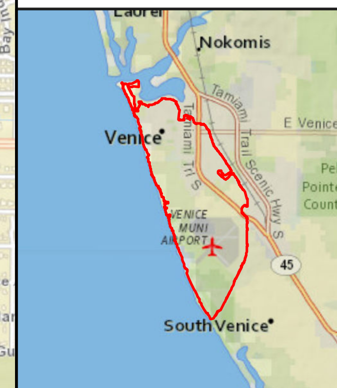




Project Extent

TAYLOR ENGINEERING, INC.

10199 Southside Blvd #310,
Jacksonville, FL 32256

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 1 :

Location Map

Notes:

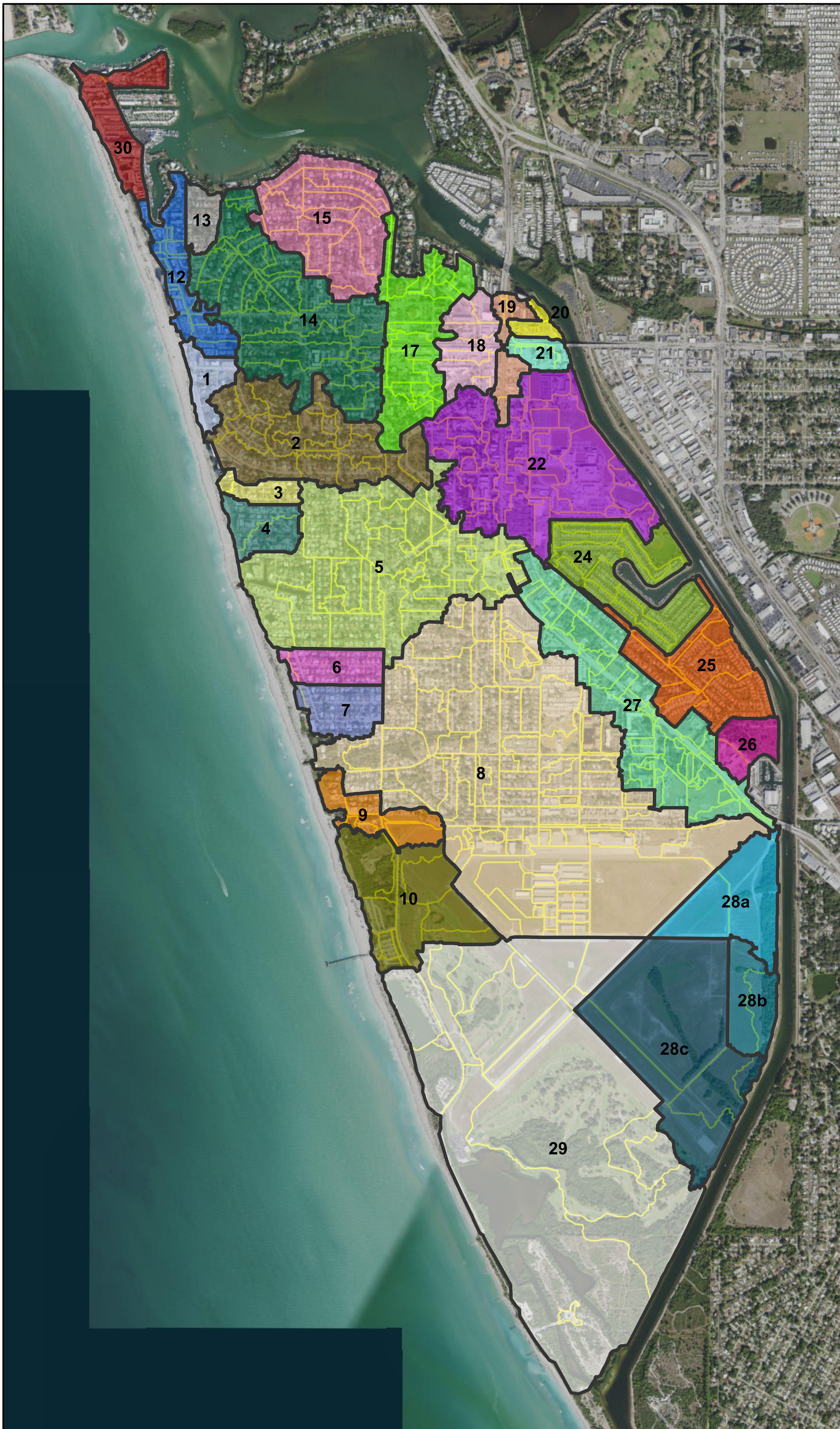
The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Feb 2019	Map Prepared By: JC Taylor Engineering



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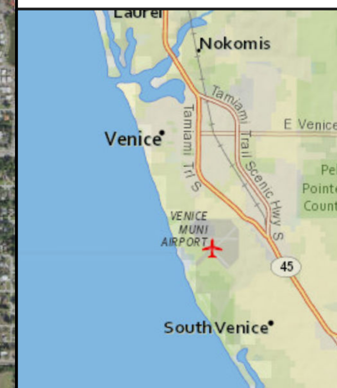

Sub-Basins
Basins

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 2:

Catchment Sub-Basins and Basins

Notes:

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0 1,000 2,000 Feet

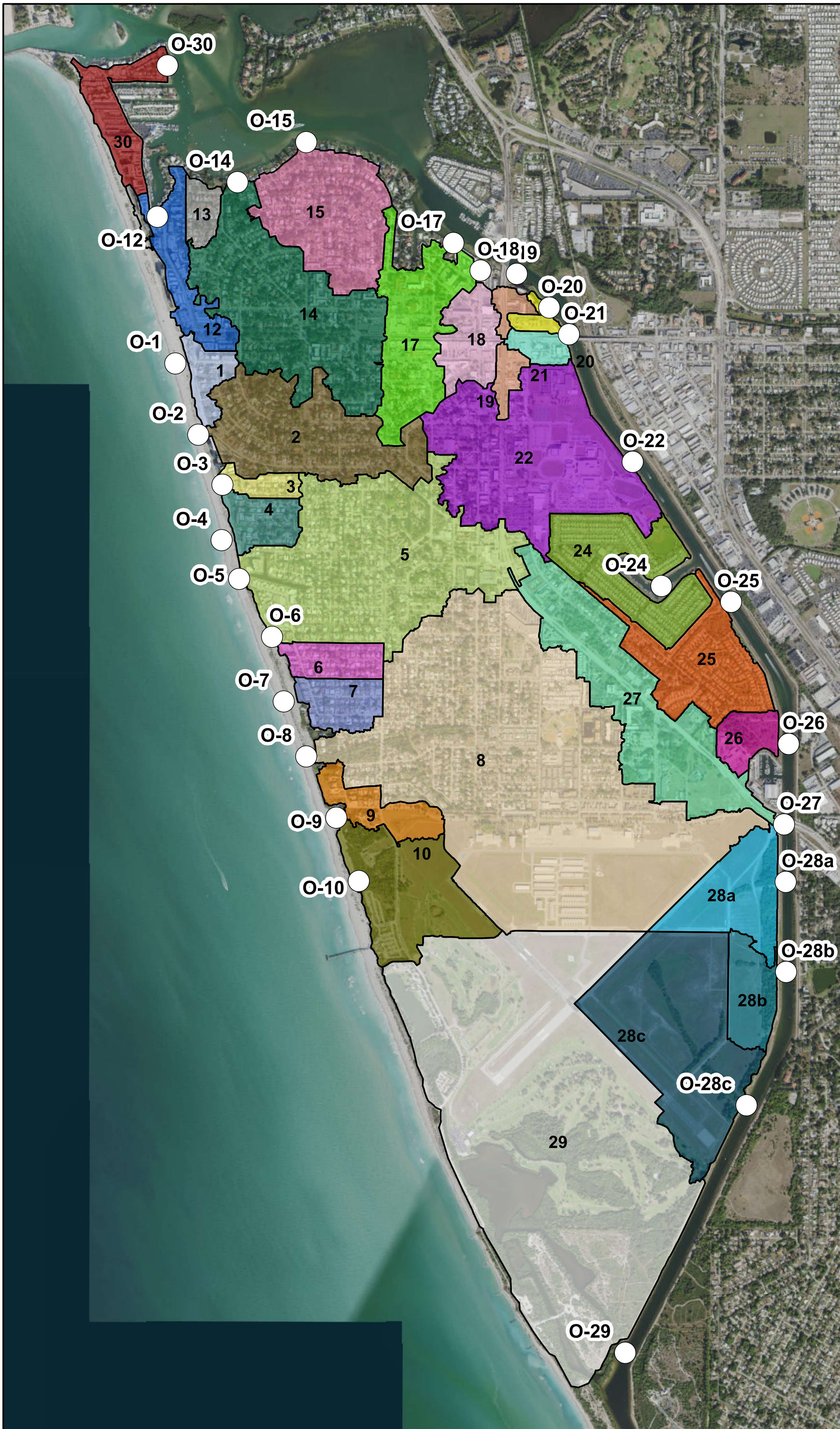
0 0.15 0.3 Miles

1:24,000

N W E S

Map Date: Aug 2019

Map Prepared By: JC Taylor Engineering



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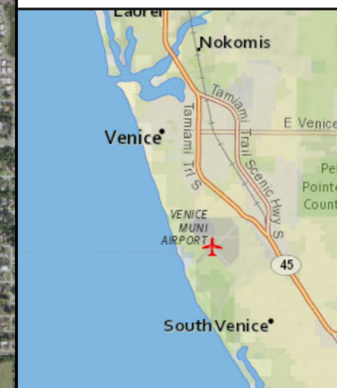

Stormwater Outfalls
Basins

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf
Sarasota County

Figure 3:

Basins Discharge to Stormwater Outfalls

Notes:

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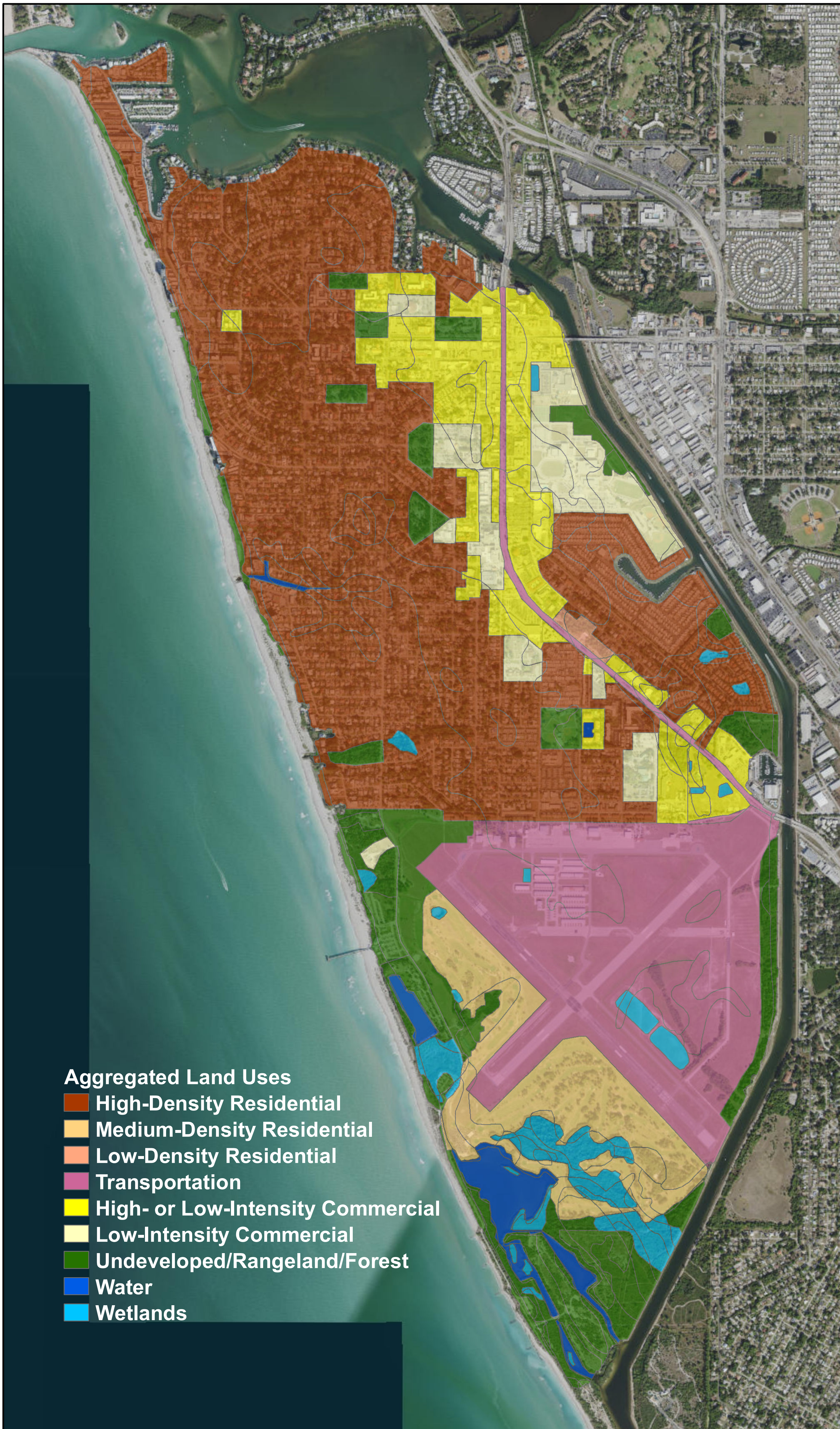
0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date:	Map Prepared By:
Aug 2019	JC Taylor Engineering



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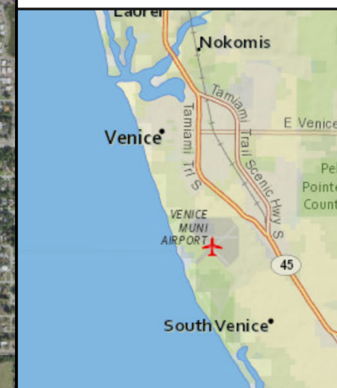

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 4:

Land Use

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date:	Map Prepared By:
Feb 2019	JC Taylor Engineering

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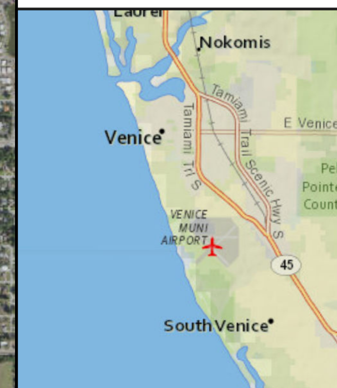

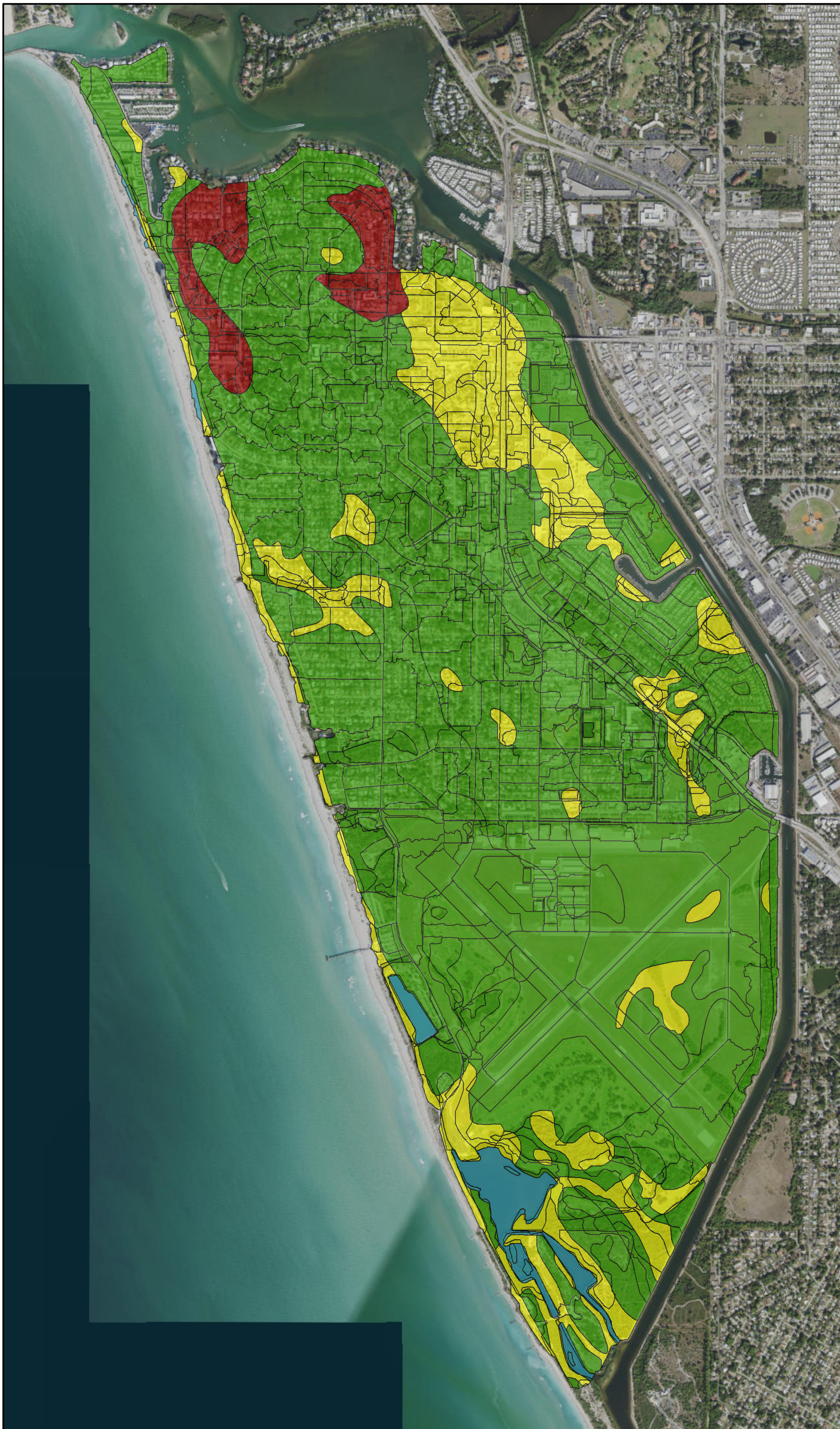

Soil Group

- A, 4%
- C, 78%
- D, 16%
- W, 2%

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 5:

Hydrologic Soil Groups

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

N W E S

Map Date:	Map Prepared By:
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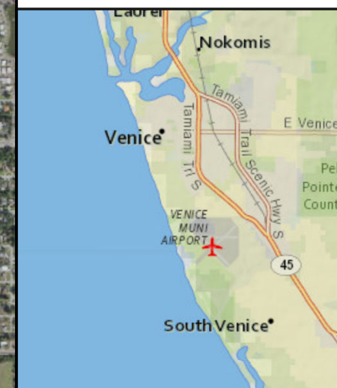


Project Area
Waterbody IDs
Stormwater Outfalls

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 6:

Waterbody Identification

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

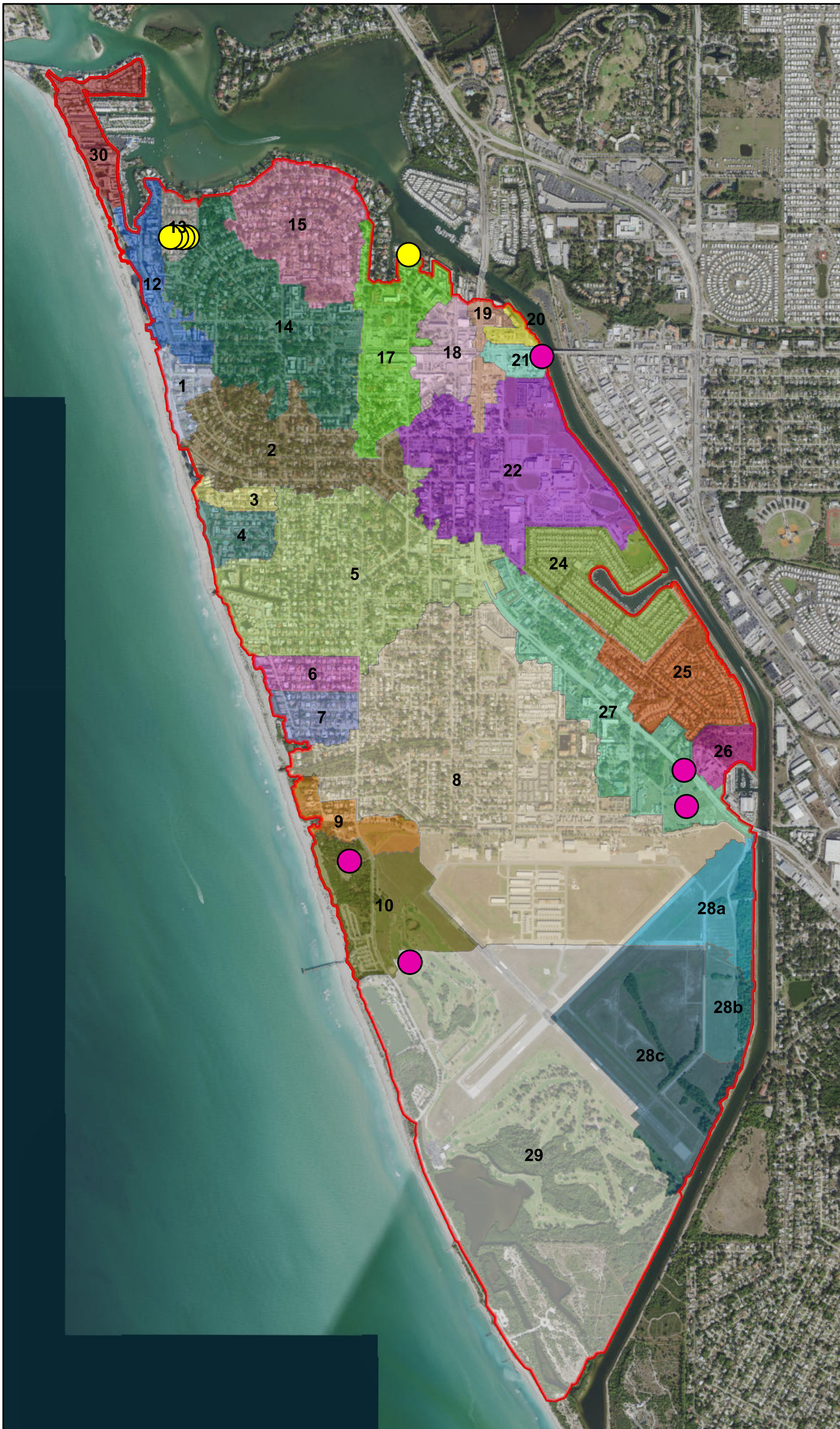
0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Aug 2019

Map Prepared By: JC Taylor Engineering



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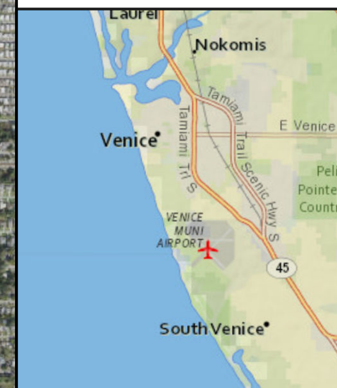

Septic Systems (10)

- Non-residential
- Residential
- Project Area

Project: City of Venice Stormwater Outfalls

Figure 7:

Septic Systems

Notes:

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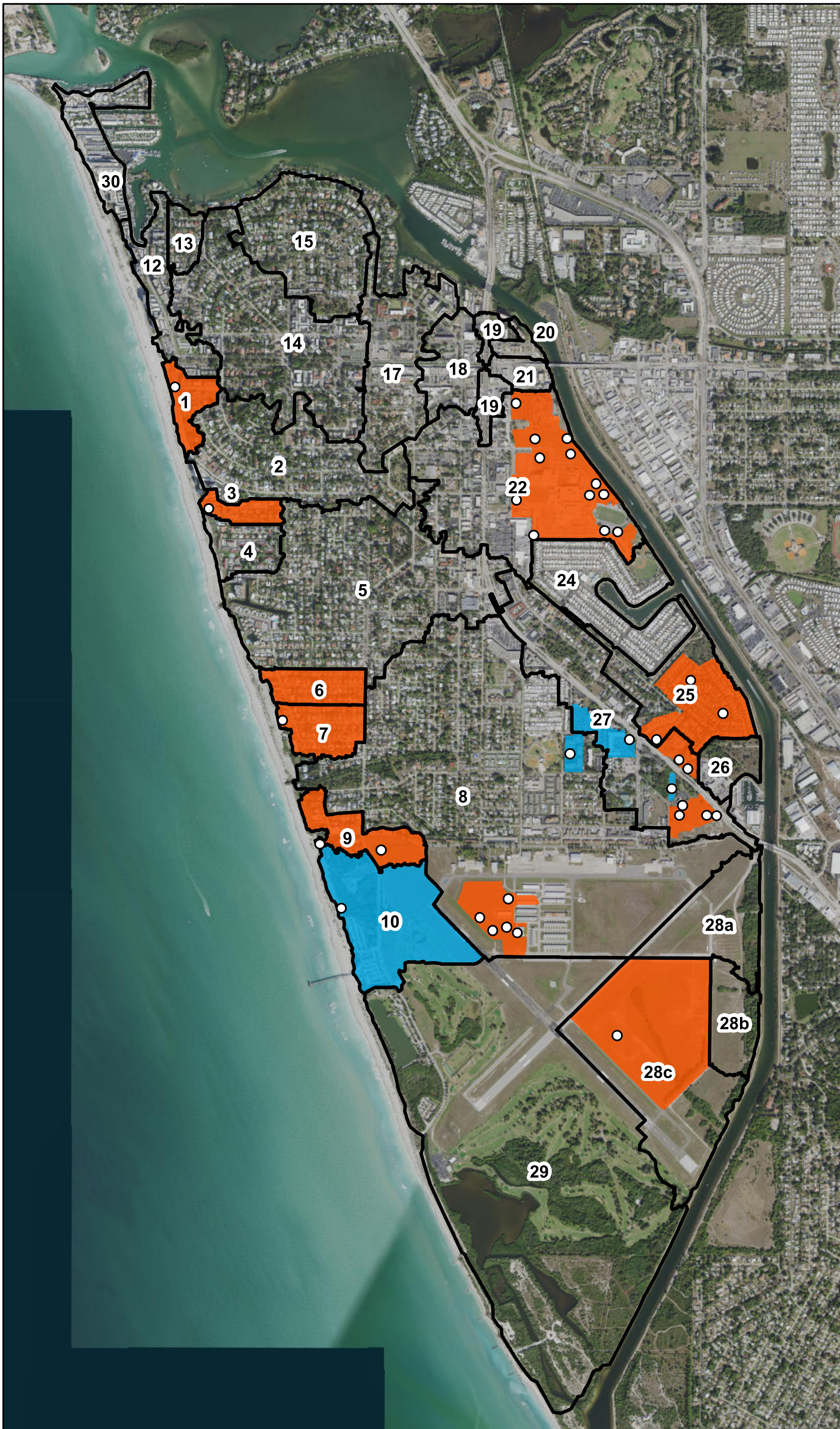
0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Feb 2019

Map Prepared By: JC Taylor Engineering



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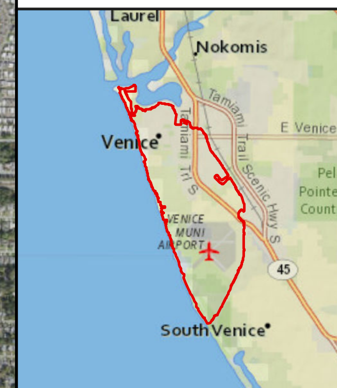

Basins

BMP points

BMP Description

Dry Retention

Wet Detention

Project: City of Venice Stormwater Outfalls

Figure 8:

BMPs

Notes:

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0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Feb 2019	Map Prepared By: JC Taylor Engineering

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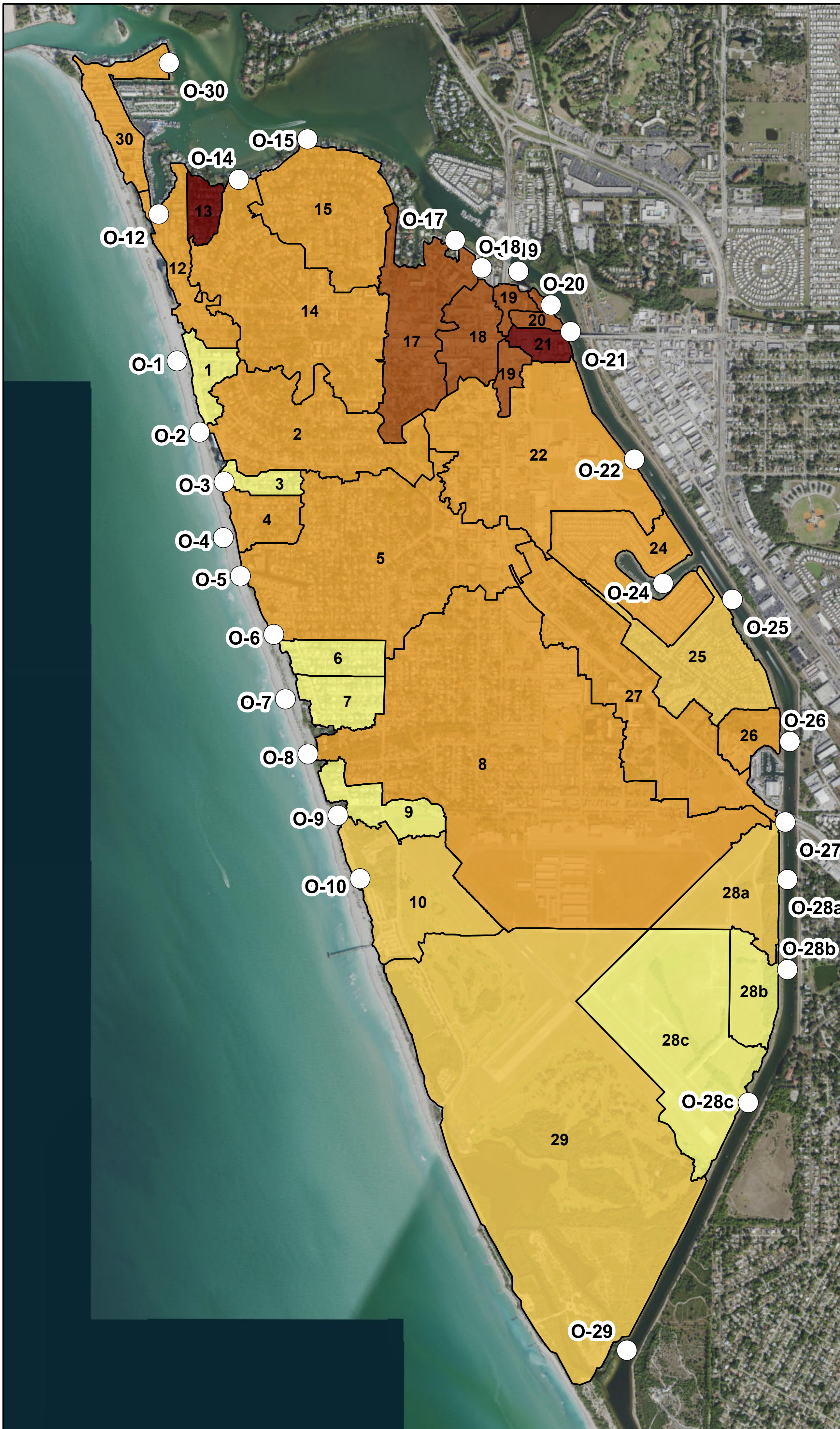

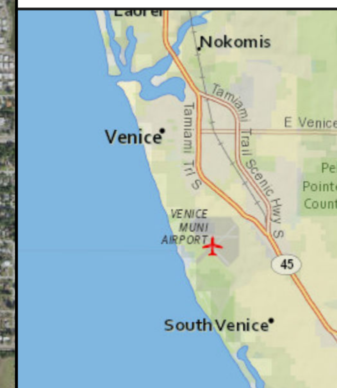

Stormwater Outfalls

Basins to Outfalls

Basins (lb/ac/yr)

TN

- 0.1 - 1.6
- 2.5 - 3.7
- 6.0 - 9.7
- 11.1 - 14.3
- 17.8 - 21.0

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 9:

Direct Runoff Loading TN

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date:	Map Prepared By:
Aug 2019	JC Taylor Engineering

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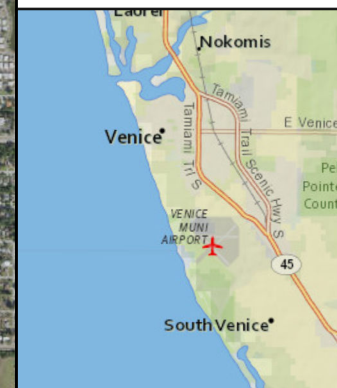


Stormwater Outfalls
Basins to Outfalls

Basins (lb/ac/yr)

TP

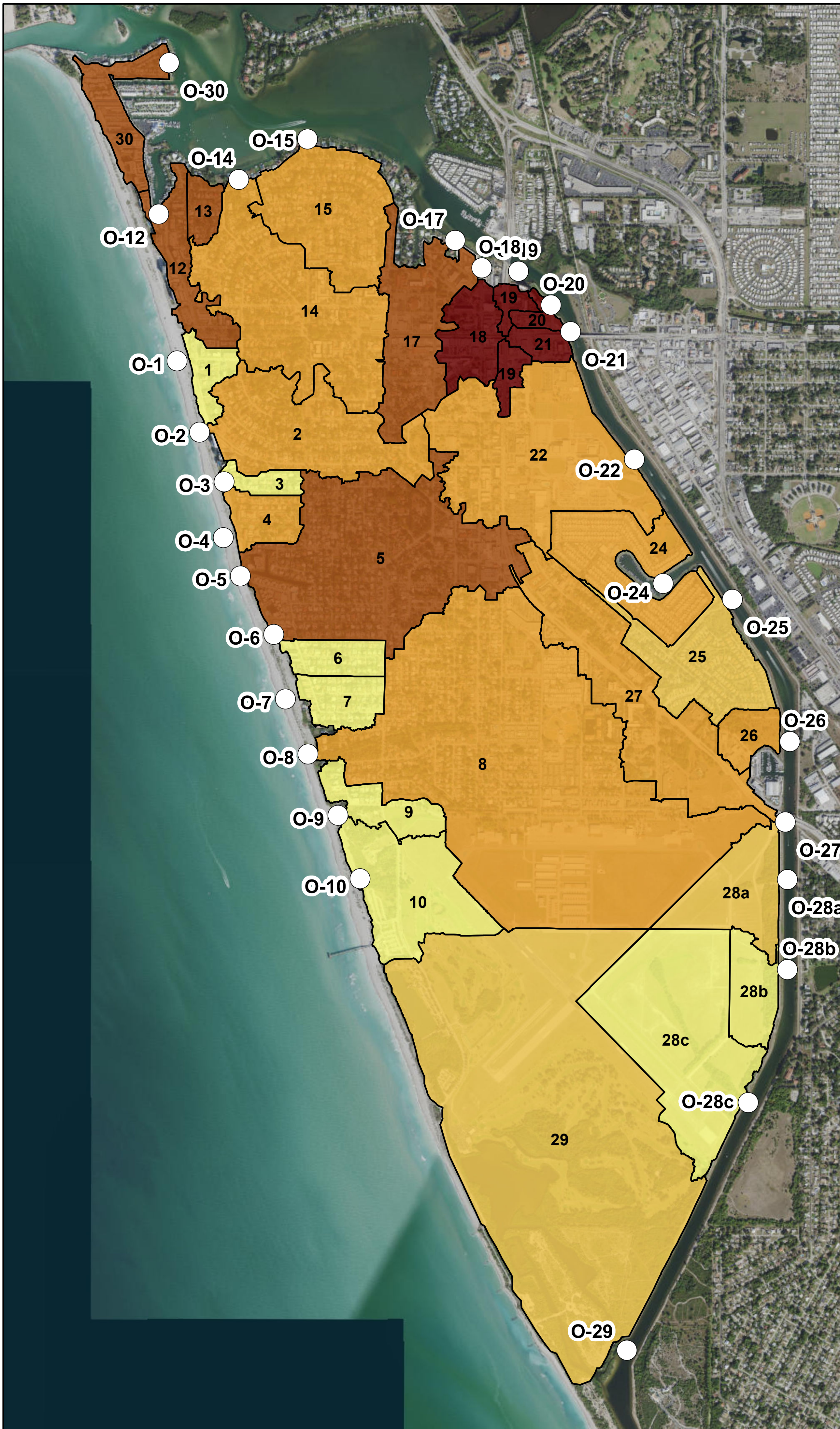
0.0 - 0.3
0.3 - 0.6
1.1 - 1.7
1.8 - 2.2
2.4 - 3.0

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf   Sarasota County

Figure 10:

Direct Runoff Loading TP



Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

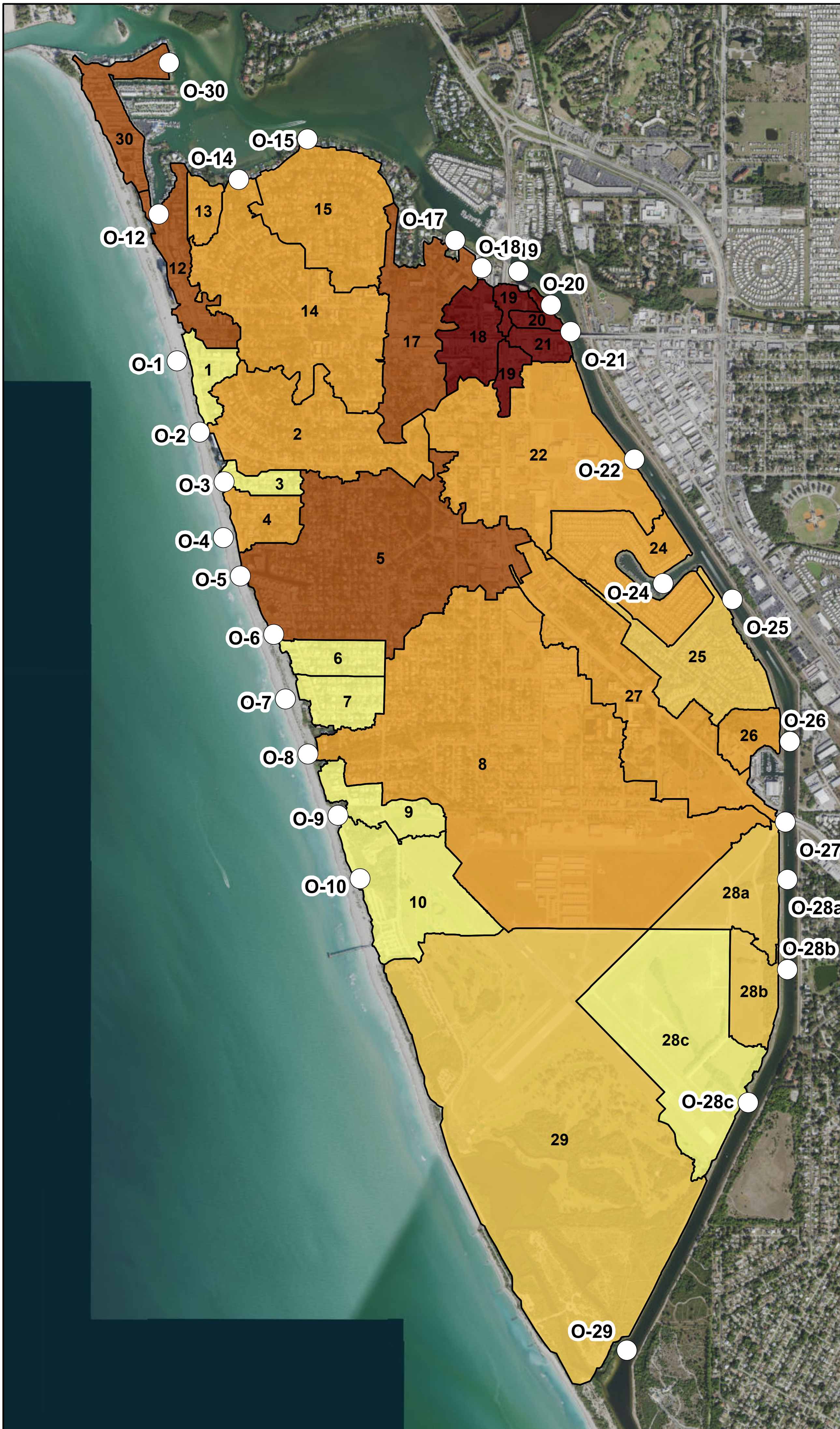
0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Aug 2019

Map Prepared By: JC Taylor Engineering



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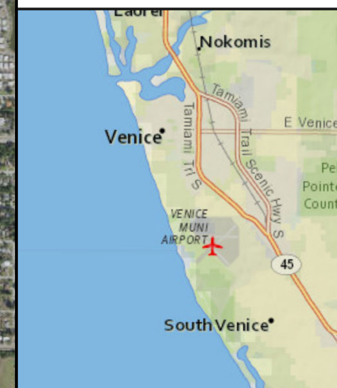


Stormwater Outfalls

Basins to Outfalls

Basins (lb/ac/yr)

TSS

- 10.2 - 137.9
- 225.9 - 403.4
- 534.6 - 752.2
- 786.1 - 936.4
- 1051.5 - 1309.2

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 11:

Direct Runoff Loading TSS

Notes:

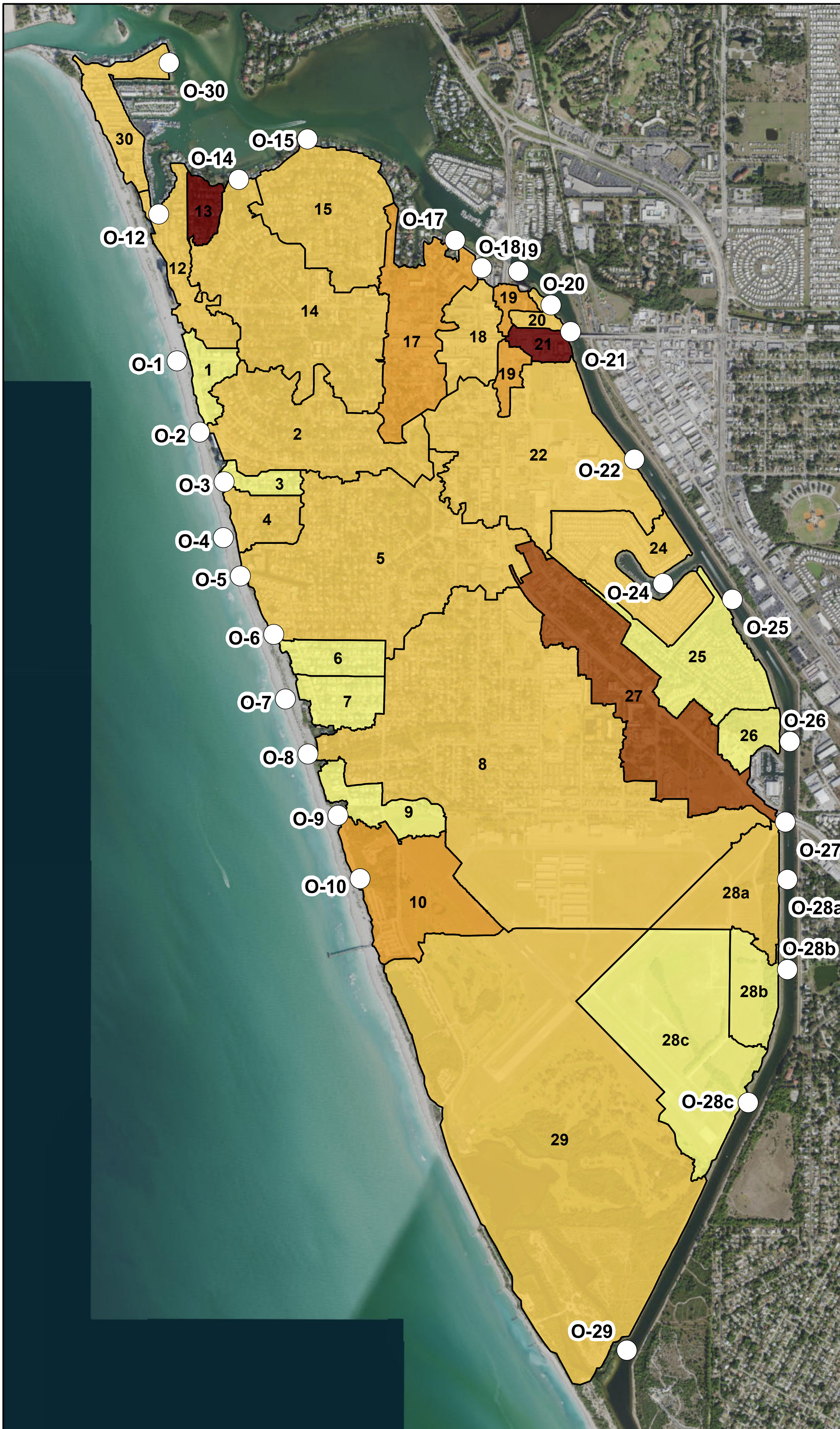
The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date:	Map Prepared By:
Aug 2019	JC Taylor Engineering



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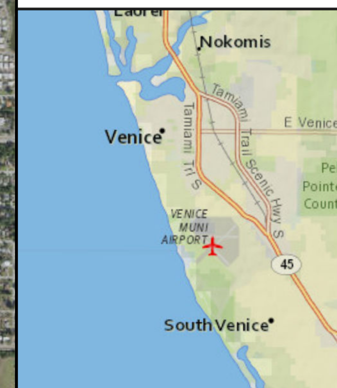


Stormwater Outfalls
Basins to Outfalls

Basins (lb/ac/yr)

Fecal Coliform (/100 ml)

3.8 - 272.1
384.4 - 682.8
1181.0 - 2178.3
3242.2
16674.0 - 20991.3

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf
Sarasota County

Figure 12:

Direct Runoff Loading FC

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

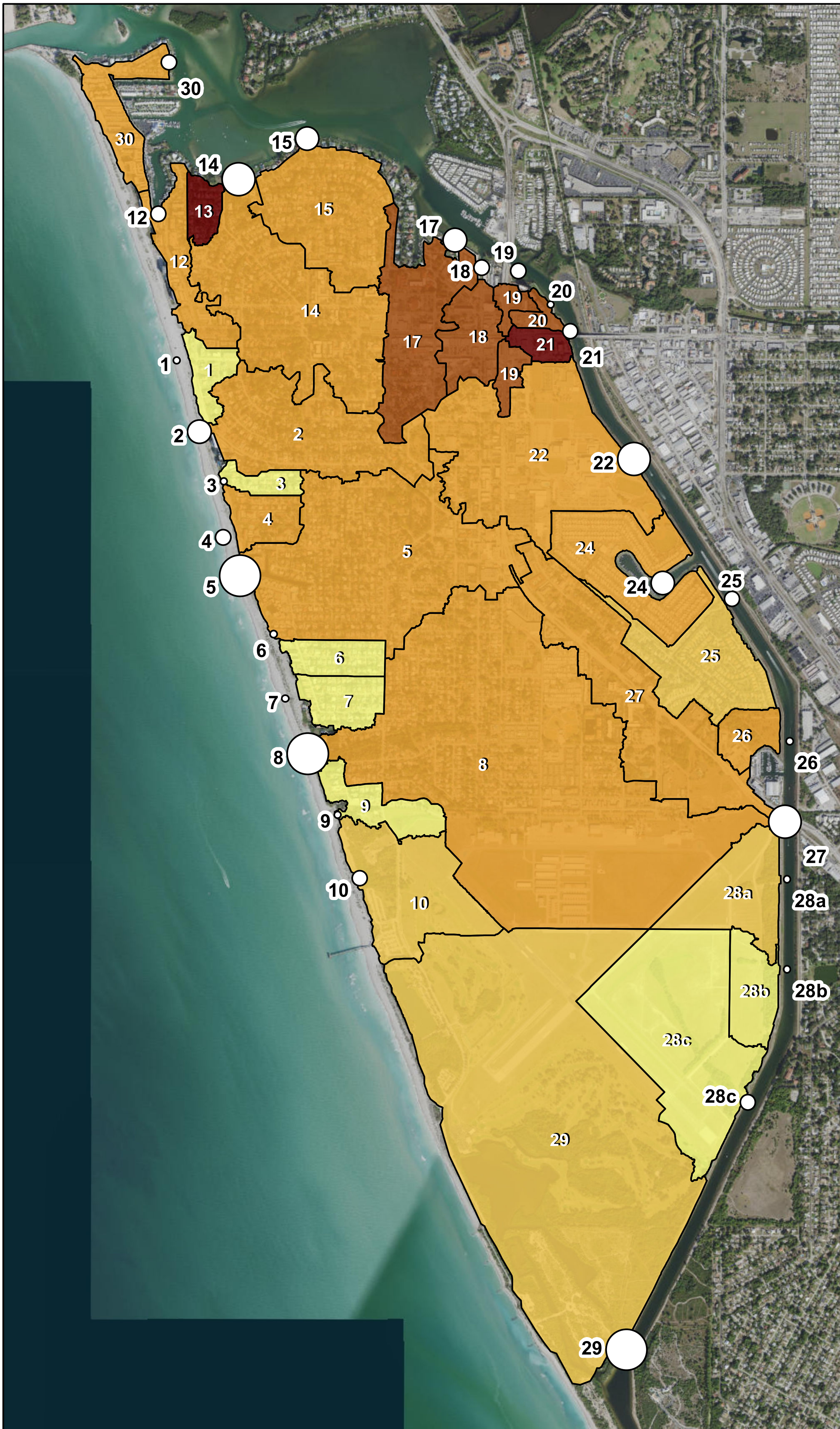
0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Aug 2019

Map Prepared By: JC Taylor Engineering



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Stormwater Outfalls
TN, % of Total

- 0.0 - 0.8
- 0.9 - 2.4
- 3.4 - 5.1
- 7.2 - 7.7
- 11.6 - 20.1

Basins to Outfalls

Major Basins (lb/ac/yr)
TN

- 0.1 - 1.6
- 2.5 - 3.7
- 6.0 - 9.7
- 11.1 - 14.3
- 17.8 - 21.0

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 13:

Direct Runoff Loading TN with Percent of Total

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date:	Map Prepared By:
Mar 2019	JC Taylor Engineering

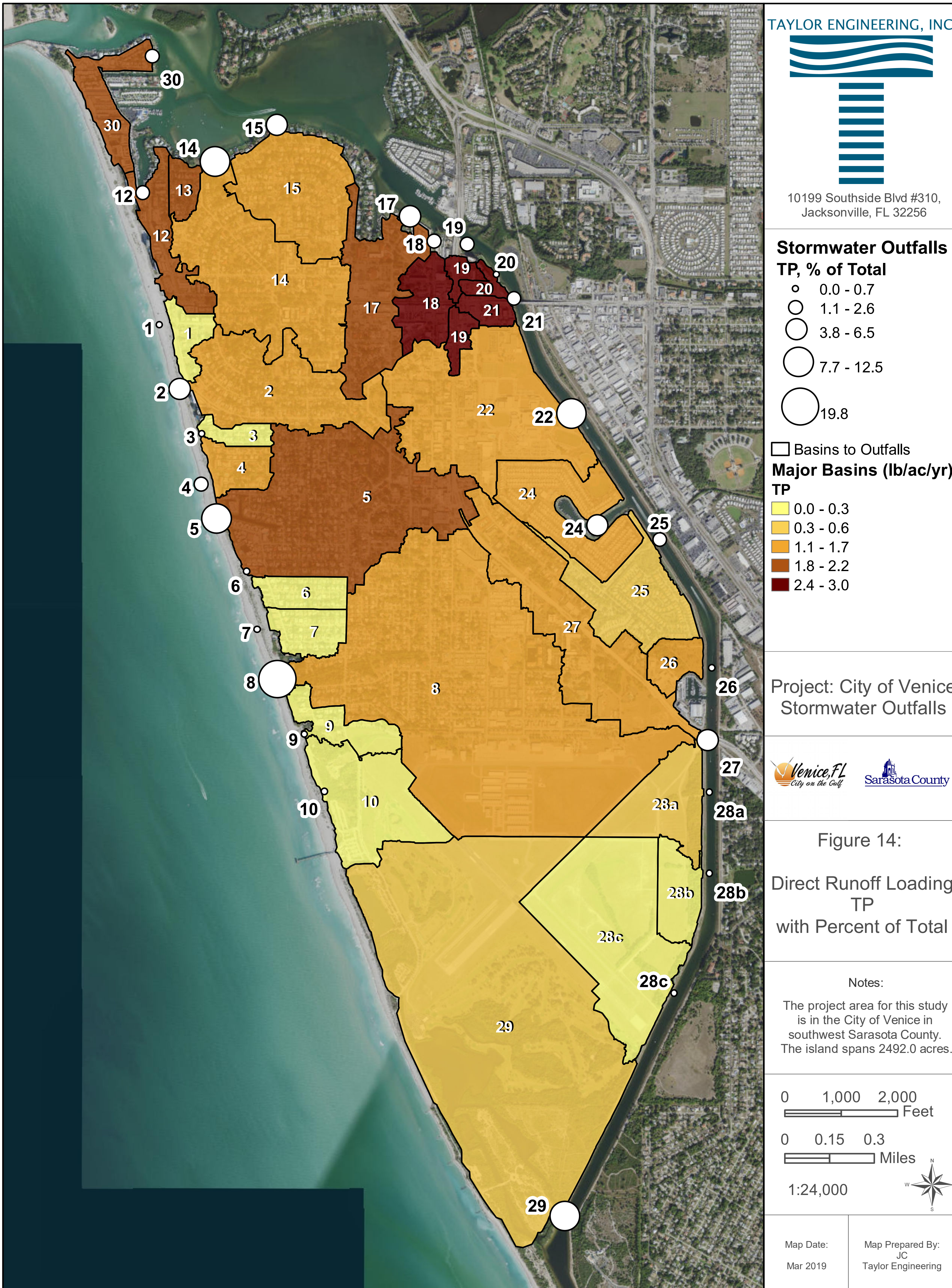


Figure 14:

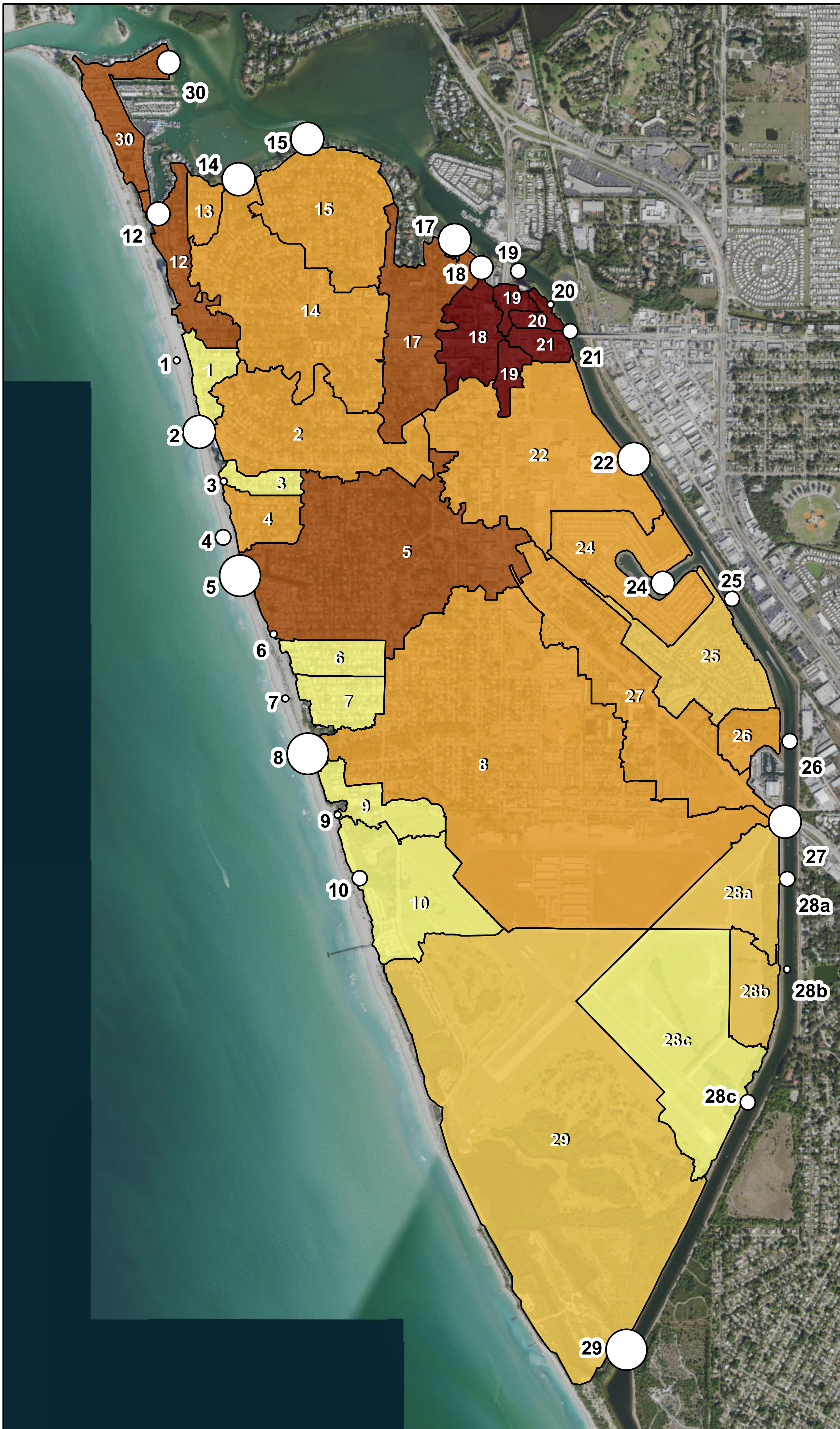
Direct Runoff Loading
TP
with Percent of Total

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

Map Date: Mar 2019

Map Prepared By: JC Taylor Engineering



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Stormwater Outfalls
TSS, % of Total

- 0.0 - 0.5
- 0.8 - 1.5
- 2.0 - 3.2
- 4.3 - 7.6
- 11.2 - 20.8

Basins to Outfalls

Major Basins (lb/ac/yr)
TSS

- 10.2 - 137.9
- 225.9 - 403.4
- 534.6 - 752.2
- 786.1 - 936.4
- 1051.5 - 1309.2

Project: City of Venice Stormwater Outfalls

Venice, FL City on the Gulf

Sarasota County

Figure 15:

Direct Runoff Loading TSS with Percent of Total

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

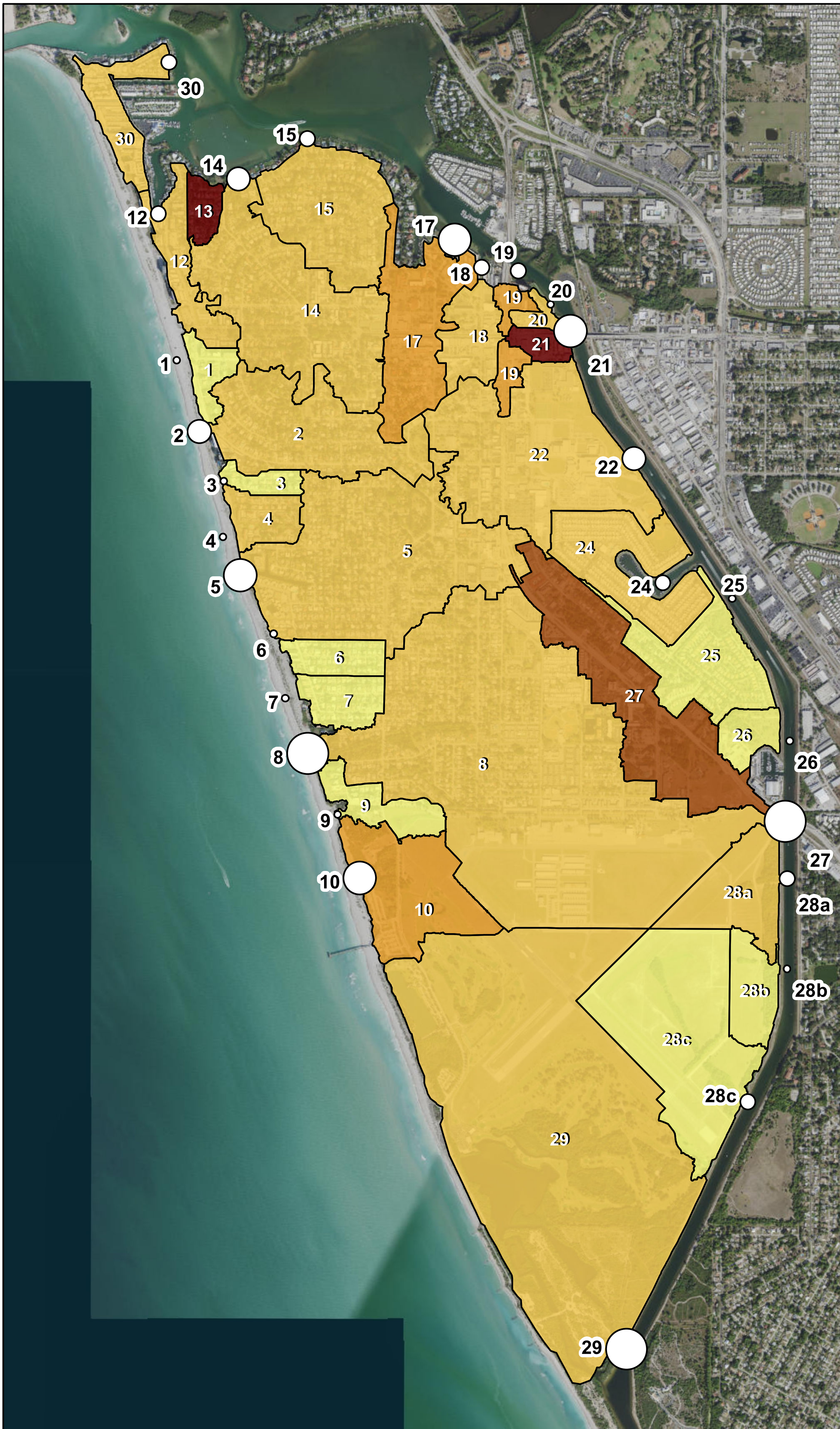
0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

Map Date: Mar 2019

Map Prepared By: JC Taylor Engineering



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Stormwater Outfalls
FC, % of Total

- 0.0 - 0.5
- 0.8 - 2.0
- 2.3 - 3.6
- 5.4 - 9.3
- 13.6 - 21.3

Basins to Outfalls

Major Basins (lb/ac/yr)
Fecal Coliform (/100 ml)

- 3.8 - 272.1
- 384.4 - 682.8
- 1,181.0 - 2,178.3
- 3,242.2
- 16,674.0 - 20,991.3

Project: City of Venice
Stormwater Outfalls

Venice, FL City on the Gulf
Sarasota County

Figure 16:

Direct Runoff Loading
FC
with Percent of Total

Notes:

The project area for this study is in the City of Venice in southwest Sarasota County. The island spans 2492.0 acres.

0 1,000 2,000 Feet

0 0.15 0.3 Miles

1:24,000

N E S W

Map Date:	Map Prepared By:
Mar 2019	JC Taylor Engineering