Memo

To:	Moira Homann, DEP; Diana Turner, DEP; Kevin O'Donnell, DEP; Eric Simpson, DEP; Tony Tomalewski, DEP
From:	Tetra Tech
Date:	July 25, 2025
Subject:	Draft Task 1. Inventory Available Data for the St. Lucie River and Estuary Watershed Model Development

1.0 INTRODUCTION

The Florida Department of Environmental Protection (DEP) contracted Tetra Tech to develop and calibrate a Hydrological Simulation Program – FORTRAN (HSPF) model for the St. Lucie River and Estuary watershed. A Watershed Water Quality Simulation (WaSh) model was previously developed for the watershed. However, DEP would like an HSPF model to have one consistent modeling platform for the Northern Everglades basin management action plans (BMAPs). In 2017, Tetra Tech completed an update to the Caloosahatchee River and Estuary HSPF model and began a new update in 2024. The St. Lucie River and Estuary Watershed HSPF model will be developed using a process that is consistent with the Caloosahatchee River and Estuary HSPF model development.

The goal of this project is to prepare a model that represents total nitrogen (TN) and total phosphorus (TP) loading throughout the watershed to estimate the nutrient load reaching the St. Lucie River and Estuary. DEP will use the model results in a future update to the St. Lucie River and Estuary BMAP. Task 1, which is presented in this memo, was gathering and inventorying available data 2008 through 2023 (using 2008 for model spin up) for the HSPF model hydrology and water quality setup, calibration, and validation.

2.0 TASK 1. INVENTORY AVAILABLE DATA

The following sections summarize the data and literature sources gathered for model setup, calibration, and validation.

2.1 LAND USE

2.1.1 Land Use and Land Cover (LULC) Coverage

Tetra Tech downloaded the publicly available LULC 2021–2023 shapefile coverage for pervious land uses from the South Florida Water Management District (SFWMD) portal (SFWMD, 2025), and 2023 National Land Cover Dataset (NLCD) shapefile coverage for impervious land uses (MRLC, 2023). Tetra Tech received Florida Statewide Agricultural Irrigation Demand (FSAID)12 directly from Florida Department of Agriculture and Consumer Services (FDACS) with updated agricultural land uses and Florida Department of Transportation (FDOT) provided a shapefile coverage of their roads and rights-of-way (ROW). Tetra Tech combined all four coverages to develop LULC for the St. Lucie River and Estuary HSPF model. Tetra Tech reduced the total number of land use classifications represented in the model by grouping similar land uses (i.e., all SFWMD 1100 level land use classifications were grouped together as Low Density Residential), following the approach used in the Caloosahatchee River and Estuary model. A total of 18 separate pervious land uses were identified in the watershed (***Figure 1***). The reduced land use classifications will be used to assign runoff and nutrient loads in the St. Lucie River and Estuary watershed HSPF model.

2.1.2 Land Use Processing

The land use processing was completed by combining the 2021–2023 SFWMD geographic information system (GIS) coverage (SFWMD, 2025), FDACS FSAID 12 coverage, and FDOT ROW coverage using GIS clipping and intersecting techniques. The SFWMD land use is a complete coverage of the watershed whereas FDACS FSAID 12 and FDOT ROW coverages cover only portions of the watershed. Where the FDACS FSAID 12 and FDOT ROW coverages exist, Tetra Tech used that information to replace the land use type contained in the SFWMD coverage. The resulting SFWMD, FSAID, and FDOT combined processed land use coverage was then intersected with the 2023 NLCD impervious coverage to determine the total impervious area in the watershed. ***Figure 1*** shows the processed land use coverage for the St. Lucie River and Estuary watershed. After watershed delineation, the total impervious area was calculated for each subbasin. The impervious areas were classified into seven impervious land use classifications, and impervious areas associated with similar land uses were grouped together. Impervious areas associated with Low Density Residential and Developed Open Space/Disturbed land uses were combined into the Low Density Residential (Impervious) classification. Impervious areas associated with Sugar Cane, Row and Field Crops, Nurseries / Ornamentals / Vineyards, Citrus Groves / Other Groves, Improved Pasture, and Rangeland / Unimproved Pasture / Woodland Pasture / Shrub , and Agricultural Fallow land uses were combined into the Agricultural (Impervious) classification. Impervious areas associated with Upland Forests, Wetlands, Water, and Seasonal grazing/Agricultural Wetland land uses were combined into the Other (Impervious) classification (***Table 1***). In low and medium density development areas, the effective impervious area (EIA) is the percentage of the mapped impervious coverage (MIA). In low and medium density areas, rooftops and other impervious areas associated with single family residential areas are not always connected to the storm sewer or piped directly to the street curb, and runoff from roads is typically directed to grass swales (Sutherland, 1995). In high density areas, most areas within a basin are directly connected to the storm sewer system. The MIA was converted to the EIA through the following equations (Sutherland, 1995):

- High Density Residential (Impervious) areas are totally connected basins where 100% of the urban area is storm-sewered with all impervious surfaces appearing to be directly connected to the system, and are calculated as:

  Equation: $EIA = MIA$

- Medium Density Residential (Impervious) are highly connected basins where the local drainage collector systems for the urban areas are predominately storm sewered with curb and gutters, no dry wells or other drainage infiltration areas are known to exist, and the rooftops are predominately connected to the streets or storm sewer system, and are calculated as:

  Equation: $EIA = 0.4(MIA)^{1.2}$

- All other land uses are average basins where the local drainage collector systems for the urban areas are predominantly storm sewered with curb and gutters, no dry wells or other drainage infiltration areas are known to exist, and the rooftops in the single family residential areas are not connected to the storm sewer or piped directly to the street curb, and are calculated as:

  Equation: $EIA = 0.1(MIA)^{1.5}$

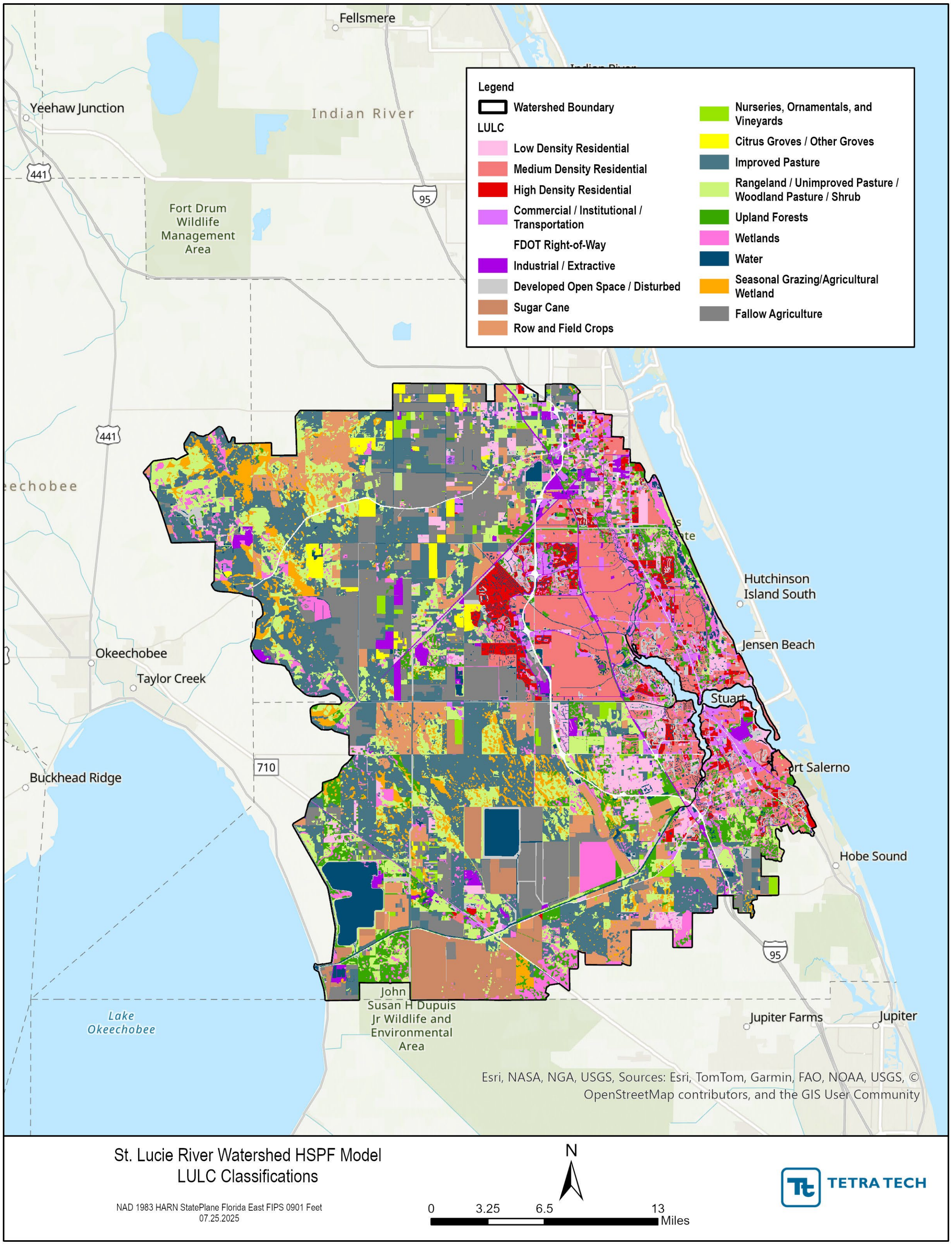

Figure 1. Land use classifications for the St. Lucie River and Estuary watershed

Table 1. Pervious land use and impervious land use classification in the St. Lucie River and Estuary watershed

HSPF Reclass Code	Description	Land Segment	Total Watershed Area (acre)	Percentage of Watershed
1	Low Density Residential (Pervious)	PERLND	21,318.5	4.0%
2	Medium Density residential (Pervious)	PERLND	33,760.2	6.3%
3	High Density Residential (Pervious)	PERLND	7,384.7	1.4%
4	Commercial / Institutional / Transportation (Pervious)	PERLND	7,425.8	1.4%
5	FDOT Right-of-Way (Pervious)	PERLND	4,545.0	0.8%
6	Industrial / Extractive (Pervious)	PERLND	9,482.4	1.8%
7	Developed Open Space /Disturbed	PERLND	14,132.3	2.6%
8	Sugar Cane	PERLND	20,078.0	3.7%
9	Row and Field Crops	PERLND	33,495.7	6.2%
10	Nurseries, Ornamentals, and Vineyards	PERLND	4,345.3	0.8%
11	Citrus Groves / Other Groves	PERLND	6,925.5	1.3%
12	Improved Pasture	PERLND	105,027.7	19.6%
13	Rangeland / Unimproved Pasture / Woodland Pasture / Shrub	PERLND	60,030.1	11.2%
14	Upland Forests	PERLND	29,029.5	5.4%
15	Wetlands	PERLND	31,241.5	5.8%
16	Water	PERLND	22,409.7	4.2%
17	Seasonal Grazing / Agricultural Wetland	PERLND	20,401.7	3.8%
18	Agriculture Fallow	PERLND	68,386.8	12.8%
21	Low Density Residential (Impervious)	IMPLND	2,974.6	0.6%
22	Medium Density Residential (Impervious)	IMPLND	13,150.5	2.5%
23	High Density Residential (Impervious)	IMPLND	6,753.4	1.3%
24	Commercial / Institutional / Transportation / Industrial / Extractive (Impervious)	IMPLND	8,321.6	1.6%
25	FDOT Right-of-Way (Impervious)	IMPLND	1,415.4	0.3%
26	Agriculture (Impervious)	IMPLND	1,582.4	0.3%
27	Other (Impervious)	IMPLND	2,429.5	0.5%
-	**Total**	**-**	**536,047.6**	**100%**

2.1.3 Upland Land Use Loading Rate

The nutrient loading rates for total nitrogen (TN) and total phosphorus (TP) associated with upland land uses were derived from “edge of field” values as reported in Harper (1994) and Soil and Water Engineering Technology, Inc. (SWET;

2008). The upland land use nutrient loading rates were assumed to represent “delivered to stream” values for the combination of surface runoff, interflow, and baseflow. ***Table 2*** shows TN and TP unit area loads provided in Harper (1994) and SWET (2008). These values were similar for urban and natural land uses, but were different for agricultural land uses. For the Caloosahatchee River and Estuary HSPF model, DEP provided guidance that more weight should be given to Harper (1994) for urban areas and to SWET (2008) for agricultural areas (Harper H. , 1994; SWET, 2008). Therefore, a similar approach will be used in the St. Lucie River and Estuary watershed model. During the model calibration, all four upland constituents (nitrate + nitrite [NO_x], ammonia [NH_3], orthophosphate [PO_4], and organic matter) and all three flow paths (surface flow, interflow, and groundwater) for each land use will be adjusted until an acceptable agreement between simulated average annual upland load and published average annual upland land use load is achieved.

Tetra Tech used an FDOT report that included event mean concentration (EMC) values for the land uses under its jurisdiction (ATM, 2010) . The HSPF model does not allow for the explicit input of EMC data. Therefore, Tetra Tech processed the FDOT EMC data into unit area loads. The FDOT report provided the percent imperviousness for each drainage area in the study. Tetra Tech averaged the drainage area imperviousness for the District 1 boundary in FDOT report that includes the Caloosahatchee River and Estuary watershed, which is the closest area in the study for the St. Lucie River and Estuary watershed, and assigned runoff values from the SWET report for the St. Lucie River and Estuary watershed (SWET, 2008). The runoff value, FDOT EMC, and average imperviousness were used to calculate TN and TP loads in pounds per acre per year (lbs/acre/yr) for the FDOT Right-of-Way Pervious and FDOT Right-of-Way Impervious land use classes (***Table 3***).

Table 2. Comparison of Harper (1994) and SWET (2008) TN and TP loads per acre

HSPF Land Uses	Land Use Classes (Harper 1994)	TN Load in lbs/acre/yr (Harper 1994)	TP load in lbs/acre/yr (Harper 1994)	Sediment Load in lbs/acre/yr (Harper 1994)	Land Use Classes (SWET 2008)	TN Load in lbs/acre/yr (SWET 2008)	TP Load in lbs/acre/yr (SWET 2008)
Low Density Residential (Pervious)	Low Density Residential	1.7 - 7.3	0.26 - 1.11	75	Low Density Residential	4.95	0.49
Low Density Residential (Impervious)	Low Density Residential	1.7 - 7.3	0.26 - 1.11	75	Low Density Residential	4.95	0.49
Medium Density Residential (Pervious)	Medium Density Residential	3.0 - 14.4	0.43 - 2.07	125	Medium Density Residential	7.20	1.40
Medium Density Residential (Impervious)	Medium Density Residential	3.0 - 14.4	0.43 - 2.07	125	Medium Density Residential	7.20	1.40
High Density Residential (Pervious)	High Density Residential	6.1 - 30.1	1.51 - 7.45	570	High Density Residential	10.80	3.00
High Density Residential (Impervious)	High Density Residential	6.1 - 30.1	1.51 - 7.45	570	High Density Residential	10.80	3.00
Commercial / Institutional / Transportation (Pervious)	Industrial and Commercial	5.2 - 21.7	0.93 - 3.89	750	Other Urban	6.30 – 9.00	0.66 – 2.40
Industrial / Extractive (Pervious)	Industrial and Commercial	5.2 - 21.7	0.93 - 3.89	750	Other Urban	6.30 – 9.00	0.66 – 2.40
Commercial / Institutional / Transportation / Industrial / Extractive (Impervious)	Industrial and Commercial	5.2 - 21.7	0.93 - 3.89	750	Other Urban	6.30 – 9.00	0.66 – 2.40
Commercial / Institutional / Transportation / Industrial / Extractive (Impervious)	Mining	0.9 - 5.5	0.12 - 0.77	390	Not applicable (N/A)	N/A	N/A
Developed Open Space / Disturbed (Pervious)	Open Land	2.6 - 7.1	0.18 - 0.51	10	Open Land	3.60	0.28
Rangeland / Unimproved Pasture / Woodland Pasture / Shrub	Pasture	3.6 - 16.3	0.35 - 1.57	280	Unimproved Pasture	4.95	0.92

HSPF Land Uses	Land Use Classes (Harper 1994)	TN Load in lbs/acre/yr (Harper 1994)	TP load in lbs/acre/yr (Harper 1994)	Sediment Load in lbs/acre/yr (Harper 1994)	Land Use Classes (SWET 2008)	TN Load in lbs/acre/yr (SWET 2008)	TP Load in lbs/acre/yr (SWET 2008)
Improved Pasture	Pasture	3.6 - 16.3	0.35 - 1.57	280	Improved Pasture	9.90	1.90
Row and Field Crops	Agriculture General	2.8 - 13.4	0.61 - 2.96	175	Row crops	13.50	4.50
Agriculture (Impervious)	Agriculture General	2.8 - 13.4	0.61 - 2.96	175	Row crops	13.50	4.50
Sugar Cane	Agriculture Tree Crop	2.0 - 9.0	0.46 - 2.12	40	Sugar Cane	7.20	0.63
Nurseries / Ornamentals / Vineyards	Agriculture Tree Crop	2.0 - 9.0	0.46 - 2.12	40	Ornamentals	10.80	2.90
Citrus Groves / Other Groves	Agriculture Tree Crop	2.0 - 9.0	0.46 - 2.12	40	Citrus	7.65	1.80
Rangeland / Unimproved Pasture / Woodland Pasture / Shrub	Rangeland	1.7 - 6.5	0.09 - 0.33	10	Rangeland	3.69	0.28
Upland Forests	Forest	0.8 - 7.2	0.11 - 0.92	50	Upland Forest	2.25	0.28
Wetlands	Wetland	0.0 - 5.3	0.00 - 0.76	15	Wetland	1.35	0.01
Water	Water	0.0 - 5.3	0.00 - 0.76	0	Water	0.81	0.05
FDOT Right-of-Way (Pervious)	N/A	N/A	N/A	N/A	Transportation	8.28	1.65
FDOT Right-of-Way (Impervious)	N/A	N/A	N/A	N/A	Transportation	8.28	1.65
Other (Impervious)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3. TN and TP loads per acre for FDOT land uses

FDOT Land Use Classes	Average % Impervious	TN Concentration in Milligrams per Liter (mg/L) (ATM 2010)	TP Concentration in mg/L (ATM 2010)	Runoff (inches/ year)	TN Load (lbs/acre/yr)	TP Load (lbs/acre/yr)
FDOT Right-of-Way (Pervious)	35	1.158	0.157	17.57	4.61	0.63
FDOT Right-of-Way (Impervious)	65	1.158	0.157	27.15	7.12	0.97

2.2 POINT SOURCES AND REUSE FACILITIES

DEP provided Tetra Tech with the list of 34 domestic wastewater (DW) and industrial wastewater (IW) treatment facilities, of which eight have National Pollutant Discharge Elimination System (NPDES) permits. DEP requested that only the NPDES facilities be evaluated for inclusion in the model as these facilities discharge to surface waters. Of the eight permitted wastewater treatment facilities (WWTFs), five had a facility status of “Active” and one was “Terminated” based on the discharge monitoring report (DMR) data provided by DEP (***Table 4*** and ***Figure 2***). No DMR data were found for FL0A00067 (Indiantown MVR Biosolids Facility, LLC) and FL0A00069 (Homegrown Shrimp), as these facilities have a status of “Under Construction.”

Florida Power & Light (FPL) - Martin Power Plant (FL0030988) reported measured daily maximum flow (MGD) only for three months (12/31/2012, 10/31/2013, and 12/31/2013) from monitoring location EFF-1. Also, daily maximum and monthly average flow were reported for seven months only (6/30/2012, 8/31/2012,12/31/2012, 2/28/2013, 8/31/2013,6/30/2014, and 10/31/2014) from monitoring location EFF-3 for that facility. Therefore, Tetra Tech recommends not including this facility in the HSPF model. Two other facilities, St Lucie County Solid Waste Baling and Recycle Facility (FL0041483) and FPL Indiantown Cogeneration LP (FL0183750), reported flow data and water quality observation as NOD (No Discharge). Therefore, Tetra Tech also recommends not including these facilities in the HSPF model. The list of NPDES facilities that will be included in the model are summarized in **Table 5**.

Table 4. List of permitted NPDES facilities in the St. Lucie watershed

NPDES Permit Number	Facility Name	Type	Facility Status	Design Capacity (MGD)	Permitted Capacity (MGD)
FL0030988	FPL - Martin Power Plant	IW	A	Not applicable	Not applicable
FL0041483	St Lucie County Solid Waste Baling and Recycle Facility	IW	A	Not applicable	Not applicable
FL0043214	Martin County Utilities Tropical Farms Water Treatment Plant (WTP) & WWTF	DW	A	4.27	5.9
FL0140406	Florida Rock Industries - Fort Pierce Quarry Mine	IW	A	13.82	12.25
FL0183750	FPL Indiantown Cogeneration LP	IW	T	Not applicable	Not applicable
FL0434698	St. Lucie County Fairgrounds WWTF	IW	A	0.013	0.0134
FL0A00067	Indiantown MVR Biosolids Facility, LLC	DW	U	Not applicable	0.26
FL0A00069	Homegrown Shrimp	IW	U	Not applicable	Not applicable

Table 5. List of recommended permitted NPDES facilities to include in the HSPF model

NPDES Permit Number	Facility Name	Type	Design Capacity (MGD)
FL0043214	Martin Co Utilities Tropical Farms WTP & WWTF	DW	4.27
FL0140406	Florida Rock Industries - Fort Pierce Quarry Mine	IW	13.82
FL0434698	St. Lucie County Fairgrounds WWTF	IW	0.013

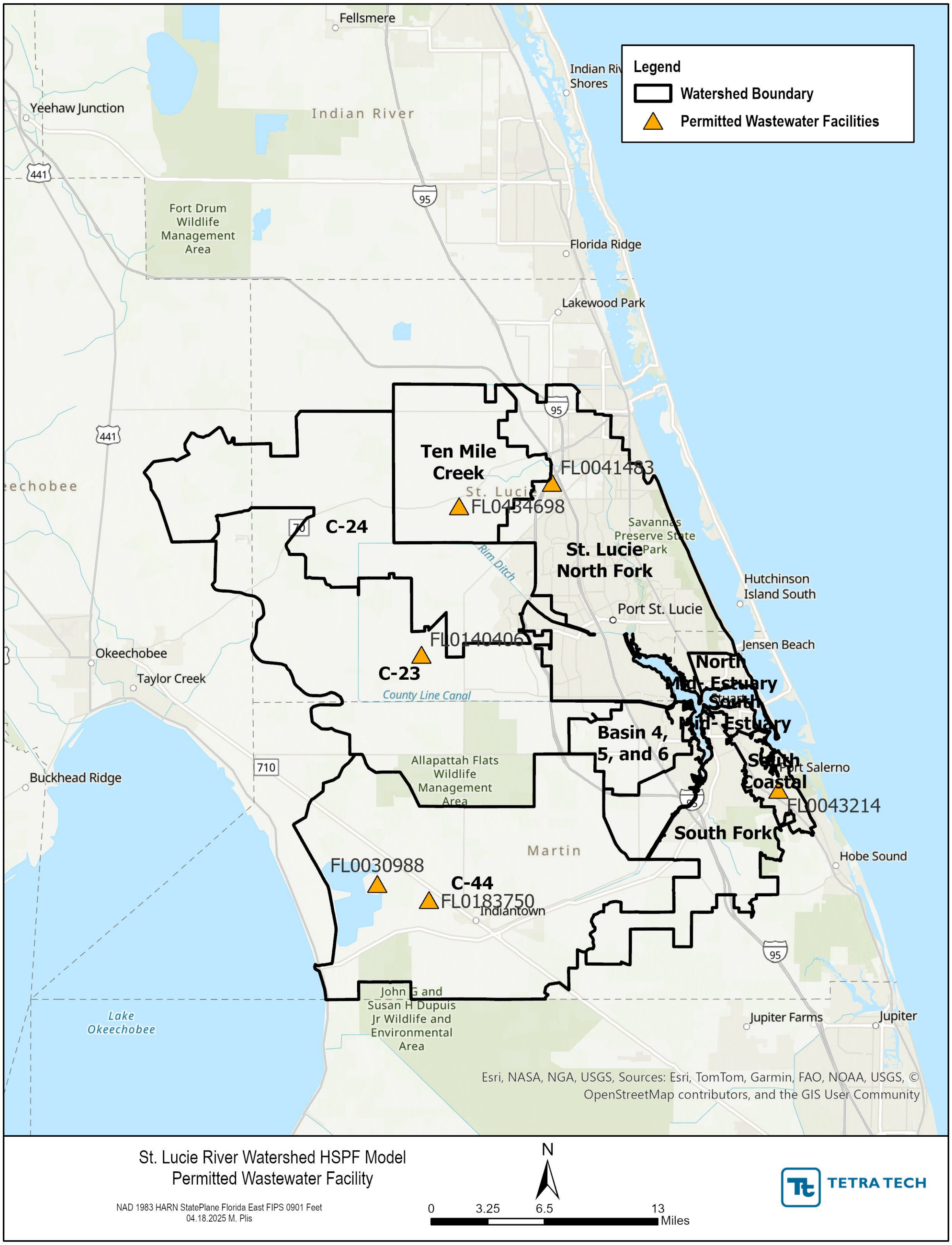

Figure 2. Spatial coverage of permitted WWTFs in the St. Lucie River and Estuary watershed

DEP also provided Tetra Tech with the list of reuse permits and DMR data for 14 reuse facilities in the watershed. Six out of these facilities were located outside the watershed boundary and the remaining eight will be included in the HSPF model. ***Table 6*** and ***Figure 3*** present spatial coverage of permitted reuse facilities in the St. Lucie River and Estuary watershed.

Table 6. List of reuse facilities for the HSPF model

Facility ID	Facility Name	Facility Type	Usage(s)	Permitted Capacity (MGD)
FL0043214	Martin County Tropical Farms WWTF	DW	Irrigation (golf courses, residences, and one park)	5.9
FLA013881	Martin Correctional Institute	DW	Toilet flushing and laundry, on a spray field or for crop irrigation	0.37
FLA013940	Okeechobee Correctional WWTF	DW	Irrigation	0.2
FLA041459	City of Stuart	DW	Irrigation	4.0
FLA043192	Martin County Utilities North WWTF	DW	Irrigation	2.76
FLA013993	St. Lucie West Services District	DW	Irrigation	2.6
FLA139653	Port St Lucie Utility Westport WWTF	DW	Irrigation and percolation ponds	6.0
FLA326321	Port St Lucie Utilities Glades WWTF	DW	Most is disposed through an on-site deep injection well. The facility is permitted for urban irrigation.	12

Note: Usage information for each reuse facility was obtained from: https://www.sfwmd.gov/sites/default/files/2021_UEC_AppE_WWTFs_EarlyPosting.pdf.

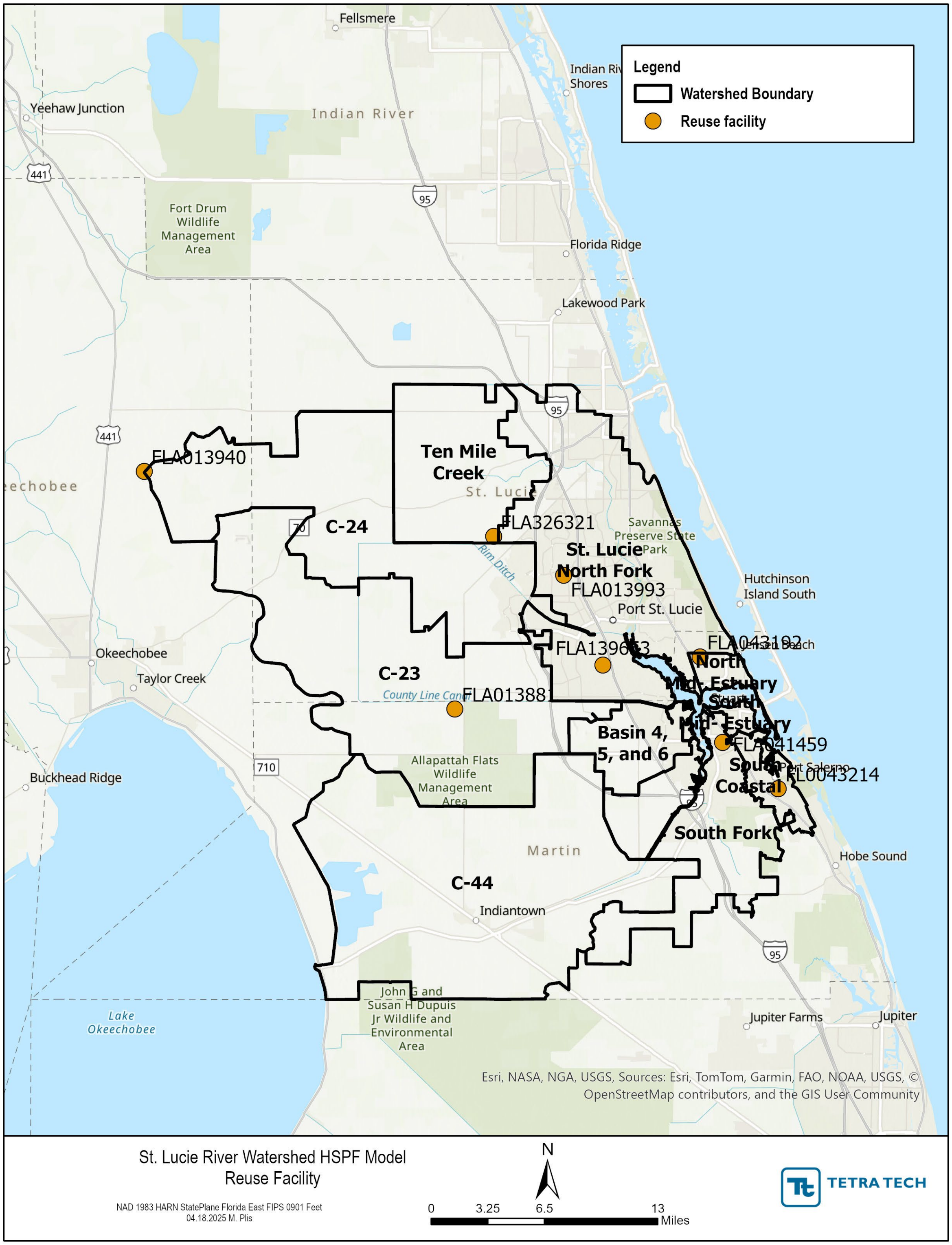

Figure 3. Spatial coverage of permitted reuse facilities in the St. Lucie River and Estuary watershed

2.2.1 Available Data

The observed average flow and water quality results for each of the NPDES WWTF and reuse facilities are shown in ***Table 7***. The number of end of pipe flow and water quality parameter observations reported by each facility is shown in ***Table 8***. For most parameters, results were reported monthly. The period of record for the available data is shown in ***Table 9***. The available measured data for these facilities will be used in the HSPF model to determine the total loading from each facility. The data were used to fill short- and long-term gaps in the data records. For example, if a facility has TN data for ten years of the modeling period, the long-term average of the measured data was used to represent the expected TN concentration for the remaining portion of the simulation period, where data were unavailable.

Table 7. Observed average value for available flow and water quality data for NPDES and reuse facilities

Facility Type	Permit	Flow (cfs)	NH_3 (mg/L)	NOx (mg/L)	OrgN (mg/L)	TN (mg/L)	PO_4 (mg/L)	OrgP (mg/L)	TP (mg/L)	CBOD5 (mg/L)	TSS (mg/L)	DO (mg/L)	WTEM (Deg C)
NPDES	FL0030988	0.13**	0.029**	0.017**	-	0.99**	0.008**	-	0.02**	-	3.0**	7.09	27.9**
NPDES	FL0041483	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0043214	0.68	-	-	-	-	-	-	-	-	-	2.61	-
NPDES	FL0140406	7.02	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0183750	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0434698	0.003	-	-	-	1.09	-	-	0.10	6.04	-	8.47	-
NPDES	FL0A00067	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0A00069	-	-	-	-	-	-	-	-	-	-	-	-
Reuse	FL0043214	3.25	-	1.57	-	2.85	-	-	0.82	3.29	3.09**	-	-
Reuse	FLA013881	0.33	-	6.7	-	-	-	-	3.74	2.70	5.29**	-	-
Reuse	FLA013940	0.29	-	7.8**	-	17.27**			5.26**	3.89	3.59	-	-
Reuse	FLA013993	2.72	-	-	-	-	-	-	-	4.84	3.01**	-	-
Reuse	FLA041459	0.35	-	11.24**	-	-	-	-	2.01**	3.24	6.65**	-	-
Reuse	FLA043192	1.18	-	-	-	4.97	-	-	1.67	4.51	5.63**	-	-
Reuse	FLA139653	1.32	-	0.91**†	-	21.5**	-	-	0.75**	5.32	2.54**	-	-
Reuse	FLA326321	0.74	-	-	-	13.90	-	-	0.76	-	2.07**	-	-

* Single sample reported in permit application.

** Maximum concentrations reported in permit application.

† Three samples reported, which were not included in the data processing.

- No data.

Table 8. Number of observations for available flow and water quality data for NPDES and reuse facilities

Facility Type	Permit	Flow (cfs)	NH_3 (mg/L)	NOx (mg/L)	OrgN (mg/L)	TN (mg/L)	PO_4 (mg/L)	OrgP (mg/L)	TP (mg/L)	CBOD5 (mg/L)	TSS (mg/L)	DO (mg/L)	WTEM (Deg C)
NPDES	FL0030988	3 (DEP)	3 (DEP)	3 (DEP)	3 (DEP)	3 (DEP)	3 (DEP)	3 (DEP)	3 (DEP)	-	3 (DEP)	3 (DEP)	3 (DEP)
NPDES	FL0041483	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0043214	27 (DEP & ECHO)	-	-	-	-	-	-	-	-	-	3 (ECHO)	
NPDES	FL0140406	105 (DEP & ECHO)	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0183750	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0434698	145 (ECHO)	-	-	-	20 (DEP & ECHO)	-	-	20 (DEP & ECHO)	10 (DEP)	-	17 (DEP)	-
NPDES	FL0A00067	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0A00069	-	-	-	-	-	-	-	-	-	-	-	-
Reuse	FL0043214	109	-	105	-	63	-	-	63	165	166	-	-
Reuse	FLA013881	157	-	137	-	-	-	-	137	167	167	-	-
Reuse	FLA013940	155	-	57	-	57	-	-	58	58	58	-	-
Reuse	FLA013993	136	-	-	-	-	-	-	-	54	188	-	-
Reuse	FLA041459	144	-	144	-	-	-	-	144	149	148	-	-
Reuse	FLA043192	146	-	-	-	146	-	-	146	168	167	-	-
Reuse	FLA139653	157	-	3*	-	98	-	-	98	158	187	-	-
Reuse	FLA326321	113	-	-	-	53	-	-	-	53	80	-	-

Table 9. Period of record for available flow and water quality data for NPDES and reuse facilities

Facility Type	Permit	Flow (cfs)	NH_3 (mg/L)	NOx (mg/L)	OrgN (mg/L)	TN (mg/L)	PO_4 (mg/L)	OrgP (mg/L)	TP (mg/L)	CBOD5 (mg/L)	TSS (mg/L)	DO (mg/L)	WTEM (Deg C)
NPDES	FL0030988	12/31/2012, 10/31/2013, 12/31/2013	12/31/2012, 10/31/2013, 12/31/2013	12/31/2012, 10/31/2013, 12/31/2013	-	12/31/2012, 10/31/2013, 12/31/2013	12/31/2012, 10/31/2013, 12/31/2013	-	12/31/2012, 10/31/2013, 12/31/2013	-	12/31/2012, 10/31/2013,	12/31/2012, 10/31/2013, 12/31/2013	12/31/2012, 10/31/2013, 12/31/2013
NPDES	FL0041483	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0043214	9/30/2008, 10/30/2008, 6/30/2009, 8/31/2009-10/31/2009, 12/31/2009-12/31/2014	-	-	-	-	-	-	-	-	-	1/31/2008-3/31/2008	-
NPDES	FL0140406	1/31/2008-6/30/2017	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0183750	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0434698	-	-	-	-	9/30/2012, 7/31/2013, 9/30/2013, 1/31/2014, 7/31/2014, 9/30/2014, 5/31/2016, 9/30/2017, 11/30/2017, 5/31/2018, 11/30/2020, 6/30/2021-9/30/2021	-	-	9/30/2012, 7/31/2013, 9/30/2013, 1/31/2014, 7/31/2014, 9/30/2014, 5/31/2016, 9/30/2017, 11/30/2017, 5/31/2018, 11/30/2020, 6/30/2021-9/30/2021	9/30/2017, 11/30/2017, 5/31/2018, 11/30/2020, 6/30/2021-9/30/2021	-	9/30/2012, 7/31/2013, 9/30/2013, 1/31/2014, 7/31/2014, 9/30/2014, 5/31/2016, 9/30/2017, 11/30/2017, 5/31/2018, 11/30/2020, 6/30/2021-9/30/2021	-
NPDES	FL0A00067	-	-	-	-	-	-	-	-	-	-	-	-
NPDES	FL0A00069	-	-	-	-	-	-	-	-	-	-	-	-
Reuse	FL0043214	10/31/2008-11/30/2017	-	10/31/2008-5/31/2012, 12/31/2017-2/28/2023	-	12/31/2017-2/28/2023	-	-	12/31/2017-2/28/2023	8/31/2008-9/30/2022	8/31/2008-9/30/2022	-	-
Reuse	FLA013881	11/30/2010-12/31/2023	-	7/31/2011-12/31/2023	-	-	-	-	7/31/2011 - 12/31/2023	7/31/2009-12/31/2023	7/31/2009-12/31/2023	-	-
Reuse	FLA013940	12/31/2010-12/31/2023	-	1/31/2011-11/30/2015	-	1/31/2011-11/30/2015	-	-	12/31/2010-11/30/2015	12/31/2010-11/30/2015	12/31/2010-11/30/2015	-	-

Facility Type	Permit	Flow (cfs)	NH_3 (mg/L)	NOx (mg/L)	OrgN (mg/L)	TN (mg/L)	PO_4 (mg/L)	OrgP (mg/L)	TP (mg/L)	CBOD5 (mg/L)	TSS (mg/L)	DO (mg/L)	WTEM (Deg C)
Reuse	FLA013993	9/30/2012-12/31/2023	-	-	-	-	-	-	-	1/31/2008-8/31/2012	1/31/2008-12/31/2023	-	-
Reuse	FLA041459	1/31/2012-12/31/2023	-	1/31/2012-12/31/2023	-	-	-	-	1/31/2012-12/31/2023	7/31/2011-12/31/2023	7/31/2011-12/31/2023	-	-
Reuse	FLA043192	11/30/2011-12/31/2023	-	-	-	11/30/2011-12/31/2023	-	-	11/30/2011-12/31/2023	1/31/2008-12/31/2021	1/31/2008-11/30/2020	-	-
Reuse	FLA139653	11/30/2010-12/31/2023	-	5/31/2009,6/30/2009, 5/31/2023	-	11/30/2015-12/31/2023	-	-	11/30/2015-12/31/2023	5/31/2009, 11/30/2010-12/31/2023	1/31/2008-12/31/2023	-	-
Reuse	FLA326321	6/30/2014-12/31/2023	-	-	-	8/31/2019-12/31/2023	-	-	8/31/2019-12/31/2023	-	3/31/2017-12/31/2023	-	-

2.2.2 Model Setup

NPDES facilities will be set up as direct input time series to RCHRES in the EXT SOURCES block in the HSPF model UCI file. The time series information will be stored in a .WDM file as a daily average value and used to input into the model at an hourly time step using the in-model DIV transformation. ***Table 10*** identifies the mapping and ratio assumption between the .WDM file and HSPF model simulation using the same ratios as the Caloosahatchee River and Estuary model.

Table 10. NPDES facility constituent mapping and ratio assumption

NPDES Constituent	Parameter ID	HSPF Constituent	Ratio
Flow	Flow	Flow	1
Orthophosphate	PO_4	Orthophosphate	1
Organic Phosphorus	OrgP	Organic Phosphorus	1
Ammonia	NH_3	Total Ammonia	1
Nitrate + Nitrite	NOx	Nitrate Nitrite	90% 10%
Organic Nitrogen	OrgN	Organic Nitrogen	1
Carbonaceous BOD5	CBOD5	Carbonaceous BOD Organic Carbon	1 3
Dissolved Oxygen	DO	Dissolved Oxygen	1
Total Suspended Solids	TSS	Sand Silt Clay	10% 50% 40%
Water Temperature	WTEM	Water Temperature	1

The reuse facilities listed in **Section 2.2** will be set up as lateral input time series to specific pervious (PERLAND) land uses in the EXT SOURCES block in the HSPF model *.UCI file. The time series information will be stored in a .WDM file as a daily average value and the DIV transformation will be used to input it into the model at an hourly time step. Unique land uses for each reuse facility's application area will not be established during the land use processing for Task 2. Therefore, it will be assumed that the Low Density Residential (Pervious) Next-Generation Radar (NEXRAD) and land use zones containing the reuse facility received the facilities application.

For a lateral input time series, the HSPF model requires the units of inches for flow and pounds/acre for pollutant mass. To transform the input data into the proper units, the PERLND ID area, along with each facility's flow and constituent load will be used to calculate the rate of flow and loading for each pollutant mass (***Table 11***). This helps to represent each facility's flow volume and constituent load appropriately even though the application area in the model is different from the application area of the facility.

Table 11. Reuse facility constituent mapping

Reuse Constituent	Parameter ID	HSPF Constituent
Flow	Flow	Lateral inflow
Orthophosphate	PO_4	Lateral orthophosphate
Organic Phosphorus	OrgP	Lateral organic matter

Reuse Constituent	Parameter ID	HSPF Constituent
Ammonia	NH_3	Lateral total ammonia
Nitrate + Nitrite	NOx	Lateral nitrate-nitrite
Organic Nitrogen	OrgN	Lateral organic matter
Carbonaceous BOD5	CBOD5	Lateral organic matter
Total Suspended Solids	TSS	Lateral Sediment

2.2.3 Missing Data Assumption

When available, measured water quality data were used to represent the NPDES and reuse facilities discharge flows and concentrations and to fill gaps in the data record. However, as shown above, measured data were not available for many parameters. Therefore, Tetra Tech identified default assumptions that were used for the NPDES facilities (***Table 12***) and reuse facilities (***Table 13***). These assumptions were based on available data from all facilities in the watershed. One of the NPDES facilities also had a corresponding reuse permit (FL0043214) and had only nutrient data for the reuse system discharge.

Table 12. Recommended default assumptions for missing water quality data for NPDES facilities

Constituent	Parameter ID	Minor (<1.0 MGD)	Major (>1.0 MGD)	Rationale
Total Phosphorus	TP	2.0 mg/L	2.0 mg/L	No measured DMR data. Based on average TP data from reuse facilities
Orthophosphate	PO_4	1.8 mg/L (90% of TP)	1.4 mg/L (70% of TP)	Professional recommendation
Organic Phosphorus	OrgP	0.2 mg/L (10% of TP)	0.6 mg/L (30% of TP)	Professional recommendation
Total Nitrogen	TN	1.0 mg/L (sum of species)	1.0 mg/L (sum of species)	Average of available data = 1.09 mg/L for FL0434698
Ammonia*	NH_3	0.05 mg/L (5% of TN)	0.05 mg/L (5% of TN)	No measured DMR data. Average percent (based on reuse facilities) of TN
Nitrate + Nitrite	NOx	0.55 mg/L (55% of TN)	0.55 mg/L (55% of TN)	No measured DMR data. Average percent (based on reuse facilities) of TN
Organic Nitrogen**	OrgN	0.4 mg/L (40% of TN)	0.4 mg/L (40% of TN)	Difference between TN and (NOx + NH_3)
Carbonaceous BOD5	CBOD5	6.0 mg/L	6.0 mg/L	Average of available data =6.04 mg/L for FL0434698
Dissolved Oxygen	DO	6.0 mg/L	6.0 mg/L	Average of available data =5.5 mg/L; range of 2.61 - 8.47 mg/L
Total Suspended Solids	TSS	4.0 mg/L	4.0 mg/L	No measured DMR data. Based on average TSS data from reuse facilities
Water Temperature	WTEM	20.0 °C October through March 30.0 °C April through September	20.0 °C October through March 30.0 °C April through September	Professional recommendation

Table 13. Recommended default assumptions for missing water quality data for reuse facilities

Constituent	Parameter ID	Minor (<1.0 MGD)	Major (>1.0 MGD)	Rationale
Total Phosphorus	TP	2.0 mg/L	2.0 mg/L	Average of available data = 1.8 mg/L; range of 0.75 – 3.74 mg/L
Orthophosphate	PO_4	1.8 mg/L (90% of TP)	1.4 mg/L (70% of TP)	Professional recommendation
Organic Phosphorus	OrgP	0.2 mg/L (10% of TP)	0.6 mg/L (30% of TP)	Professional recommendation
Total Nitrogen	TN	12.0 mg/L (sum of species)	12.0 mg/L (sum of species)	Average of available data = 12.11 mg/L; range of 2.9 – 21.5 mg/L
Ammonia*	NH_3	0.6 mg/L (5% of TN)	0.6 mg/L (5% of TN)	Average percent of TN
Nitrate + Nitrite	NOx	6.0 mg/L (55% of TN)	6.0 mg/L (55% of TN)	Average percent of TN for FL0043214
Organic Nitrogen**	OrgN	5.4 mg/L (40% of TN)	5.4 mg/L (40% of TN)	Difference between TN and (NOx + NH_3)
Carbonaceous BOD5	CBOD5	4.0 mg/L	4.0 mg/L	Average of available data = 4.18 mg/L; range of 2.7 - 5.4 mg/L
Dissolved Oxygen	DO	6.0 mg/L	6.0 mg/L	Professional recommendation
Total Suspended Solids	TSS	4.0 mg/L	4.0 mg/L	Average of available data = 4.2 mg/L; range of 2.1 - 6.7 mg/L
Water Temperature	WTEM	20.0 °C October through March 30.0 °C April through September	20.0 °C October through March 30.0 °C April through September	Professional recommendation

* When both TN and NOx were available in raw data, ammonia concentrations were calculated as: $NH_3 = 10\% \times (TN - NO_x)$

** When both TN and NOx were available in raw data, organic nitrogen concentrations were calculated as: $OrgN = 90\% \times (TN - NOx)$

2.3 AGRICULTURAL IRRIGATION

Agricultural irrigation will be applied directly to the land surface. Agricultural irrigation time series will be developed using crop water demand, growth coefficients, and evapotranspiration data.

2.3.1 Agricultural Irrigation Water Demand

Using the Florida Department of Agriculture and Consumer Service's (FDACS') Florida Statewide Agricultural Irrigation Demand Geodatabase 12 (FSAID12), the irrigated acreage of each crop category was determined for the St. Lucie River and Estuary watershed model (***Figure 4***). Crops requiring irrigation in the St. Lucie River and Estuary watershed were classified into the following five crop categories: 1) sugarcane, 2) nurseries/ornamentals/vineyards, (3) citrus groves/other groves, (4) all other crops (including blueberries, melons, peppers, small vegetables, and tomatoes), and 5) pasture. ***Table 14*** summarizes the total areas and irrigated areas by major crop category and growing season for 2023 from FSAID 12 geodatabase (FDACS, 2025) in the St. Lucie River and Estuary watershed.

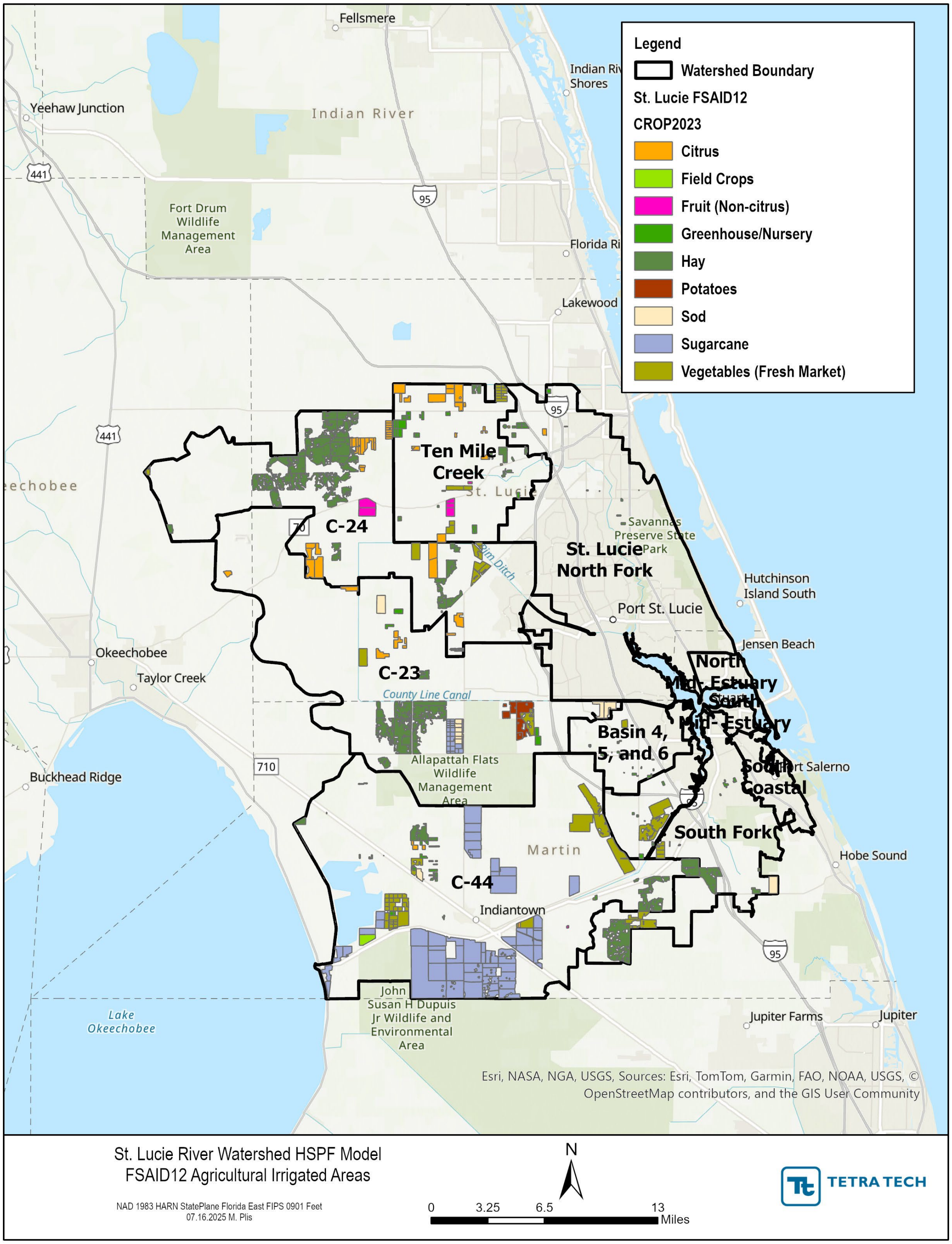

Figure 4. Spatial coverage of FSAID Agricultural Irrigated Areas in 2023 in St. Lucie River and Estuary watershed

Table 14. Total acreage, irrigated acreage, and growing season for the major crop categories in the St. Lucie River and Estuary watershed in 2023

Crop Category	Crop Sub-category	Growing Season	Total Area (acres)	Irrigated Area (acres)
Sugar Cane	Sugar Cane	Perennial	20,416.3	20,416.3
Nurseries, Ornamentals, and Vineyards	Container Nursery Field Nursery Nursery Ornamentals Palm Nursery Tree Nurseries Sod	Perennial	5,349.7	3,713.5
Citrus Groves / Other Groves	Citrus Lemons	Perennial	5,841.5	5,788.4
Row and Field Crops	Pongamia Tropical Fruit Corn Small Vegetable Tomatoes Potatoes	September - March	11,495.9	11,495.9
Pasture	Bermudagrass Hay Pasture Improved Pasture	Perennial	18,482.3	18,482.3
Total	-	-	**61,585**	**59,896.3**

For each major crop category, an associated monthly crop evapotranspiration coefficient was determined using information from various sources. The SFWMD Water Use Division uses a modified Blaney-Criddle equation to determine irrigation needs (SFWMD, Accessed 2025; SFWMD, 2000). ***Table 15*** through ***Table 17*** show the monthly growth coefficient for perennial and annual crops. The monthly coefficients for perennial crops are based on the water needs of the plant based on the growth stage throughout the year (such as bloom, fruit set, fruit development, and fruit maturation (SFWMD, 2000; SFWMD, Accessed 2025). The coefficients for the annual crops are based on the water demand of the plant at different stages in the three- or four-month growing cycle (such as planting, initiation of flowering, maturity, and harvest) (SFWMD, Accessed 2025).

Table 15. Monthly growth coefficient for perennial crops

Crop	Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Citrus	SFWMD	0.63	0.66	0.68	0.70	0.71	0.71	0.71	0.71	0.70	0.68	0.67	0.64
Sugarcane	SFWMD	0.39	0.30	0.53	0.61	0.70	0.79	0.79	0.84	0.73	0.88	0.72	0.69
Pasture	SFWMD	0.46	0.60	0.63	0.68	0.70	0.53	0.56	0.58	0.52	0.53	0.49	0.44

Table 16. Monthly growth coefficients for annual crops – three-month growing season

Crop	Source	Month 1 of growing season	Month 2 of growing season	Month 3 of growing season
Tomatoes	SFWMD	0.50	0.93	0.84
Potatoes	SFWMD	0.54	1.18	1.32
Small Vegetables	SFWMD	0.54	0.81	0.62
Corn	SFWMD	0.57	0.99	1.03

Table 17. Monthly growth coefficients for annual crops – four-month growing season

Crop	Source	Month 1 of growing season	Month 2 of growing season	Month 3 of growing season	Month 4 of growing season
Tomatoes	SFWMD	0.47	0.76	1.00	0.80
Potatoes	SFWMD	0.46	0.96	1.33	1.30
Small Vegetables	SFWMD	0.48	0.77	0.81	0.57
Corn	SFWMD	0.52	0.85	1.06	1.95

Also, the Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS) model provided information on the irrigated and total root depths by crops, crop water use coefficients, and allowable water use depletions for perennial and annual crops ***Table 18*** and ***Table 19*** (SJRWMD, 1990; SJRWMD, 2007).

Table 18. Perennial crops water use coefficient (Kc) data by month from AFSIRS

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Citrus	0.70	0.70	0.70	0.80	0.88	0.97	1.05	1.05	1.05	1.05	1.05	0.80
Sugarcane	0.80	0.60	0.55	0.80	0.95	1.00	1.05	1.05	1.05	1.00	0.95	0.90
Pasture	0.65	0.70	0.75	0.90	0.90	0.95	0.95	0.95	0.90	0.80	0.70	0.65
Container nursery	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Field Nursery	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sod	0.92	0.92	0.92	0.98	0.92	0.92	0.88	0.88	0.88	0.88	0.88	0.88

Table 19. Root zone and water use coefficient data (Kc) for annual crops from AFSIRS

Crop	Minimum Irrigated Crop Root Depth at Beginning of Growing Season (in)	Maximum Irrigated Crop Root Depth at Peak Growth Stage (in)	Kc for Root Depth at Beginning of Growing Season	Kc for Root Depth at Peak Growth Stage
Tomatoes	9	12	1.05	0.75
Potatoes	12	18	1.05	0.70
Small Vegetables	8	12	1.00	0.85
Corn	12	18	1.05	0.55

Also, the University of Florida – Institute of Food and Agricultural Science (IFAS) reported crop coefficients for perennial and annual crops that are commonly grown in Florida (Kisekka, 2013). ***Table 20*** and ***Table 21*** show the crop coefficients for the major perennial and annual crops in Florida, respectively.

Table 20. Typical crop coefficient (Kc) for a perennial crop (citrus) in Florida

Month	Citrus
January	0.79
February	0.86
March	0.93
April	0.97
May	1.03
June	1.05
July	1.05
August	1.03
September	1.00
October	0.95
November	0.87
December	0.79

Table 21. Typical crop coefficients (Kc) at various growth stages for annual crops commonly grown in Florida

Crop	Initial Stage	Mid-Stage	Late-Stage
Tomatoes	0.4	0.9	0.75
Green pepper	-	1.05	0.9
Strawberries	0.2-0.4	0.5	0.6

For sugar cane and pasture, the monthly crop evapotranspiration coefficients were determined using a monthly average of the data from FDACS and AFSIRS presented in ***Table 15*** and ***Table 18***. For nurseries/ornamentals/vineyards/sod, the monthly crop evapotranspiration coefficients were determined from the AFSIRS data in ***Table 18***. For citrus groves/other groves, the monthly evapotranspiration coefficients were determined using a monthly average of the data from FDACS, AFSIRS, and IFAS (***Table 15*** , ***Table 18***, and ***Table 20***).

For all other crops (annual crops), the monthly crop evapotranspiration coefficients were determined using a weighted average of the various crop coefficients (corn, small vegetables, potatoes, and tomatoes) found in ***Table 16***, ***Table 17***, ***Table 19***, and ***Table 21***. Since this category includes crops with different growing seasons, only the crops growing in any specific month were used for weighing in that month. ***Table 22*** summarizes the monthly crop evapotranspiration rates by major crop category.

Table 22. Monthly crop coefficients (Kc) rate for major crop categories in the St. Lucie River and Estuary watershed model

Month	Sugar Cane	Nurseries, Ornamentals, Vineyards, and Sod	Citrus Groves/ Other Groves	All Other Crops	Pasture
January	0.60	0.96	0.77	0.76	0.56
February	0.45	0.96	0.71	0.81	0.56
March	0.54	0.96	0.74	0.75	0.65
April	0.71	0.99	0.77	0.74	0.69
May	0.83	0.96	0.82	0.00	0.79
June	0.90	0.96	0.87	0.00	0.80
July	0.92	0.94	0.91	0.00	0.74
August	0.95	0.94	0.94	0.00	0.76
September	0.89	0.94	0.93	0.60	0.77
October	0.94	0.94	0.92	0.70	0.71
November	0.84	0.94	0.89	0.80	0.67
December	0.80	0.94	0.86	0.79	0.60

The FSAID 12 geodatabase provided information on irrigated crop types, irrigation systems, and irrigated acres. Tetra Tech used the efficiency of the seven irrigation methods in the AFRIS model (SJRWMD, 2007) (***Table 23***) to calculate area-weighted irrigation efficiency for each major crop category in the St. Lucie River and Estuary watershed (***Table 24***).

Table 23. Irrigation efficiency for the seven irrigation methods used in the AFRIS model

Irrigation System	AFSIRS Efficiency
Center Pivot and Linear	75%
Drip	85%
Micro spray	80%
Impact Sprinkler (Spray Head Sprinkler, Sprinkler, Impact Sprinkler, and Overhead)	75%
Container Nursery	20%
Portable Gun and Traveling Gun	70%
Gravity Systems (Seepage and Flood)	50%

Table 24. Area-weighted irrigation efficiency for each major crop category

Crop Category	Irrigation Efficiency
Sugar Cane	50%
Nurseries, Ornamentals, and Vineyards	52%
Citrus Groves / Other Groves	77%
Row and Field Crops	58%
Pasture	51%

2.3.2 Agricultural Irrigation Water Supply Sources

The permitted wells and boreholes shapefile was downloaded from the SFWMD Geospatial Open Data portal to establish irrigation sources in the model. This dataset provides information on the source of groundwater pumping, such as the Floridan aquifer system, Upper Floridan aquifer, Surficial aquifer, and undefined aquifer. After filtering for wells and boreholes status (active and unknown) and purpose of wells (withdrawal), 50 permitted wells and boreholes were identified in the St. Lucie River and Estuary watershed (***Figure 5***). The information on pump capacity was not provided in the permitted shapefile database. In agricultural areas that did not contain permitted wells and boreholes, it was assumed that withdrawal from local reaches and canals was the primary source of irrigation water.

Tetra Tech downloaded the above-ground impoundment (AGI) GIS shapefile from the SFWMD portal (SFWMD, 2018). AGIs are surrounded by a dike, and water is pumped into them for temporary storage. The dataset was filtered for agricultural land use, and out of 100 permits, 79 were agricultural permits with active permit status. However, 70 of those reported their final activity date before 2008, and the remaining nine permits reported final activity between 2008 and 2014. No information regarding pump capacity was publicly available. ***Figure 5*** shows the location of 39 active AGI permits in the St. Lucie River and Estuary watershed. Also, Tetra Tech downloaded the consumptive use permit GIS shapefile from the SFWMD portal, but the database did not indicate the source of the irrigation water.

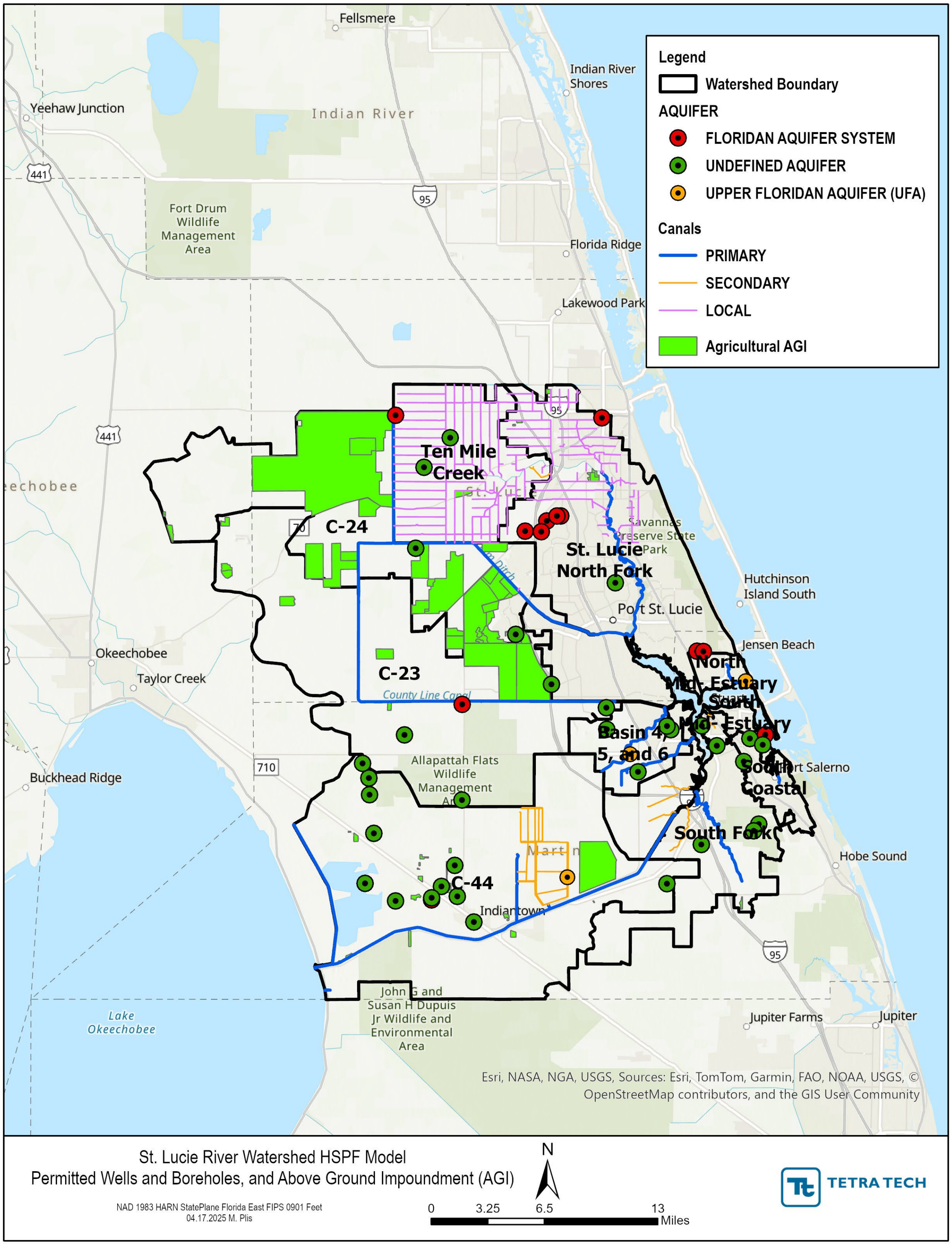

Figure 5. Spatial coverage of permitted wells and boreholes, and agricultural AGIs in the St. Lucie River and Estuary watershed

2.4 REGIONAL PROJECT OPERATIONS

2.4.1 Bluefield Water Farm

The purpose of the Bluefield Water Farm is to collect, divert, and store surface water from canals during periods when the discharges of excess water may harm the coastal estuaries. The operational intent of the project is to retain excess water to reduce freshwater discharges to tide through the C-23 Canal. The system includes six storage cells and five pump stations. Water from the C-23 Canal is pumped into Cell 2 of the Bluefield Water Farm using an existing retrofitted pump station (Pump Station 3) that includes two diesel pumps with a combined flow rate of 111 cubic feet per second (cfs) (50,000 gallons per minute [gpm]). Construction was completed in 2021 the Bluefield Water Farm started full operation in January 2023 (***Figure 6***) (Hazen, 2019). There are no data available regarding the pumping station withdrawal from C-23 into Cell 2 of the Bluefield water farm for inclusion in the model.

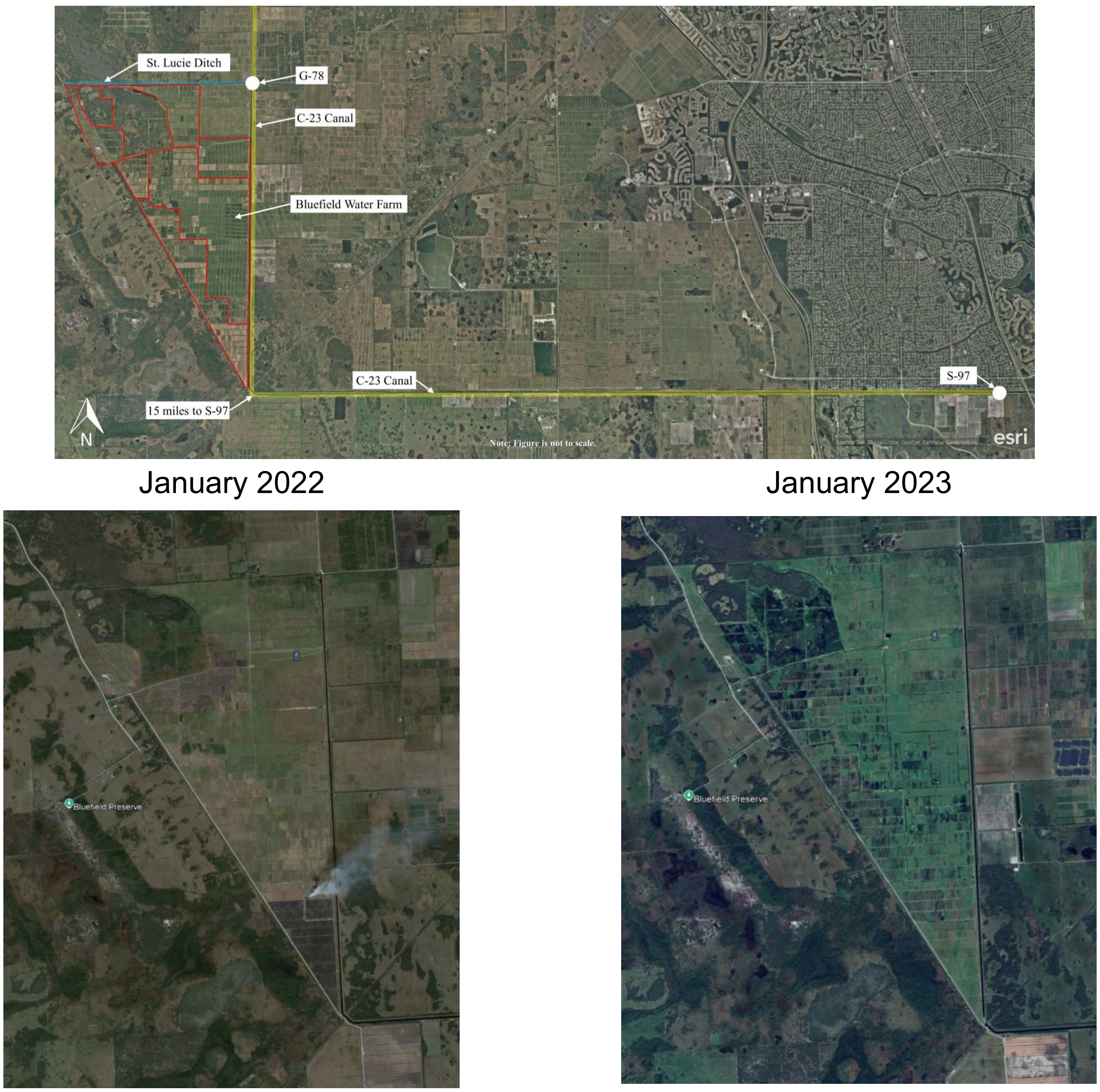

Figure 6. Aerial imagery of Bluefield Water Farm (accessed in March 2025)

2.4.2 C-44 Reservoir and Stormwater Treatment Area (STA)

Overall, the C-44 Reservoir and STA covers about 8% of the C-44 basin area and will pump water from the C-44 into the reservoir via the intake canal to attenuate freshwater flows to the St. Lucie Estuary and allow initial treatment of the water. Water will be distributed from the reservoir to the STA via outflow structure and distribution canals for additional treatment. Treated water will be released to the C-44 via the seepage collection canals and outlet canals. The aerial imagery showed the C-44 Reservoir and STA started operating in January 2022 (***Figure 7***). The initial fill for the STA was initiated in November 2019 (STA construction was completed prior to reservoir completion to facilitate vegetation growth). The completion of the structure was scheduled for September 2021. After successful completion of this plan, the entire facility (C-44 Reservoir and STA), will enter the Operating Testing and Monitoring Phase for up to two years to allow time to perform as intended before it is transferred to SFWMD for the Operational, Maintenance, Repair, Replacement, and Rehabilitation phase (SFWMD, 2021).

The C-44 Reservoir and STA consists of an 3,400 acre above ground reservoir which captures flow from the C-44, and 6,300 acres of STA cells to treat the water before it is released back to the C-44. The project includes the following (SFWMD, 2021):

- **Inflow to C-44 Reservoir and STA**: Water enters the 3,400-acre above ground reservoir from the C-44 Canal via the intake canal (C-400) and pump station (S-401) located in the southeastern corner (***Table 25***). Water levels in the reservoir will range from elevation 29.0 feet North American Vertical Datum of 1988 (NAVD88) (the bottom of the reservoir is at approximately elevation 26.0 feet NAVD88) to elevation 41.0 feet NAVD88.
- **Reservoir Function**: The reservoir captures and stores flow from the C-44 Canal, preparing it for treatment.
- **Gravity Release**: Water is released from the reservoir by gravity through an outlet structure (S-402) into the distribution canal (C-400W, C-401N) (***Table 26***).
- **Distribution to STA Cells**: Flow from the reservoir through S-402 structure conveyed via two 7 foot by 7 foot box culverts through the embankment to the distribution canal (C-401N). The distribution canal delivers water at a uniform elevation to six STA cells.
- **Flow Control into STA Cells**: Water flowing into the STA cells is regulated using gated culverts. At a minimum, some flow from the reservoir to the STA is required on a regular basis to offset seepage and evapotranspiration losses to avoid dry-out. The operating flow to the STA under normal operations is 600 cfs.
- **Release from STA Cells**: Water is released from the STA cells to the STA collection canals, controlled by weir outlet structures.
- **Outlet Structure (S-404 Spillway and S-404S Mid Spillway)**: The STAs cells receive water from the C-401N and C-401S distribution canals through inlet gates and release water over weir outlet structures to the drainage/collection canals (C-402E and C- 402W). Treated water from the STA collection canals (C-402E/C-402W) is released back into the C-44 Canal via structures S-404 and S404S (***Table 27***). The purpose of S-404 is to control the flow from the STA system by maintaining water surface levels within the C-402W and C-402E collection canals S-404 has measured flow since May 2021. The S-404S is located downstream of S-404 at the confluence of the C-44 Canal and was formerly operated by the U.S. Army Corps of Engineers (USACE) as the Mid Spillway prior to the C-44 Reservoir and STA project. Water quality data are available for temperature, DO, TN, NH3, NOx, OrgP, and PO_4 at S404 from July 2021 to December 2023.
- **Alternate STA pump station S-401T:** S-401T is operated when the C-44 Reservoir is not in use to maintain minimum water levels in the STAs and prevent dry-out conditions. This structure delivers water from the C-44

Intake Canal (C-400) to STA cell 2, facilitating storage and distribution to the other five STA cells. S-401T has been in service since November 7, 2019. During this operation, the direction of flow within STA cell 2 is reversed (south to north), and the cell monitoring will also be adjusted accordingly. Flow time series for S-401T are available from February 2021 (***Table 28***).

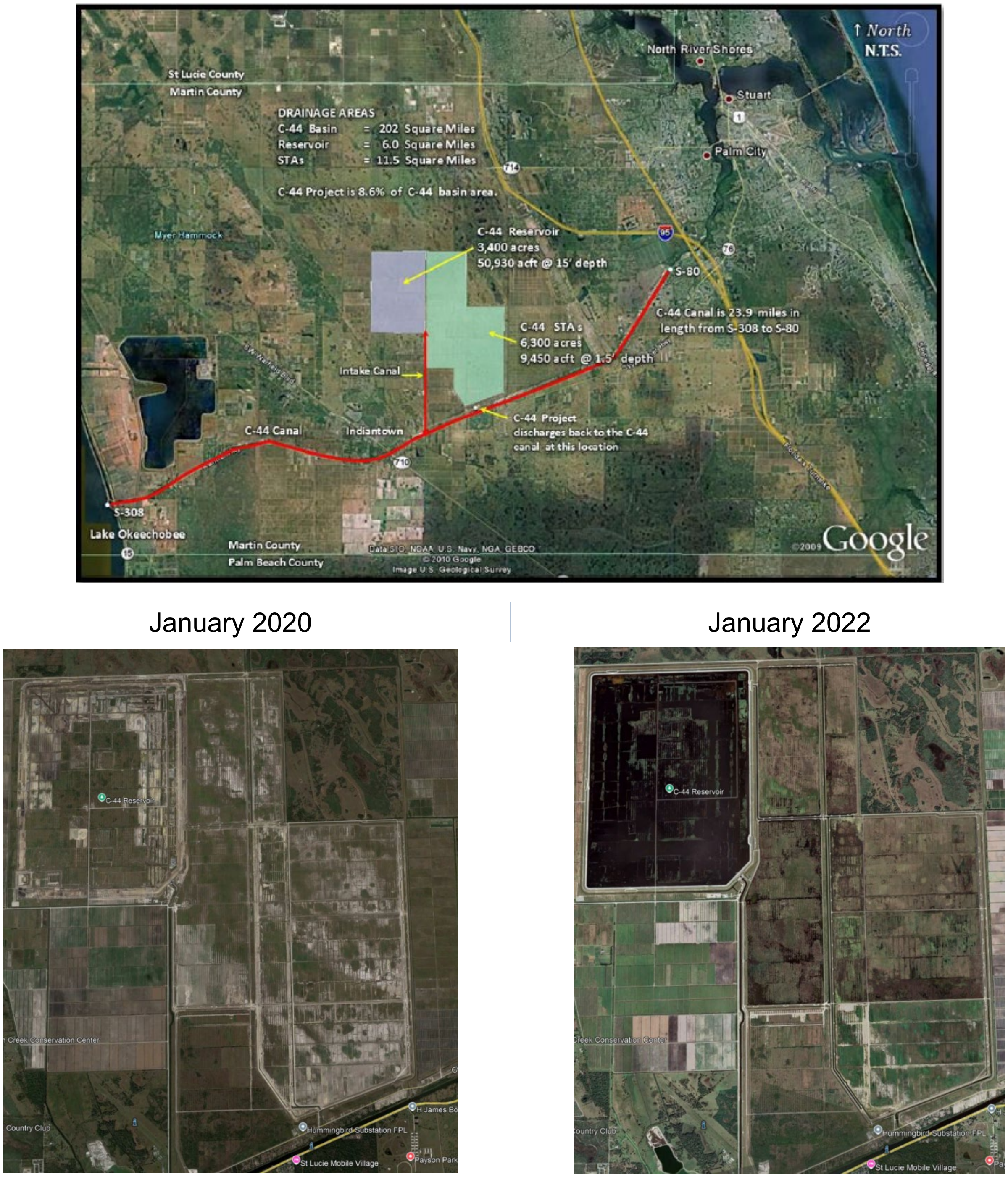

Figure 7. Aerial imagery of C-44 Reservoir and STA (accessed in March 2025)

Table 25. Monthly average withdrawal (cfs) from C-44 Canal to C-44 Reservoir via C-400 Canal and S-401 pump station

Month	2021	2022	2023
January	-	10,912.6	0.0
February	-	9,746.2	604.8
March	-	1,969.8	994.8
April	-	1,391.1	1,802.0
May	-	1,235.2	122.9
June	-	118.5	282.4
July	-	0.0	4,755.6
August	-	0.0	2,837.3
September	-	3,142.5	2,298.2
October	-	8,219.1	6,319.1
November	-	461.1	0.0
December	-	1,161.9	795.0

Table 26. Total monthly withdrawal (cfs) from the C-44 Reservoir into the distribution canal C-400W via S-402 structure

Month	2021	2022	2023
January	-	-	1,738.7
February	-	0.0	981.4
March	-	18.4	2,292.3
April	-	0.0	635.1
May	-	0.0	302.9
June	-	8,568.1	1,454.8
July	-	224.1	1,519.1
August	-	501.6	998.0
September	-	0.0	1,326.4
October	-	530.1	857.2
November	-	116.0	1,555.1
December	-	736.1	828.3

Table 27.Total monthly flow (cfs) released from STAs cells (Cell 6) to C-44 Canal via S-404 structure

Month	2021	2022	2023
January	-	327.8	535.5
February	-	350.1	475.5
March	-	339.5	519.6

Month	2021	2022	2023
April	-	583.8	625.5
May	24.3	881.7	436.6
June	612.8	15,803.4	538.4
July	3,307.4	4,173.3	425.2
August	2,259.7	339.5	611.4
September	1,407.8	1,938.4	492.3
October	200.7	596.4	1,156.9
November	177.7	766.3	580.7
December	201.8	510.9	529.2

Table 28. Total monthly withdrawal (cfs) from C-400 intake canal to STA via S-401T

Month	2021	2022	2023
January	-	758.5	-
February	1,052.0	1,629.8	-
March	1,847.8	2,261.6	-
April	1,335.2	3,193.9	-
May	2,335.8	1,354.9	-
June	4,424.5	0.0	-
July	680.7	0.0	-
August	749.5	0.0	-
September	380.6	-	-
October	400.2	-	-
November	577.1	0.0	-
December	1,129.4	0.0	-

2.4.2.1 Normal Operations with No Regulatory Release

When Lake Okeechobee is not making regulatory releases, structures S-308 and S-80 are operated to maintain the C-44 Canal without releasing water to tide. The optimal stage for the C-44 Canal is between 14.0 and 14.5 feet National Geodetic Vertical Datum of 1929 (NGVD29), with a minimum elevation of 12.56 feet NGVD29 for navigation. The C-44 Reservoir and STA project aims to balance canal levels within these ranges while limiting S-80 releases to the St. Lucie Estuary. Under normal flow conditions of 600 cfs, the STA maintains an average depth of 1.5 feet, capturing basin runoff for treatment and vegetation maintenance to avoid dry-out.

When Lake Okeechobee's elevation is below 14.0 feet NGVD29, the S-308 lock is typically open, allowing water to flow back into the lake while maintaining canal levels. Coordination between SFWMD and USACE is crucial during wet conditions to manage basin runoff and canal staging. In dry conditions, the S-401 pump station is usually off, and S-404 supplies water to the canal. Prioritizing STA hydration, releases from the STAs to the canal are halted when the reservoir reaches 3 feet (29.0 feet NAVD88) or when STA depths drop below 0.75 feet. Releases from the reservoir will resume only when the reservoir exceeds 29.0 feet NAVD88 and the STA reaches a normal depth of 1.5 feet. When Lake Okeechobee exceeds 14.0 feet NGVD29, releases through S-80 are made to maintain canal levels, and the C-44 Reservoir and STA captures inflows to attenuate flow at S-80. If the canal stage reaches 15.5 feet NGVD29 or higher, releases from the reservoir to the STA are restricted unless S-80 is open and releases are occurring. Under high flow conditions, if flows at S-80 exceed 2,000 cfs, releases from the reservoir to the STAs are not permitted unless the reservoir elevation exceeds 41.0 feet NAVD88 due to rainfall or other factors, ensuring runoff remains less than pre-project conditions (SFWMD, 2021).

2.4.2.2 Operations with Regulatory Releases

When Lake Okeechobee is making regulatory releases through S-308 and S-80, both structures are operated to manage water levels in Lake Okeechobee and the C-44 Canal, following guidance from the USACE under Lake Okeechobee regulatory releases (Lake Okeechobee Regulation Schedule [LORS] 2008) (SFWMD, 2021). During wet hydrologic conditions, inflows to the reservoir from S-401 will exceed outflows to the C-44 Canal to help attenuate flows to the St. Lucie Estuary, focusing on capturing local basin runoff without reducing regulatory releases. As the reservoir approaches an elevation of 41.0 feet NAVD88, inflows from S-401 will be matched by outflows from S-404 to the C-44 Canal for water treatment benefits. Water will continue to be pumped into the reservoir as long as the C-44 Canal remains above the minimum stage of 12.56 feet NGVD29. Releases from the STAs will be adjusted based on conditions at S-80 and the St. Lucie Estuary to minimize releases and will be halted when the reservoir reaches 29.0 feet NAVD88 or when the STAs drop below a minimum depth of 0.75 feet (SFWMD, 2021).

2.4.3 Caulkins Water Farm

The objective of Caulkins Water Farm (3,275 acres) is to capture and redirect surface water from the C-44 Canal during times when discharges could negatively impact coastal estuaries. The AGI (permit number: 43-00360-S) has created a 3,014 acre water storage area and has been designed to store a maximum of four feet of water. Water from the C-44 Canal is pumped into the AGI using an existing pump station that includes three electric pumps with a combined capacity of approximately 105,000 gpm (464 acre-feet/day or 234 cfs). The farm began operations in 2018 (***Figure 8***) (SFWMD, 2019). There are no data available regarding the pumping station withdrawal from C-44 into the Caulkins Water Farm. Inflow water quality data (TN, TP, NOx, total Kjeldahl nitrogen [TKN], and TSS) from CAULK-IN (Spur canal between C44 and Caulkins Citrus) were available from February 2014 to October 2016. No water quality data were available from outfall CAULK-OUTN (northern outflow from Caulkins Citrus) and CAULK-OUTS (southern outflow from Caulkins Citrus), and CAUEX-OUT (outfall discharge located on the northwest corner of the Caulkins Water Farm Expansion).

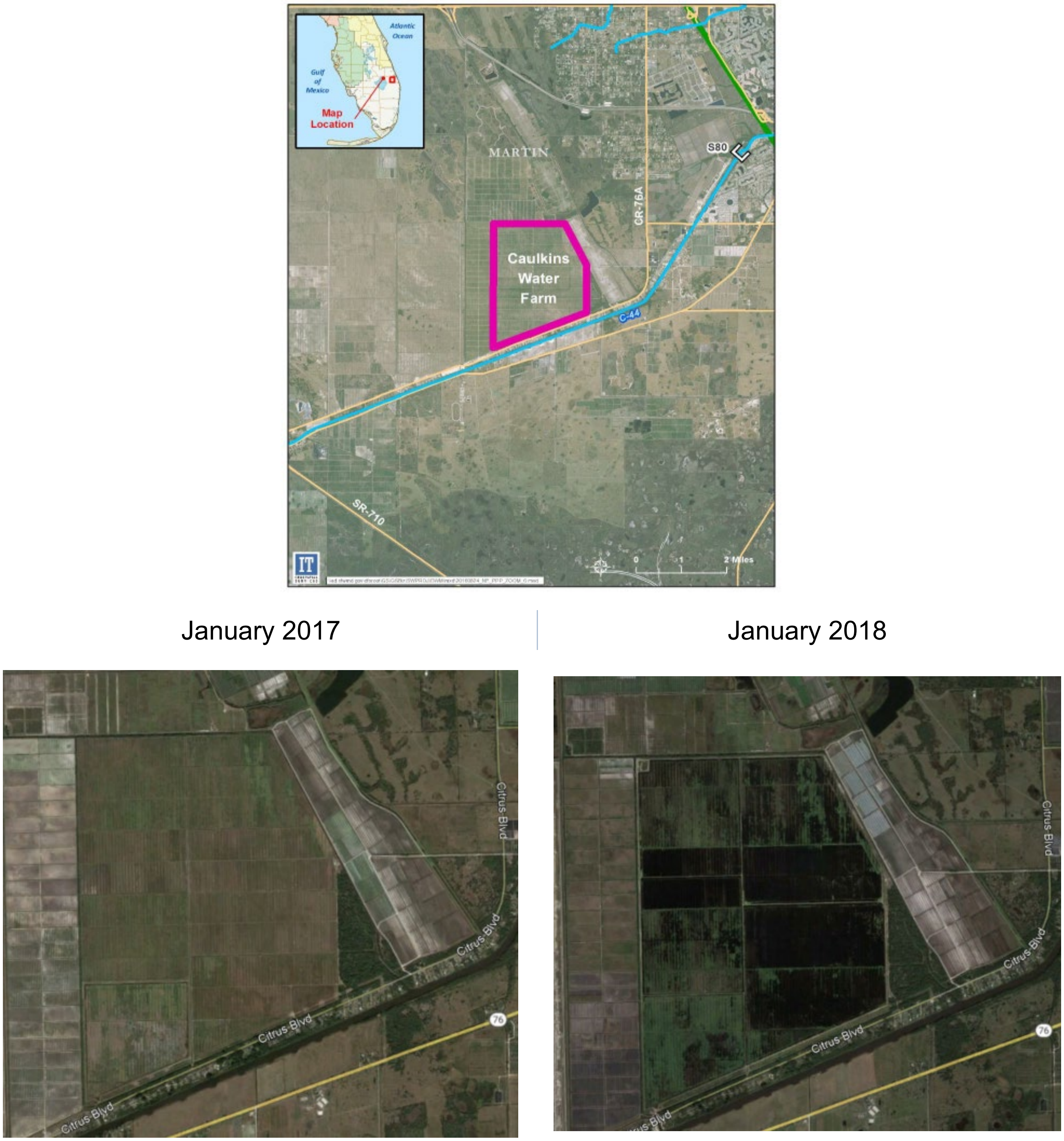

Figure 8. Aerial imagery of Caulkins Water Farm (accessed in March 2025)

2.4.4 Section C Dispersed Water Management (DWM) Project

Section C DWM (Indian River Lagoon AGI permit#56-00042-S) is a shallow depth AGI that will provide interim storage benefits to the C-23/C-24 basins, which contribute water to the St. Lucie Estuary. With approximately 1,240 acre-feet of static storage (one-time fill), the Section C DWM is estimated to provide up to 1,700 acre-feet of retention and storage per year. The operational schedule is as follow (SFWMD, 2016):

- Wet Season (June through October): The proposed operational schedule is to pump water from the C-23 Canal into the AGI during the wet season when C-23 Canal stages reach 19 feet NAVD or when SFWMD's operational staff deems there is excess surface water in the basin.
- Dry Season (November through May): During an average annual dry season, excess surface waters from the C-23 basin are not anticipated to be available to pump onto the site since the C-23 Canal also serves as a source of irrigation water supply to local agricultural operations with existing consumptive use permits. Seepage and evapotranspiration losses are expected to bring the site back to seasonal baseline hydrologic conditions. During an average annual dry season, the site will be a rainfall driven system.

Aerial imagery shows that the Section C AGI started operation in 2017 (***Figure 9***). There are no data available regarding the pumping station withdrawal from C-23 canal into the Indian River Lagoon AGI.

Figure 9. Aerial imagery of Section C AGI (accessed in March 2025)

2.4.5 Spur Land and Cattle Water Farm

The Spur Land and Cattle Water Farm (Bull Hammock Ranch AGI permit# 43-00062-S) project is an existing water management area totaling approximately 210 acres and consisting of a 60-acre AGI and 150 acres of adjacent marsh wetlands (***Figure 10***). The main goal is to create regional storage by collecting direct rainfall and runoff from the Main Ditch, which drains areas south of Martin Highway and Allapattah Parcel C. This approach aims to decrease discharge through PC32 and manage excess water from the C-23 Canal. The project is not required to pump more than 1,500 acre-feet per year (SFWMD, 2024). Water quality data for TN, NOx, TP, and TSS from SPUR-IN (inflow to Spur Land Impoundment) were available from February 2015 to July 2018, and limited water quality data were available from 2015 to 2018 from SPUR-OUT (discharge from Spur Land Impoundment) into C-23 Canal. However, there are no data available for inflow and outflow discharges.

Figure 10. Aerial imagery of Spur Land and Cattle Water Farm (accessed in March 2025)

2.4.6 Ten Mile Creek Water Preserve Area

The Ten Mile Creek Water Preserve Area is located at the outlet of the 30,682-acre Ten Mile Creek Basin in St. Lucie County. The primary operational objective of the Ten Mile Creek Water Preserve Area is to improve the timing of water discharged into the North Fork of the St. Lucie River by capturing and storing stormwater runoff from the Ten Mile Creek basin. Secondary benefits of the project include reduction of sediment, TP, and TN loads to the St. Lucie River. The captured water is pumped from Ten Mile Creek into the Water Preserve Area via the S-382 pump station on the northern levee adjacent to the creek (***Table 27***). The S-383 interior structure delivers the water into the polishing cell by gravity flow through a culvert or via two small pumps. The S-384 box culvert at the polishing cell outfall conveys treated water to the creek immediately downstream of the Gordy Road Structure to C-96 and from there to Ten Mile Creek River (***Table 28***). The S-382 structure has a return bay (a gated culvert), which provides the ability to discharge from the Water Storage Area to the creek. The return bay's permitted discharge rate of 200 cfs lowers the Water Storage Area by about 0.75 feet per day when the Water Storage Area is completely inundated to elevation 22.0 feet (SFWMD, 2019).

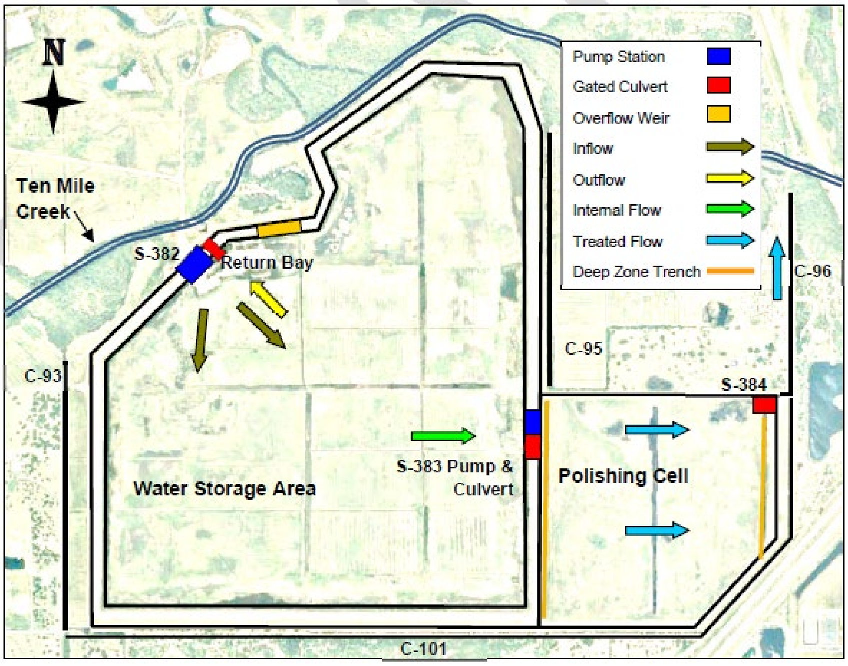

Figure 11. Ten Mile Creek Water Preserve Area map

Table 29. Total monthly withdrawal (cfs) from Ten Mile Creek into Water Preserve Area via S-382 pump station (passive operation before 2020)

Month	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	-	99.2	0.2	0.0	0.0	1,610.5	0.0	0.0	0.0	0.0	0.0	124.2	247.8	346.9	211.7	528.3	572.7
February	-	73.8	1.0	0.0	0.0	255.1	0.0	0.0	0.0	0.2	0.0	163.7	3.8	127.1	159.2	516.1	575.8
March	-	443.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	191.3	173.3	218.4	261.2	347.9	283.4
April	-	146.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	155.6	0.0	257.3	150.1	295.2	377.7	246.1	276.3
May	-	110.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	199.0	0.0	388.3	85.3	70.8	148.6	213.9	282.0
June	-	3.6	0.0	0.0	0.0	0.0	0.0	0.0	389.5	50.8	558.6	64.8	147.7	146.8	172.0	260.3	229.5
July	-	1.0	0.0	0.0	0.0	0.0	0.0	0.0	345.3	450.8	654.5	218.2	263.8	3.9	356.4	481.7	0.0
August	327.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	475.9	302.2	396.1	358.2	11.4	186.1	510.7	184.3	209.3
September	221.0	131.0	0.0	0.0	0.0	0.0	0.0	0.0	151.6	312.8	463.8	307.9	489.2	142.1	948.0	671.6	0.0
October	81.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	143.1	11.4	558.0	656.3	488.7	357.9	1147.8	188.4	18.2
November	264.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.6	0.0	143.2	188.6	147.3	102.5	396.6	612.1	626.2
December	195.6	12.7	0.0	0.0	1082.2	0.0	0.0	0.0	0.0	0.0	140.8	181.8	160.6	194.7	999.8	0.6	774.0

Table 30. Total monthly releasing treated water (cfs) from polishing cell to C-96 via S-384 (passive operation before 2020)

Month	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	-	-	-	-	-	-	-	-	-	0.0	-	0.0	181.3	0.0	4.7	480.3	55.5
February	-	-	-	-	-	-	-	-	-	0.0	-	2.7	91.6	0.0	34.8	133.1	362.4
March	-	-	-	-	-	-	-	-	-	0.0	-	0.0	0.0	0.0	41.6	220.7	58.9
April	-	-	-	-	-	-	-	-	-	0.0	-	9.7	0.2	0.0	28.7	98.4	248.2
May	-	-	-	-	-	-	-	-	-	131.8	-	214.4	0.2	0.0	0.0	132.8	215.3
June	-	-	-	-	-	-	-	-	-	173.7	0.0	42.8	0.1	86.9	150.1	198.2	165.7
July	-	-	-	-	-	-	-	-	-	160.4	0.0	136.9	0.1	12.6	89.0	316.2	20.3
August	-	-	-	-	-	-	-	-	-	231.9	0.0	318.2	89.1	3.3	313.0	0.0	0.0
September	-	-	-	-	-	-	-	-	-	191.9	0.0	113.8	117.7	0.0	501.7	326.1	0.0
October	-	-	-	-	-	-	-	-	0.19	160.8	0.0	46.2	2.7	0.0	726.7	48.4	15.6
November	-	-	-	-	-	-	-	-	0.01	-	0.0	33.7	0.3	0.0	282.7	87.6	171.6
December	-	-	-	-	-	-	-	-	1.11	-	0.0	117.5	45.3	0.0	502.6	91.4	550.1

2.4.7 Summary of Available Regional Project Information

Table 31 summarizes the available withdrawal and release data for the regional project discussed above, along with Tetra Tech's recommendations for inclusion in the HSPF model. ***Figure 12*** illustrates the spatial coverage of recommended pumping and release facilities in the St. Lucie River Estuary watershed HSPF model.

Table 31. Withdrawal and release information for regional projects and recommendations for HSPF model inclusion

Project	Withdrawal Location	Release Location	Operational Start Date	Period of Available Data	Pumping/Release Facility	Include in HSPF Model
Bluefield Water Farm	Withdrawal	C-23 Canal	January 2023	-	Pump station 3	No
Bluefield Water Farm	Release	From Cell 6 to St. Lucie County ditch and culvert 9 to cell 4	-	-	-	No
C-44 Reservoir and STA	Withdrawal	C-44 Canal via intake canal C-400	January 2022	January 2022 – December 2023	S-401	Yes
C-44 Reservoir and STA	Alternative Withdrawal	C-44 Canal via intake canal C-400	February 2021	February 2021 – December 2022	S-401T	Yes- combined with S-401
C-44 Reservoir and STA	Release	C-44 Canal	May 2021	May 2021 – December 2023	S-404	Yes-discharge and water quality 2021-2023
Caulkins Water Farm	Withdrawal	C-44 Canal	January 2018	February 2014 – October 2016 (water quality)	CAULK-IN	No
Caulkins Water Farm	Release	Outfall ditch return to C-44	-	-	CAULK-OUTN, CAULK-OUTS, CAUEX-OUT	No
Section C DWM	Withdrawal	C-23 Canal	January 2017	-	Project Culvert (PC-52)	No
Section C DWM	Release	Emergency release structure into the ditch	-	-	-	No
Spur Land and Cattle Water Farm	Withdrawal	C-23	December 2014	February 2015 – July 2018 (water quality)	SPURIN	No

Project	Withdrawal Location	Release Location	Operational Start Date	Period of Available Data	Pumping/Release Facility	Include in HSPF Model
Spur Land and Cattle Water Farm	Release	C-23	-	February 2015 – July 2018 (water quality)	SPUROUT	No
Ten Mile Creek Preserve Area Operation Plan	Withdrawal	Ten Mile Creek	August 2007	August 2007 – December 2023	S-382	Yes-but return flow constituent concentration from S-384 is not available
Ten Mile Creek Preserve Area Operation Plan	Release	C-96 via polishing cell	October 2015	October 2015 – December 2023	S-384	Yes-but return flow constituent concentration from S-384 is not available

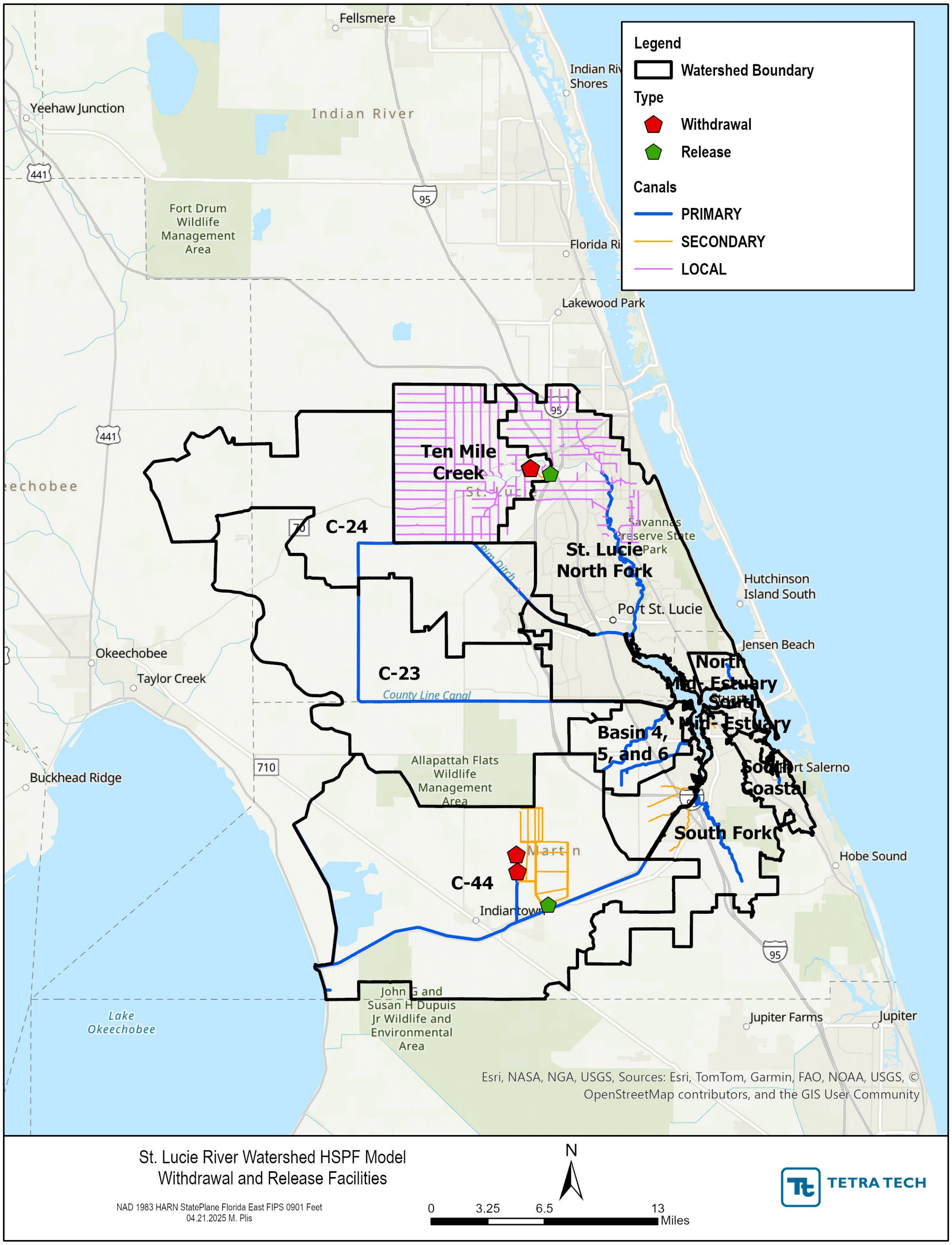

Figure 12. Spatial coverage of regional treatment facilities with available data for inclusion in the St. Lucie River and Estuary watershed HSPF model

2.5 UPSTREAM BOUNDARY CONDITION

The St. Lucie River and Estuary receives flows and loads from Lake Okeechobee. Water from Lake Okeechobee is released into the St. Lucie River at the S-308 Lock, which USACE controls. Water in the St. Lucie River is also pumped back into Lake Okeechobee, and this occurred 35% of the time during the data collection period for the model (January 1, 2008 through December 31, 2023). During pumping, the flow of water in the St. Lucie River reverses and moves towards Lake Okeechobee.

The St. Lucie River and Estuary HSPF watershed model incorporates an upstream boundary condition at the S-308 structure, which regulates water flow and quality inputs from Lake Okeechobee into the St. Lucie River (C-44 Canal). Developing an accurate time series for this boundary condition is important for representing flow and nutrient contributions to the watershed model from Lake Okeechobee.

2.5.1 Available Flow Gauges for Daily Average Flow at S-308 Lock

For the model time period of interest (January 1, 2008, to December 31, 2023), three flow gauges provided a record of daily average flow data relevant to the upstream boundary condition for the St. Lucie River (C-44 Canal):

1. ST. LUCIE CANAL BLW S-308, NR PORT MAYACA (AUX) FL (Site ID: 02276877, U.S. Geological Survey [USGS])
   - This flow gauge is located downstream of the S-308 Lock.
   - The period of record spans the full model simulation period.
   - Recorded streamflow during the simulation period range between a minimum of -3,510 cfs, indicating flow reversal to Lake Okeechobee, and a maximum of 4,680 cfs, with positive flows representing release from Lake Okeechobee to the St. Lucie Canal.
2. S-308 SPILLWAY AND SECTOR FLOW ON ST. LUCIE CANAL AT LAKE OKEECHOBEE (Site ID: S308_S, USACE)
   - This station is located at the S-308 structure itself.
   - Data are available for the entire period of interest.
   - Flows recorded at this station range from a minimum of -8,665 cfs to a maximum of 5,669 cfs during the model simulation period. Negative values represent reverse flows back into Lake Okeechobee, while positive values indicate water released into the St. Lucie Canal.
3. ST. LUCIE CANAL ABV S-80 NR STUART FL (Site ID: 02276998, USGS)
   - Located upstream of the S-80 structure, this gauge provides data starting later in the model period, with a record from July 15, 2017 through December 31, 2023.
   - Streamflow values range from a minimum of -206 cfs to a maximum of 6,430 cfs, capturing both reverse flows and lake releases.

The primary station for the flow boundary condition development is S308_S (USACE), with data gaps supplemented using flow records from 02276877 (USGS). The third station, 02276998 (USGS), provides valuable supporting data for the more downstream segment of the St. Lucie Canal starting in mid-2017. Together, these gauges provide a comprehensive coverage of flow dynamics, including periods of flow reversal and significant releases, throughout the St. Lucie River system.

A tabular summary of the three streamflow gauges evaluated for the Lake Okeechobee to St. Lucie Canal flow boundary condition development is provided in ***Table 32***. Additionally, a map displaying the streamflow gaging stations is included in ***Figure 13***.

Table 32. Summary of streamflow gages evaluated for the Lake Okeechobee to St. Lucie Canal boundary condition development

Site Description	Site ID (Org)	Coordinates (Latitude, Longitude)	Start Date (Within Model Period)	End Date (Within Model Period)	Minimum Streamflow (cfs)	Minimum Positive Streamflow (cfs)	Maximum Streamflow (cfs)
ST. LUCIE CANAL BLW S-308, NR PORT MAYACA (AUX) FL	02276877 (USGS)	(26.985533, -80.6156)	1/1/2008	12/31/2023	-3,510	0.01	4,680
S-308 SPILLWAY AND SECTOR FLOW ON ST. LUCIE CANAL AT LAKE OKEECHOBEE	S308_S (USACE)	(26.984749,-80.621157)	1/1/2008	12/31/2023	-8,665	0.40	5,669
ST LUCIE CANAL ABV S-80 NR STUART FL	02276998 (USGS)	(27.108667, -80.28725)	7/15/2017	12/31/2023	-206	0.53	6,430

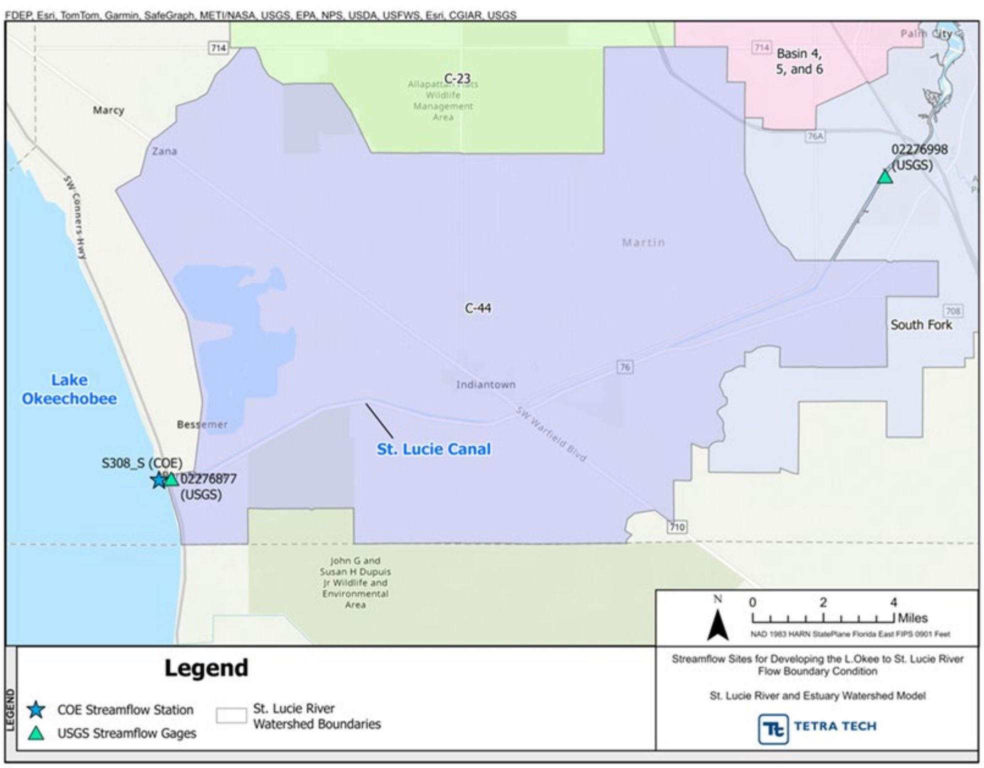

Figure 13. Streamflow gaging stations evaluated for the flow boundary condition processing for Lake Okeechobee to St. Lucie Canal

2.5.2 Available Water Quality Monitoring Stations at S-308 Lock

Measured water quality data from a small group of monitoring stations were evaluated and used to construct the water quality time series associated with positive flows from the S-308 Lock. Although water quality measurements near the S-308 Lock are sporadic, four water quality monitoring sites provide valuable constituent concentration measurements during the model time period. The following provides a summary of each site, including its location, monitoring period, and measured water quality parameters:

1. Site ID C44C1: S308C Collected on Canal Side of Structure (SFWMD)
   - This site is located on the canal side of the S-308 structure.
   - Water quality sampling at this location occurred from July 1, 2021, to August 11, 2023, with 12 observations recorded.
   - Key parameters measured include DO, NH_3, NOX, TN, PO_4, TP, WTEM, and phytoplankton (PHYTO).
2. Site ID S308LDS: S308 Lock Downstream (SFWMD)
   - This site is situated downstream of the S-308 Lock.
   - Sampling was conducted from January 22, 2023, to August 11, 2023, resulting in 11 observations.
   - Parameters analyzed include DO, NH_3, NOX, TN, PO_4, TP, WTEM, and PHYTO.
3. Site ID C44Canal-S308C: At Intersection of Herbert Hoover Dike and the East St. Lucie River (DEP)
   - Located at the intersection of the Herbert Hoover Dike and the East St. Lucie River.
   - The monitoring period for this site extends from October 16, 2020, to September 25, 2023, with 28 observations recorded.
   - Measured parameters include NH_3, NOX, TKN, PO_4, and TP.
4. Site ID L004: L.Okee-cntrl, 6.0 Statute Miles Due West of Buoy C#5 Adjacent to St. Lucie Canal (SFWMD)
   - This site is located in open waters of Lake Okeechobee.
   - Sampling occurred from January 14, 2008, to December 12, 2023, with 216 observations collected.
   - Key parameters measured include DO, NH_3, NOX, TKN, TN, PO_4, TP, WTEM, PHYTO, TSS, and total organic carbon (TOC).

A summary of these water quality monitoring stations, including sampling dates and observed parameters, is provided in ***Table 33***. Additionally, data availability for specific water quality parameters at each station is summarized in ***Table 34***. The spatial locations of these monitoring sites are depicted in ***Figure 14***, providing context for their geographic distribution within the St. Lucie Canal and Lake Okeechobee. These data are critical for constructing the water quality time series associated with inflows and outflows at the S-308 Lock.

Table 33. Summary of water quality monitoring stations evaluated for the Lake Okeechobee to St. Lucie Canal boundary condition development

Description	Site ID (Org)	Coordinates (Latitude, Longitude)	Start Date (Within Model Period)	End Date (Within Model Period)	Count of Individual Samples
S308C Collected on Canal Side of Structure	C44C1 (SFWMD)	(26.98498, -80.6209497)	7/1/2021	8/11/2023	12
S308 Lock Downstream	S308LDS (SFWMD)	(26.98447, -80.6196497)	1/22/2023	8/11/2023	11
At Intersection of Herbert Hoover Dike and the East St. Lucie River	C44Canal-S308C (DEP)	(26.985151688, -80.62070276)	10/16/2020	9/25/2023	28

Description	Site ID (Org)	Coordinates (Latitude, Longitude)	Start Date (Within Model Period)	End Date (Within Model Period)	Count of Individual Samples
L.Okee-cntrl, 6.0 Statute Miles Due West of Buoy C#5 Adjacent to St. Lucie Canal	L004 (SFWMD)	(26.9775,-80.709444)	1/14/2008	12/12/2023	216

Table 34. Data availability for water quality parameters of interest at evaluated monitoring stations for the Lake Okeechobee to St. Lucie Canal boundary condition development

Constituent	C44C1	S308LDS	C44Canal-S308C	L004
BOD (lbs)	-	-	-	-
DO (lbs)	X	X	-	X
NH_3 (lbs)	X	X	X	X
NOX (lbs)	X	X	X	X
TKN (lbs)	-	-	X	X
TN (lbs)	X	X	-	X
PO_4 (lbs)	X	X	X	X
TP (lbs)	X	X	X	X
TSS (tons)	-	-	-	X
WTEM (BTU)	X	X	-	X
PHYTO (lbs)	X	X	-	X
TOC (lbs)	-	-	-	X

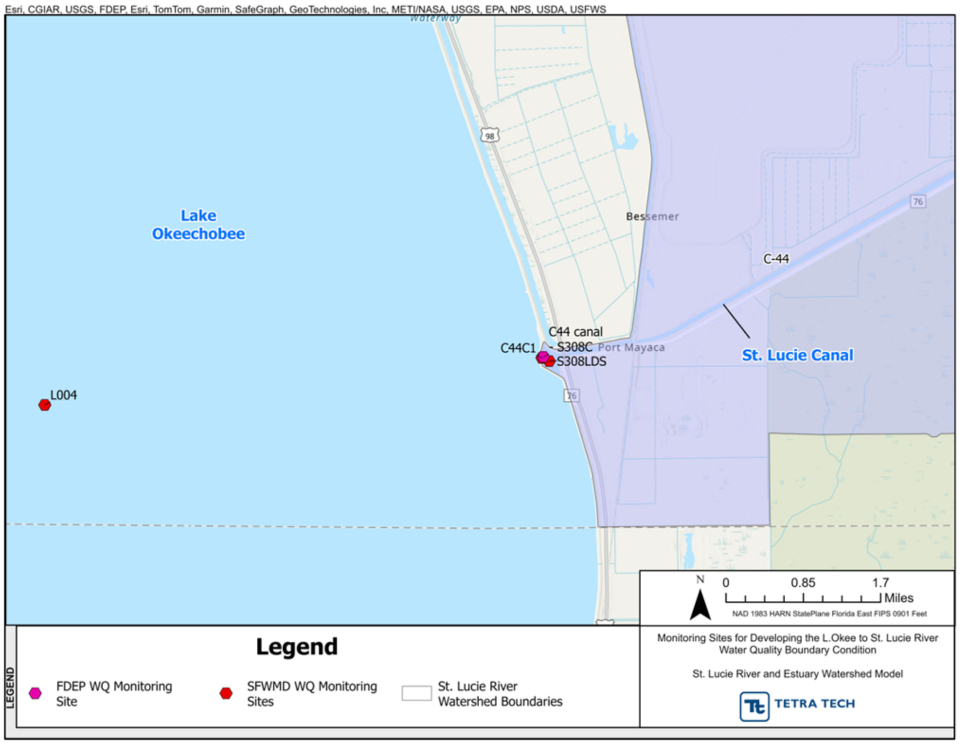

Figure 14. Monitoring stations evaluated for the water quality boundary condition processing for Lake Okeechobee to St. Lucie Canal

2.5.3 Flow Time Series Development

The primary source of flow data was the S308_S station, with gaps filled using flow records from USGS 02276877 (St. Lucie Canal below S-308) for a particular day in the time series where the S308_S station lacked a flow measurement. The data were processed to provide continuity and consistency over the simulation period. Zero flow periods were validated using operational records. The final flow series was aligned temporally to match the model's daily timestep (January 1, 2008, to December 31, 2023).

Some discrepancies in flow were noted between the USACE S308_S and USGS 02276877 measurements. Looking downstream at USGS 02276998, it appears that USACE S308_S may match the USGS 02276998 time series a bit better, although USGS 02276998 displays higher average flow overall (***Figure 15***). Tetra Tech will need to test out the USACE S308_S and the USGS 02276998 time series during the hydrology calibration.

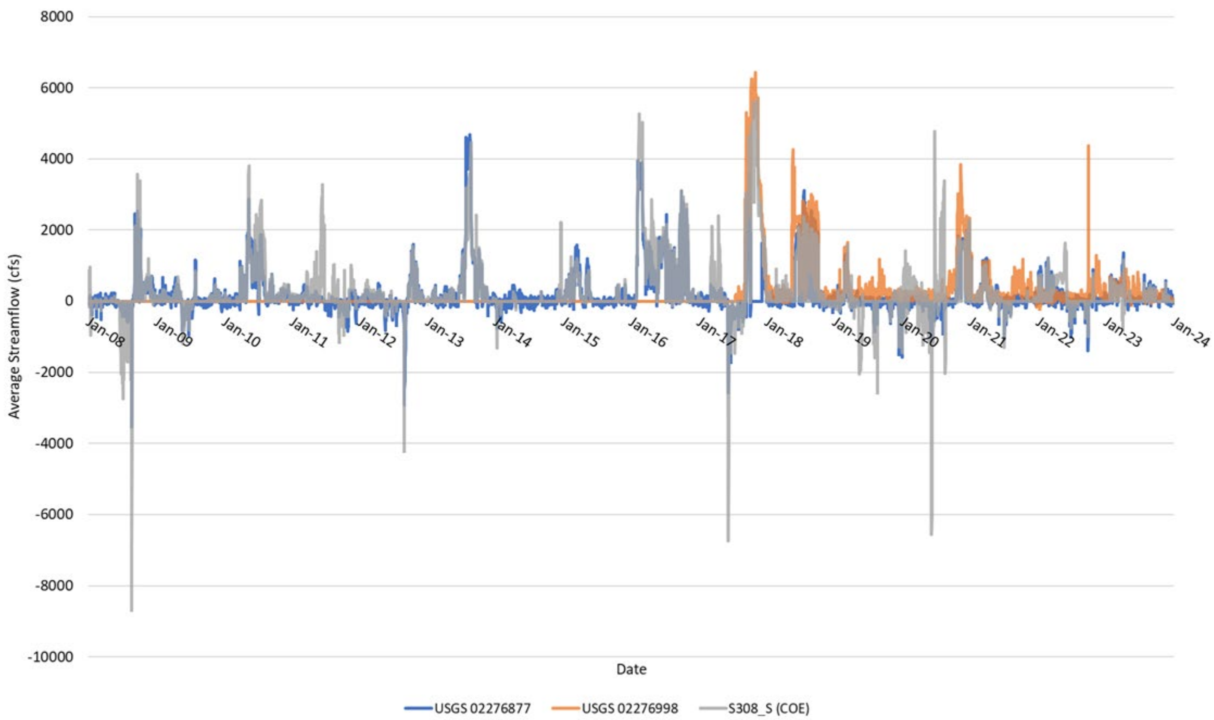

Figure 15. Daily mean streamflow comparisons (by station of interest) near the boundary of Lake Okeechobee and St. Lucie Canal

2.5.4 Water Quality Time Series Development

The water quality data were compiled from sporadic measurements at stations including C44C1, S308LDS, and C44Canal-S308C, covering key parameters such as TN, TP, TSS, and DO. Temperature data were supplemented with measurements from USGS 02276877. These stations' measured water quality data were used to construct the water quality time series associated with positive flows. A daily concentration time series for the simulation constituents were created by using: (1) observed data on days when observations were available, (2) monthly average by year to fill in gaps between daily observations, and (3) long-term monthly average for entire model simulation period in months where data were not collected.

Remaining gaps for DO, chlorophyll-a (CHLA), and organic nitrogen during specific seasons required further resolution using data from hydrologically similar sites. Additionally, TSS, biochemical oxygen demand (BOD), and TOC data were missing for the abovementioned three monitoring stations. To resolve these data gaps, Tetra Tech investigated data availability at station L004, which is an open water station in Lake Okeechobee. There is fair availability of water quality observations during the model timeframe. Thus, this station was evaluated to help provide insight on additional appropriate gap-filling assumptions, particularly for DO, CHLA, and TKN.

Water quality input loads were tabulated for days with positive flows by synchronizing the compiled flow and water quality datasets. Input loads were calculated by multiplying positive flow volumes for that day in the time series with corresponding water quality concentrations. The measured negative flows were distributed via volume weighting and withdrawn from relevant reaches downstream of S-308 to represent the bidirectional flow caused by the pumping. This process ensures the S-308 boundary condition accurately reflects the temporal variability in both hydrology and water quality contributions from Lake Okeechobee.

2.6 WEATHER DATA

2.6.1 NEXRAD Data

NEXRAD data estimate the amount of precipitation in an area based on radar measurements from a network of stations. NEXRAD data were provided by SFWMD for the model simulation period January 01, 2008 to December 31, 2023. The data were provided at hourly time steps for 649 cells, sized 2 kilometers by 2 kilometers, which covered the St. Lucie River and Estuary watershed. The hourly data were summed for each year, and the average annual rainfall was calculated for each cell, with the maximum and minimum average annual rainfall of 60.1 inches and 44.1, respectively (***Figure 16***).

The NEXRAD annual average rainfall for each cell was used to develop initial precipitation based weather regions in the St. Lucie River and Estuary watershed. First, the average annual precipitation values were rounded to the nearest integer to simplify the data and subsequently grouped into 1-inch intervals across 17 groups. Based on these groups, three precipitation classes were then defined to achieve the best correspondence with the NEXRAD data and flow stations. These classes were used to assign three distinct weather regions, and any outlier cells were smoothed to enhance spatial continuity (***Table 35*** and ***Figure 17***).

To provide consistency with long-term precipitation patterns in the region, the Parameter-elevation Regressions on Independent Slopes Model (PRISM) 30-year normal annual precipitation dataset (800 meter resolution) (PRISM, 2025) was used as a reference framework during the delineation process (***Figure 18***).

Table 35. NEXRAD average annual rainfall total (inches) for each assigned weather region in the St. Lucie River and Estuary watershed

Weather Region	NEXRAD Average Annual Rainfall (in)
Region 1	47.3
Region 2	50.3
Region 3	54.1

Reference evapotranspiration (ET_0) was provided by SFWMD in a daily time step for the model simulation period from January 1, 2008, to December 31, 2023, at the NEXRAD grid cell level for 649 cells. After watershed delineation, the NEXRAD grid cell ET_0 will be used to develop an area-weighted representative ET_0 time series for each weather region.

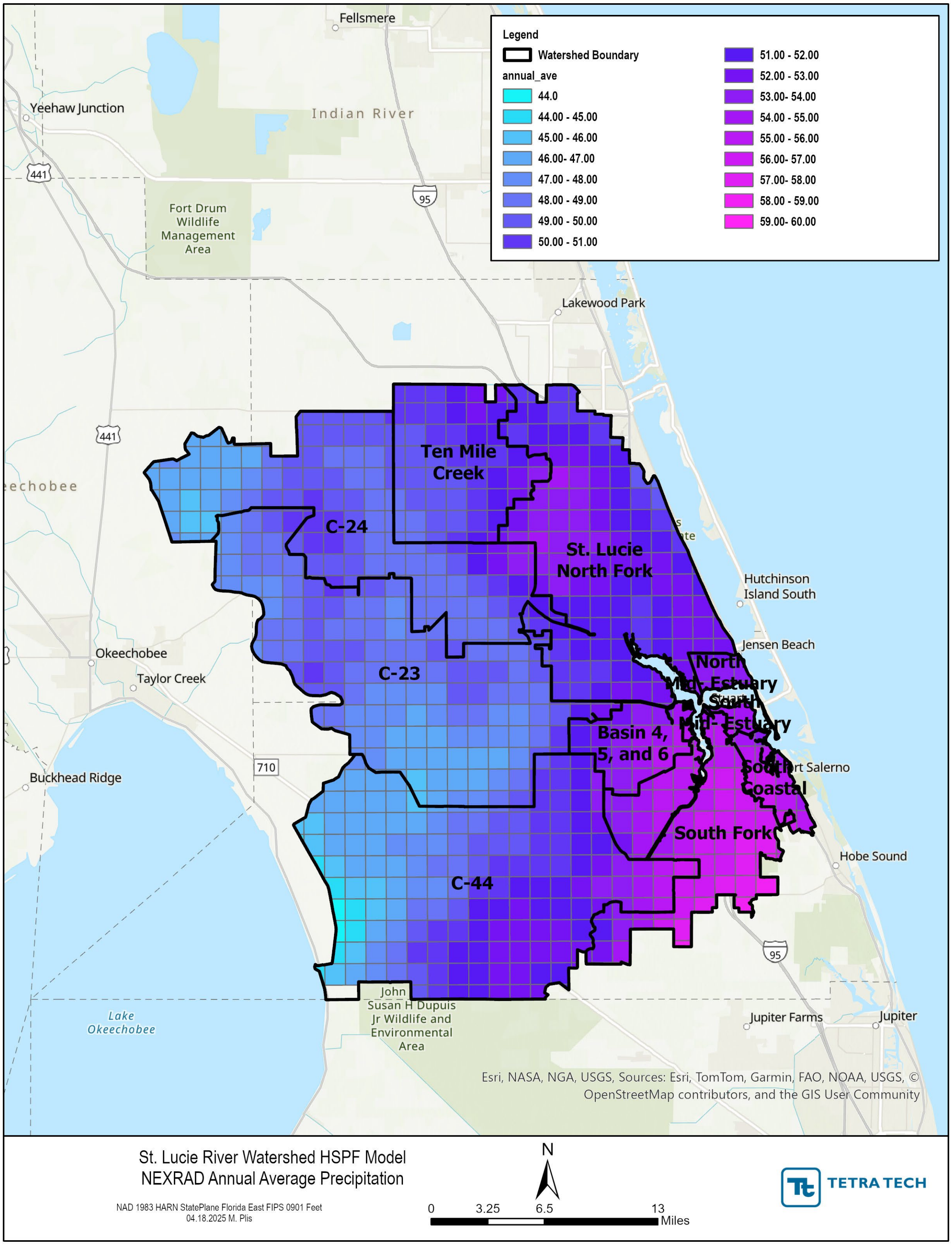

Figure 16. Annual average precipitation from NEXRAD

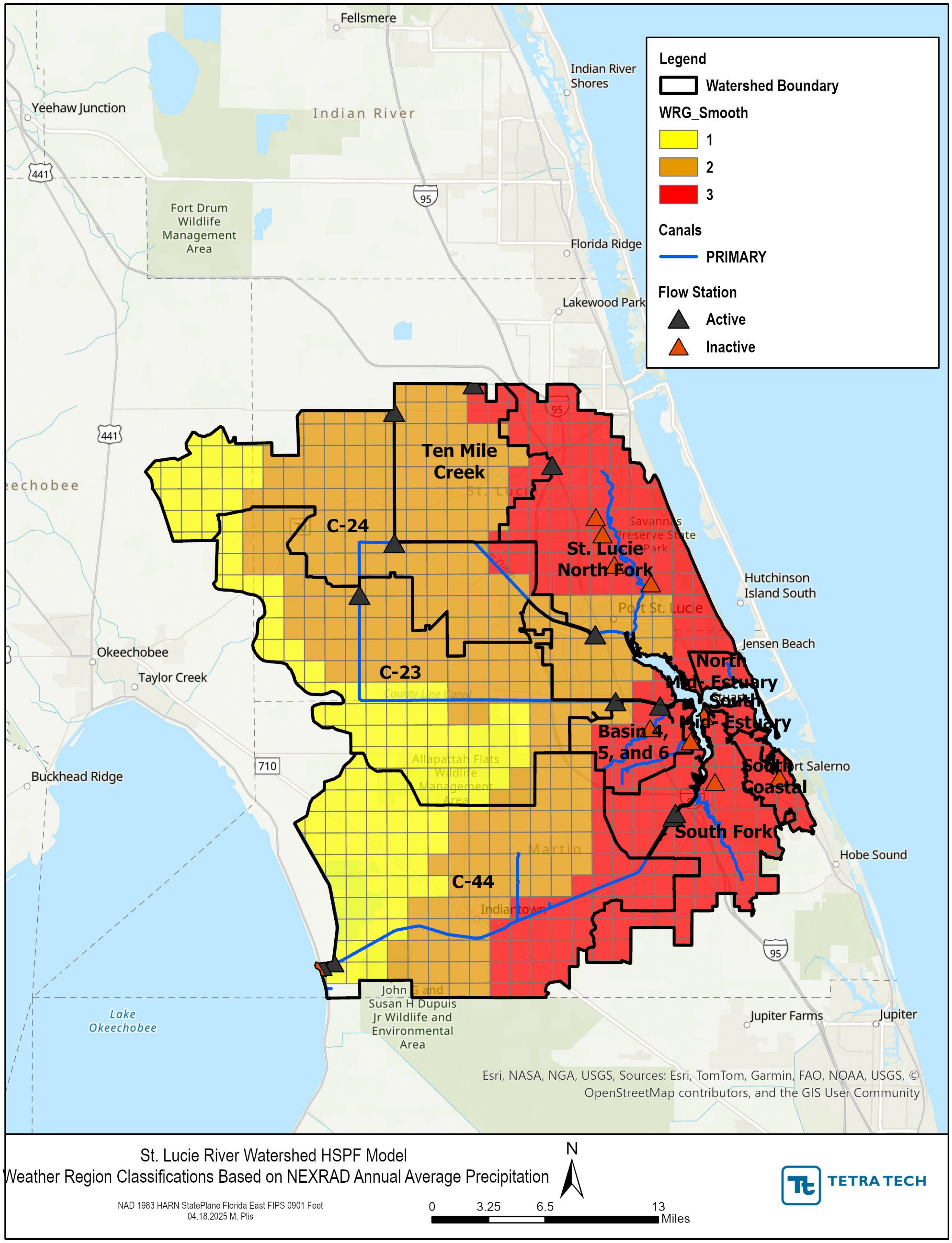

Figure 17. Weather region based on annual average precipitation from NEXRAD

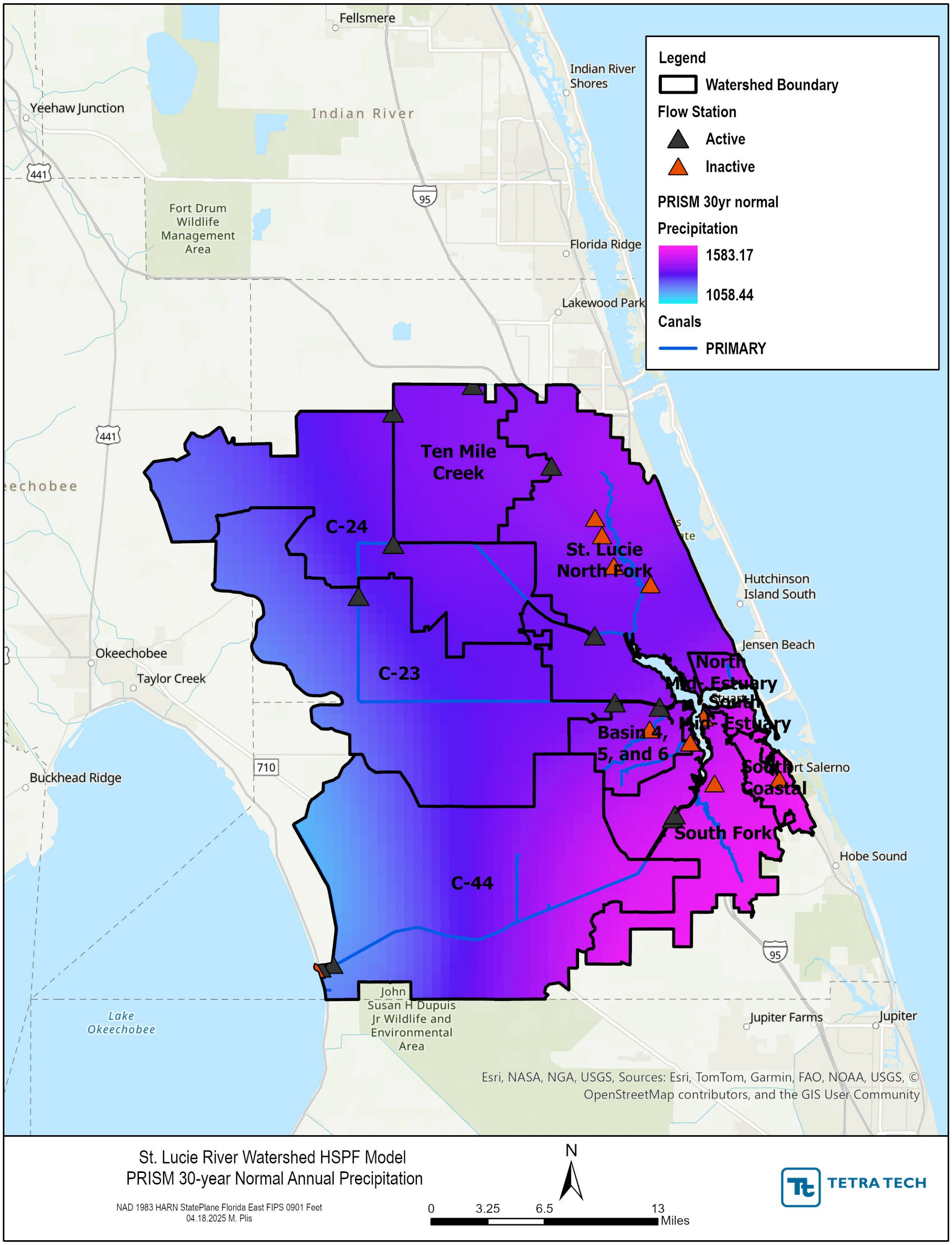

Figure 18. PRISM 30-year normal annual precipitation 800-m resolution

2.6.2 Ground-Based Data

A web subscription to the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI)–Local Climatological Data (LCD) was used to obtain Surface Airways (SA) data (NOAA NCEI QCLCD, 2024). The international airport located in Fort Pierce in St. Lucie County was selected for weather file development (***Figure 19***).

The hourly observations of dew point temperature, air temperature, cloud cover, wind speed, and wind direction were used from the SA station. SA stations have multiple station ID labels, and the stations are referred to by their five-character Weather Bureau Army Navy Identification (WBAN ID). The WBAN ID for the Fort Pierce International Airport is 12895. Meteorological data from January 1, 2008, through December 31, 2023, were downloaded for WBAN 12895. Hourly air temperature, dew point temperature, wind speed and direction observations collected from 2008 through 2023 were reviewed for outliers, missing, or impaired data, and were subsequently repaired. The repairs were performed by averaging the before and after values when data were missing for a short period (less than or equal to three hours), and if a missing period was longer (greater than four hours missing), the time series was completed by inserting the unimpaired record from a previous period.

Cloud cover was estimated from the sky condition observations provided at the SA station. Data from the LCD dataset provided cloud cover information as abbreviations presented in ***Table 36***. The numerical assignments for the model input listed in the table were used to create a time series. Cloud cover was required as a weather input in the HSPF model. The data collected during 2008 through 2023 were reviewed for outliers, missing, or impaired data, and were subsequently repaired. The repairs were performed by averaging the before and after values when data were missing for a short period (less than or equal to three hours), or if a missing period was longer (greater than four hours), the time series was completed by inserting the unimpaired record from two nearby observation stations, WBAN 92815: Stuart Witham Field Airport, and WBAN 12843: Vero Beach International Airport.

Because SA stations collect only cloud cover, solar radiation was calculated using the CE-QUAL-W2 methodology (Cole, 2003) within the Meteorological Data Analysis and Preparation Tool (MetADAPT), developed by Tetra Tech. MetADAPT is a Microsoft Excel-based tool designed to process ground-based weather data, particularly for calculating solar radiation. It is highly modular and can be customized to incorporate additional data input and model output options (Tetra Tech, 2007). CE-QUAL-W2 is a two-dimensional, laterally averaged hydrodynamic and water quality model developed by Portland State University in collaboration with the USACE Waterways Experiment Station (WES). The heat exchange subroutine from CE-QUAL-W2 is one of the methods used in MetADAPT to compute short-wave solar radiation. This approach requires hourly cloud cover, date, and the station's latitude. The calculated solar radiation was then used as an input in the HSPF model.

Table 36. Numerical cloud cover assignments for model input

Description	Abbreviations	National Weather Service Suggested Numerical Range (Eights)	Numerical Assignments for Model Input (Tenths)
Clear Sky	CLR	0	0
Few	FEW	1-2	1.25
Scattered	SCT	3-4	4.38
Broken	BKN	5-7	7.5
Variable	VV	8	10
Overcast	OVC	8	10

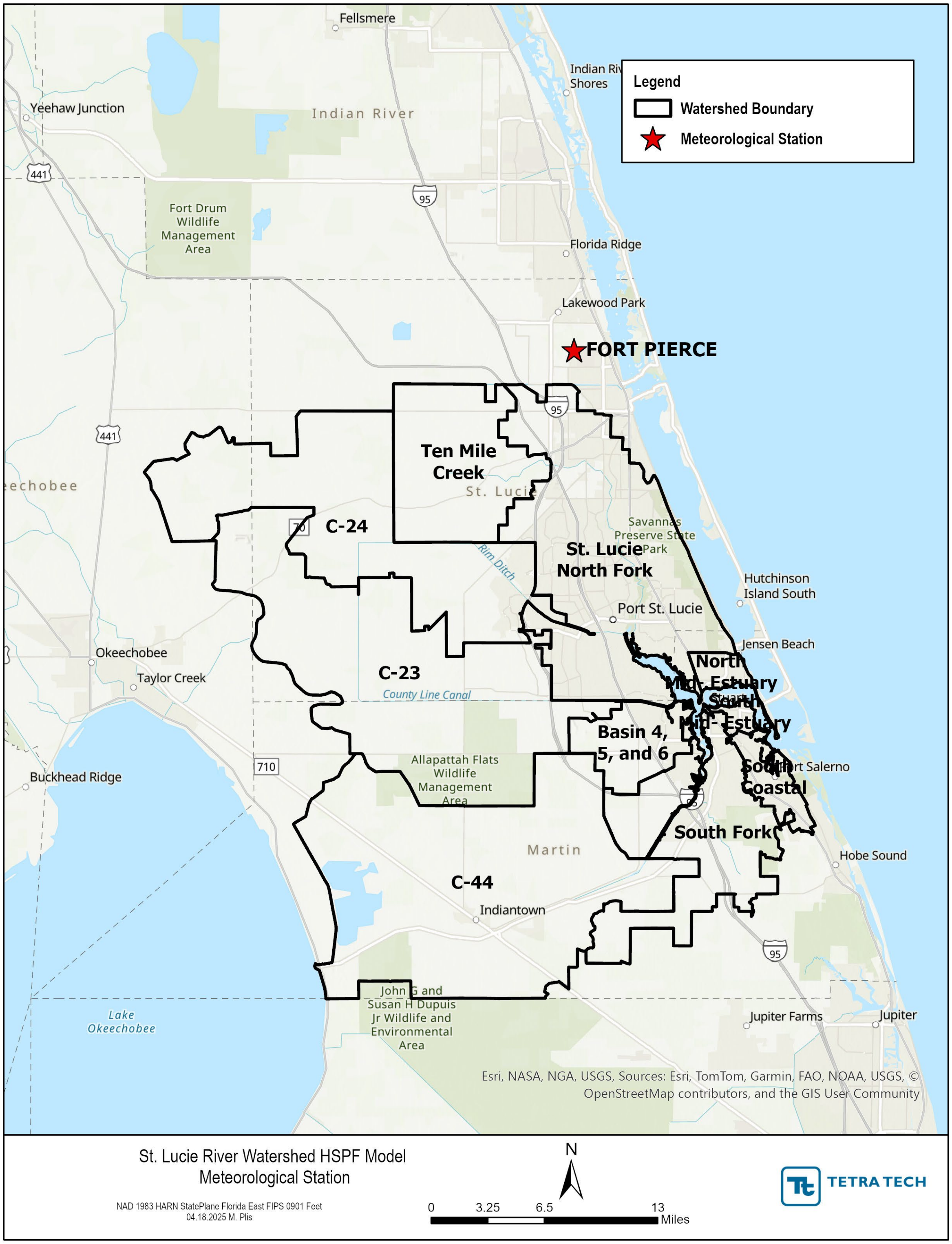

Figure 19. Weather station WBAN 12895 at Fort Pierce International Airport

2.7 ATMOSPHERIC DEPOSITION

Atmospheric deposition can be a significant source of nitrogen loading to waterbodies and watersheds. The HSPF model accounts for wet deposition of pollutants by applying specified concentrations to precipitation that falls on land and in streams or waterbodies. Additionally, dry deposition is included in the HSPF model, represented as a mass flux to both land surfaces and directly to streams and waterbodies. While time series data were available for quantifying nitrogen deposition, such data were not available for phosphorus deposition. In the model, atmospheric nitrogen deposition is explicitly represented as a time series input, whereas phosphorus deposition is represented implicitly through setup and parametrization as a sediment-sorbed constituent.

2.7.1 Wet Deposition of Nitrogen

Key nitrogen constituents involved in wet deposition include ammonium (NH_4) and nitrate (NO_3). These constituents can originate from various sources, including agricultural activities, fossil fuel combustion, and industrial processes. The National Trends Network (NTN) of the National Atmospheric Deposition Program (NADP) monitors and quantifies the concentrations of eight major ions, including NH_4 and NO_3 (NTN, 2025). The active NTN sites closest to the St. Lucie River and Estuary watershed are FL41 (Verna Well Field in Sarasota County, Florida) and FL11 (Everglades National Park Research Center in Dade County, Florida) (***Figure 20***) (NADP, 2025). Data from NADP-NTN are provided as monthly precipitation-weighted average concentrations (data downloaded from: nadp.slh.wisc.edu/sites/ntn-ab32/).

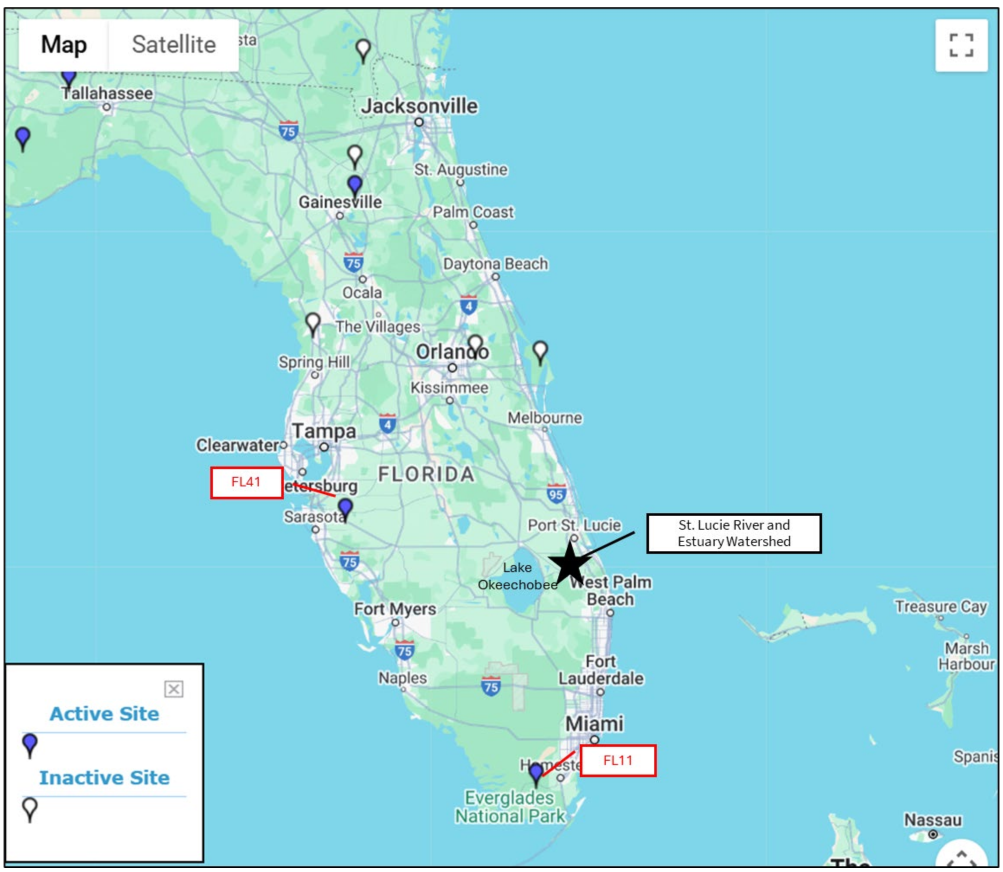

Figure 20. Interactive NADP-NTN map for wet deposition sites at Verna Well Field in Sarasota County, Florida (FL41) and Everglades National Park Research Center in Dade County, Florida (FL11)

Figure 21 and ***Figure 22*** show the NADP-NTN precipitation-weighted concentration plots at FL41 and FL11 for NH_4 and NO_3, respectively, during the HSPF simulation period (2008–2023). NH_4 concentrations typically ranged between 0.016 - 0.98 mg/L, and NO_3 concentrations varied between 0.10–1.92 mg/L, with no clear trends over time. Tetra Tech recommends averaging the data from the two stations to develop wet deposition time series for the St. Lucie River and Estuary watershed HSPF model.

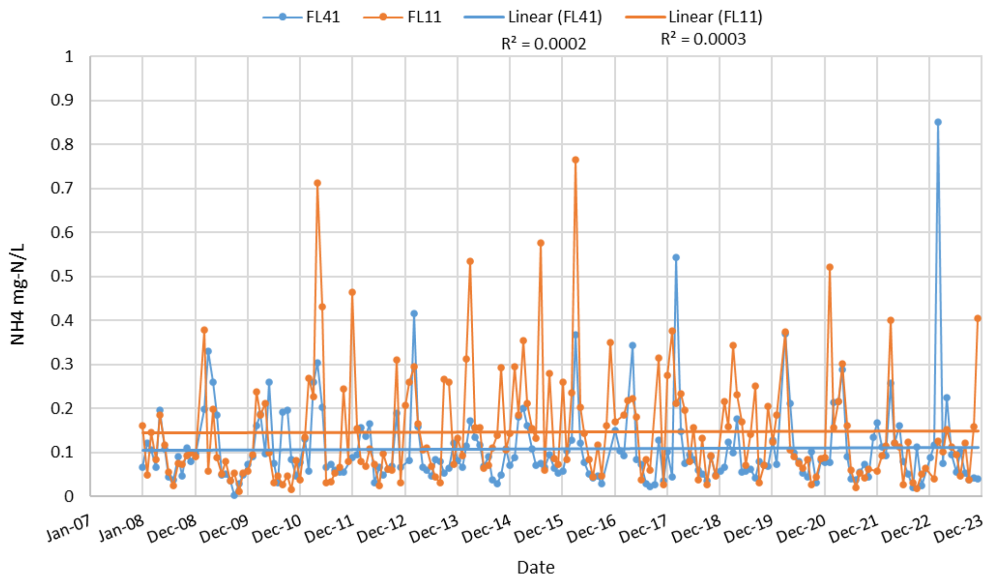

Figure 21. NADP-NTN precipitation-weighted concentration of NH_4 (mg N/L)

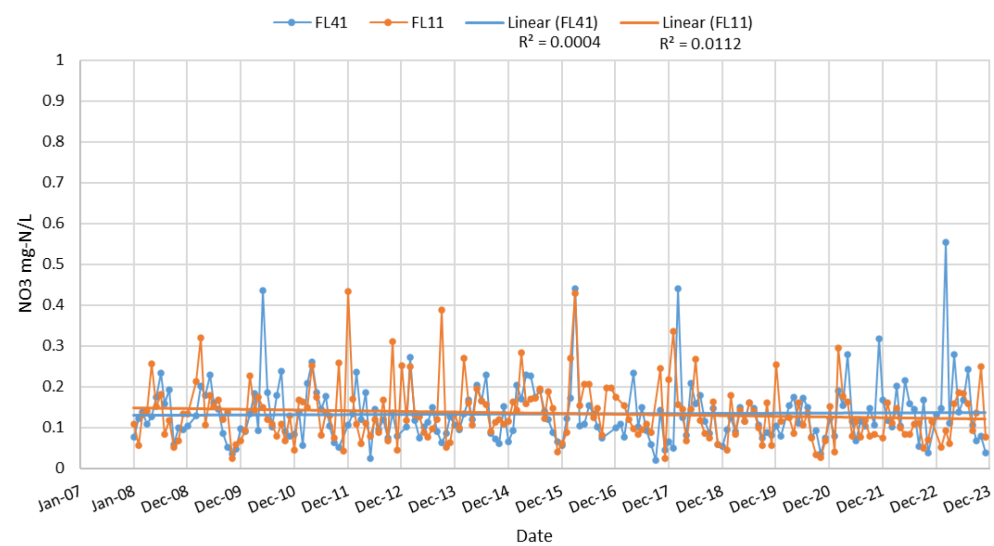

Figure 22. NADP-NTN precipitation-weighted concentration of NO_3 (mg N/L)

2.7.2 Dry Deposition of Nitrogen

Dry deposition rates can vary significantly based on factors such as the type of surface, weather conditions, and the concentration of nitrogen compounds in the atmosphere, and it is subject to much greater uncertainty than wet deposition. USEPA's Clean Air Status and Trends Network (CASTNET) monitors air concentrations of NH_4, nitric acid (HNO_3), and NO_3, and calculates net dry deposition fluxes using the Multi-Layer Model (CASTNET, 2025). The closest active CASNET sites to the St. Lucie River and Estuary watershed are the Indian River Lagoon in Indian River County, Florida (IRL141) and Everglades National Park in Dade County, Florida (EVE419) (***Figure 23***) (USEPA, 2025). Data from CASTNET were provided as seasonal three-month totals (data downloaded from: Index of /CASTNET/CASTNET_Outgoing/data).

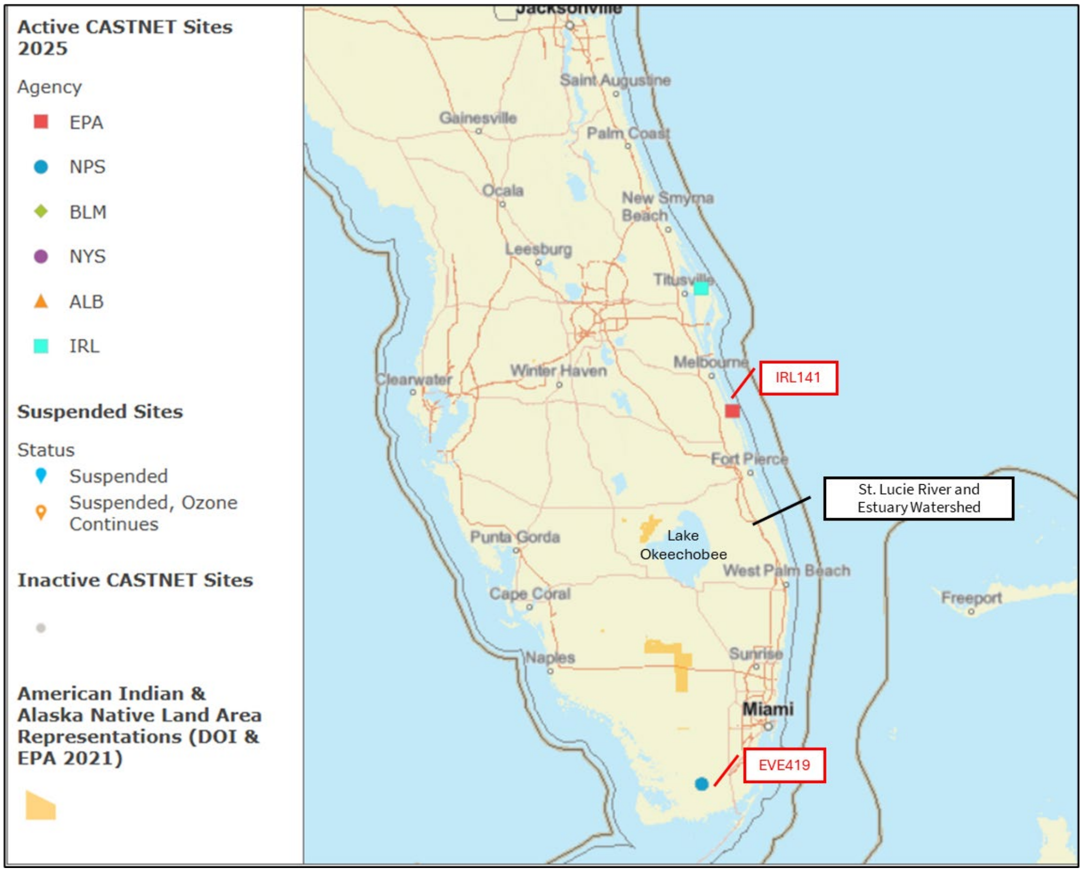

Figure 23.Interactive CASTNET map for two dry deposition sites IRL141(Indian River Lagoon in Indian River County, Florida) and EVE419 (Everglades National Park in Dade County, Florida) close to St. Lucie River and Estuary watershed

Figure 24 shows the time series plot of dry atmospheric deposition loads of HNO_3 ranged 0.016-0.10 kilograms per hectare per three months (kg/ha/3-months) at IRL141 and 0.002-0.14 kg/ha/3-months at EVE419 during HSPF model simulation period, with a decreasing trend over time. Loads of NO_3 decreased over time and typically varied between 0.005–0.035 kg/ha/3-months at IRL141 and 0.001-0.04 kg/ha/3-months at EVE419 (***Figure 25***). Loads of NH_4 also decreased over time and typically varied between 0.005–0.037 kg/ha/3-months at IRL141 and 0.001–0.04 kg/ha/3-months at EVE419s (***Figure 26***). Tetra Tech recommends averaging the data from the two stations to develop wet deposition time series for the St. Lucie River and Estuary watershed HSPF model.

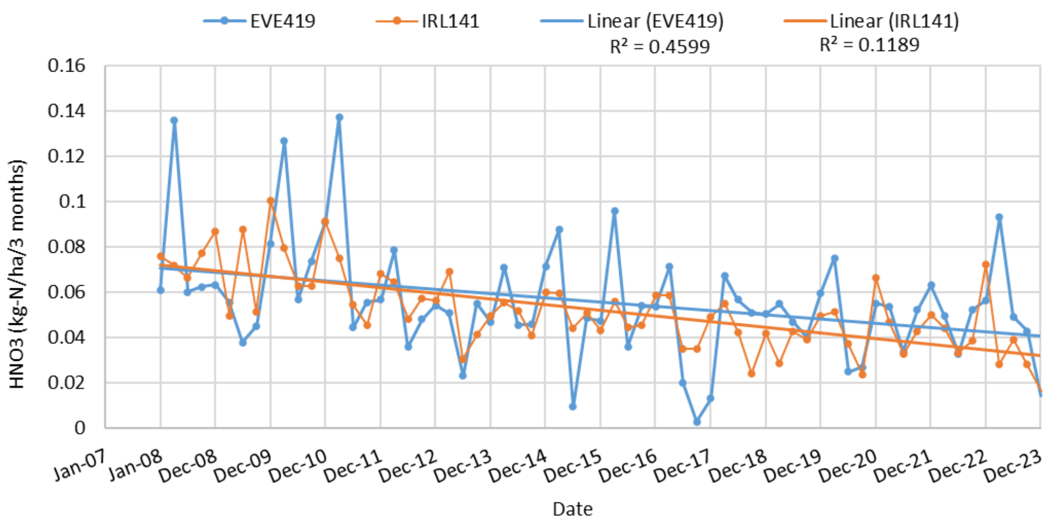

Figure 24. CASTNET dry atmospheric deposition loads time series of HNO_3 (kg/ha/3 months) at IRL141 (Indian River Lagoon in Indian River County, Florida) and EVE419 (Everglades National Park in Dade County, Florida)

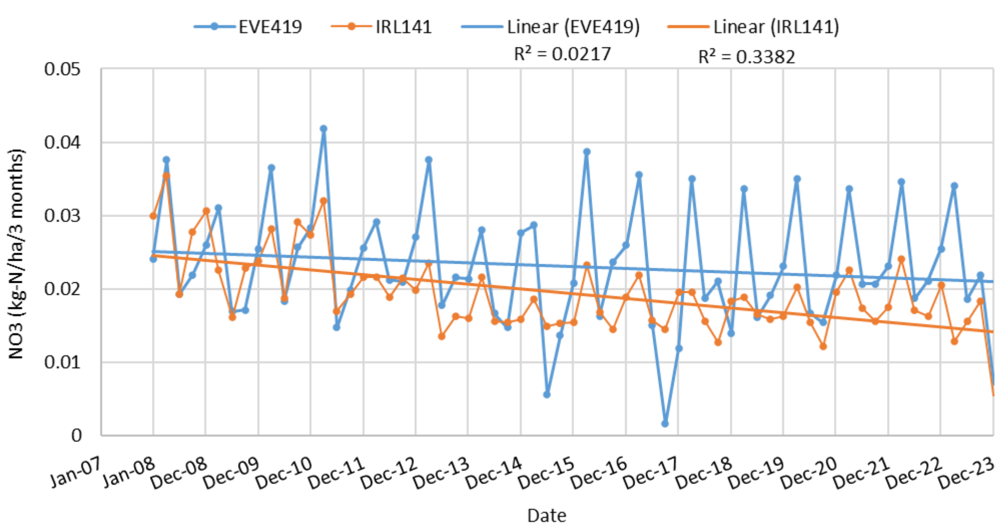

Figure 25. CASTNET dry atmospheric deposition loads time series of NO_3 (kg/ha/3 months) at IRL141 (Indian River Lagoon in Indian River County, Florida) and EVE419 (Everglades National Park in Dade County, Florida)

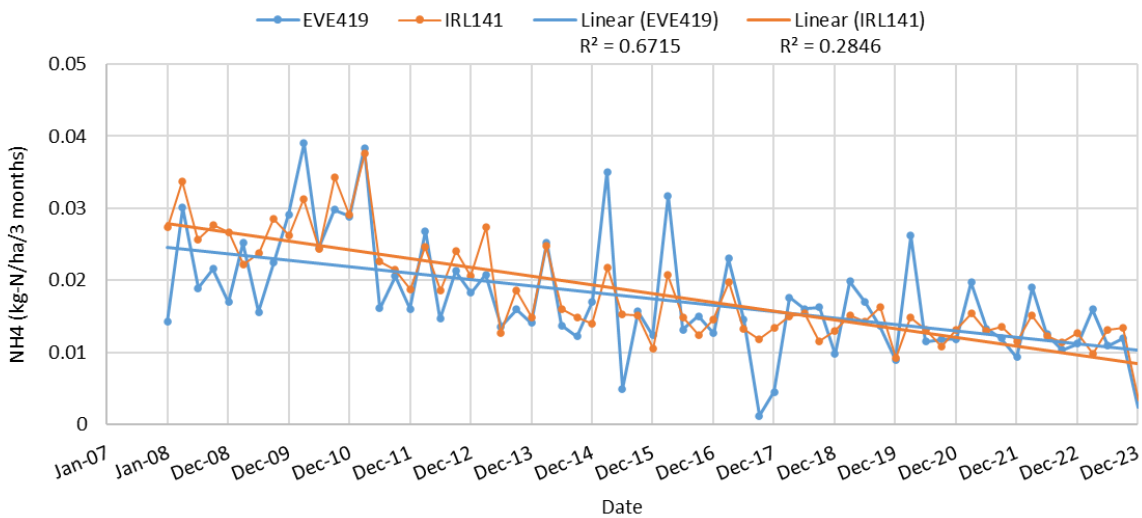

Figure 26. CASTNET dry atmospheric deposition loads time series of NH_4 (kg/ha/3 months) at IRL141 (Indian River Lagoon in Indian River County, Florida) and EVE419 (Everglades National Park in Dade County, Florida)

2.8 FLOW DATA

Tetra Tech received surface water time series from SFWMD for 93 stations and canal operating structures. Of these, 61 stations were located within the watershed boundary. Five stations had data records that extended before 2008. Also, Tetra Tech downloaded all active flow station shapefiles from DBHYDRO Insights from the SFWMD portal (SFWMD, 2025). ***Table 37*** presents a list of stations, including pumping stations, start and end dates, and corresponding basins in the St. Lucie River and Estuary watershed. The canal operation structures for 11 structures with available flow data within the St. Lucie River and Estuary watershed are described in ***Table 38***. ***Figure 27*** shows the location of flow stations and pumping stations in the St. Lucie River and Estuary watershed.

Table 37. List of flow stations, canal operating structure, and pumping stations from/to canals in the St. Lucie River and Estuary watershed

Station ID	Start Date	End Date	Basin	Canal Order and Description
02276998	7/15/2017	9/25/2024	C-44	Primary-bidirectional flow
G78_C	5/8/2012	9/25/2024	C-23	Primary-bidirectional flow
G79_C	5/22/2003	9/25/2024	C-24	Primary-bidirectional flow
G81_C (prior reconstruction was G81_S)	5/15/2000	3/25/2025	C-24	Primary-culvert C-24 bidirectional flow
GORDY_S	7/28/1999	9/25/2024	Ten Mile Creek	Primary
S48_S	7/8/1963	9/25/2024	C-23	Primary-spillway on C-23 at tidewater
S49_S	12/21/1961	6/30/2024	C-24	Primary-spillway on C-24
S80_S_Q/DJ238	03/01/1998	09/17/2023	C-44	Primary-S-80 spillway and sector on C-44 at tidewater-bidirectional flow

Station ID	Start Date	End Date	Basin	Canal Order and Description
S97_S	1/30/1964	6/30/2024	C-23	Primary-spillway on C-23 near Florida Turnpike
S99_S	2/27/1964	9/25/2024	C-25	Primary-spillway on C-25 near Florida Turnpike
S153L_S	6/29/1985	9/18/2024	C-44	Primary-latching gate on L-65 at C-44A
S308_S_1	9/13/1998	2/12/2014	C-44	Spillway and sector flow on St. Lucie Canal at Lake Okeechobee- bidirectional flow (SFWMD)
S308_S2/DJ239	5/1/1996	9/26/2024	C-44	Spillway and sector flow on St. Lucie Canal at Lake Okeechobee- bidirectional flow (USACE)
S308.DS	3/31/1931	3/22/2025	C-44	St. Lucie Canal below S308 at Port Mayaca
S382_P	08/09/2007	09/25/2024	Ten Mile Creek	S382 pump station inflow to Ten Mile Creek reservoir
S384_C	10/1/2015	9/25/2024	Ten Mile Creek	Secondary-culvert at Ten Mile Creek STA to a local canal (C-96) and from there to Ten Mile Creek
S401_P	11/28/2021	9/25/2024	C-44	Primary-pumping station in intake channel to C-44 reservoir
S401TEMP_P	1/31/2021	9/25/2024	C-44	Primary to secondary - alternative pump station from intake channel to C-44 STA cell 2
S404_W	5/26/2021	9/25/2024	C-44	Secondary-fixed weir flow from C-44 STA cell 6 to primary C-44 canal
S404_C	4/19/2023	3/19/2025	C-44	Secondary-flow from C-44 STA cell 6 culvert to primary C-44 canal
SLT07_W	12/2/2004	11/3/2011	Basin 4, 5, and 6	Primary-flow-inactive
SLT09_W	12/3/2004	11/6/2011	Basin 4, 5, and 6	Primary-flow-inactive
SLT17_W	11/11/2004	11/3/2011	Tidal St. Lucie North Fork	Ditch-flow-inactive
SLT19_W	11/9/2004	11/3/2011	Tidal St. Lucie North Fork	Local-stage-inactive
SLT21_W	11/9/2004	11/3/2011	Tidal St. Lucie North Fork	Local-flow-inactive
SLT26_W	11/12/2004	11/3/2011	Tidal St. Lucie North Fork	Local-flow-inactive
SLT31_W	11/12/2004	11/3/2011	South Fork	Local-flow-inactive

Station ID	Start Date	End Date	Basin	Canal Order and Description
SLT36_W	11/24/2004	11/3/2011	South Coastal	Primary-Manatee Creek weir flow-inactive
SLT40_W	11/12/2004	11/3/2011	South Fork	Local-flow-inactive

Note: S: Spillway; C: Culvert; W: Weir; and P: Pump station

Table 38. Canal operating structures and operating ranges for 11 structures within the St. Lucie River and Estuary watershed

Canal or Waterbody	Structure	Canal Operating Range
Ten Mile Creek	S382	S382 operates in the 10/9.7 feet NGVD29 start/stop range as long as Ten Mile Creek reservoir cell is less than target stage.
Ten Mile Creek	Gordy Road	Dry season operation: when upstream pool elevation is 9.5 to 10.5 feet NGVD29. Wet season operation: when upstream pool elevation is as low as 6.5 feet NGVD29 (operated by North St. Lucie River Water Control District).
L-65	S153	C-44 operating range: 18.6 to 19.1 feet NGVD29.
C-44	S308 and S308 Lock	Optimum range of C-44 is 14.0-14.5 feet NGVD29. The negative measured flow represents reverse flow back into Lake Okeechobee, while positive values indicate water released into the St. Lucie Canal(operated by USACE).
C-44	S80 and S80 Lock	Optimum canal elevation: 14 to 14.5 feet NGVD29. During heavy rain: 13.5 to 15.5 feet NGVD29. For irrigation: >12 feet NGVD29. The negative measured values represent reverse flows and lake releases (Operated by USACE).
C-24	G81	Typically closed. It can be used to provide water supply or to assist with flood control, subject to conditions in adjoining basin. The measured flow at the G81 was reversed at times, potentially due to the structure operations.
C-24	S49	High range: 20 feet NGVD29 (gates open 21.2 feet NGVD29 and close 19.5 feet NGVD29). Intermediate or Normal range: 19 feet NGVD29 (gates open 20.2 feet NGVD29 and close 18.5 feet NGVD29). Low range: used during very wet conditions gates open at 19.2 feet NGVD29 and close at 17.5 feet NGVD29. Note: To avoid canal bank erosion and sloughing, DEP uses operational ranges of 0.5 feet and shifts as needed within or between the ranges.
C-23	S48	Fixed weir crest elevation at 8.0 feet NGVD29.

Canal or Waterbody	Structure	Canal Operating Range
C-23	S97	High range: 22.8 feet NGVD29 (gates open 23.2 feet NGVD29 and close 22.2 feet NGVD29). Intermediate or Normal range: 21.0 feet NGVD29 (gates open 22.2 feet NGVD29 and close 20.5 feet NGVD29). Low range: used during very wet conditions gates open at 21.2 feet NGVD29 and close at 19.5 feet NGVD29. Note: To avoid canal bank erosion and sloughing, DEP uses operational ranges of 0.5 feet and shifts as needed within or between the ranges.
C-23	G79	Allows water transfer from C-23 to C-24 basins when the western portion of C-23 is in excess of optimum and C-24 has capacity to spare. The measured flow at the G79 reversed less than 1% of the time, potentially due to the reverse flow back to C-23.
C-23	G78	Allows transfer of water from C-23 to C-24 basins when the western portion of C-23 is in excess of optimum and C-24 has capacity to spare. The measured flow at the G79 reversed about 5% of the time, potentially due to the reverse flow back to C-23.

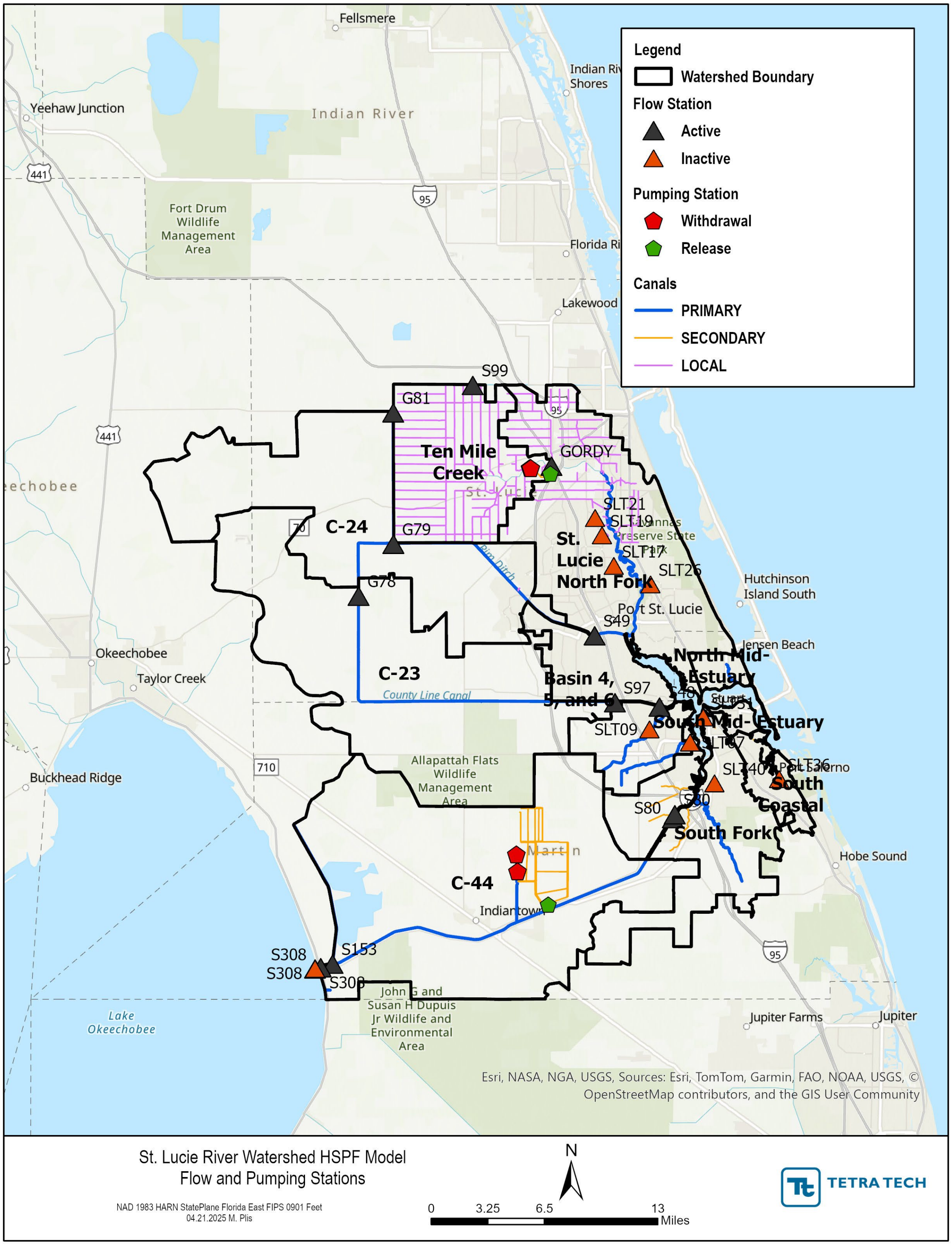

Figure 27. Spatial coverage of flow stations and pumping (withdrawal and release) stations in St. Lucie River and Estuary watershed

2.9 WATER QUALITY DATA

Tetra Tech received water quality data from DEP from several sources, including DBHYDRO (SFWMD) and STORET (USEPA). Also, Tetra Tech received a separate water quality spreadsheet for groundwater wells nutrient data (STORET). DEP provided the list of stations and geodatabase for the St. Lucie River and Estuary BMAP. After filtering the data for surface water and removing duplicate stations, 123 water quality stations with available data were selected (***Table 39***), including 75 water quality stations that were listed in the St. Lucie River and Estuary BMAP. ***Figure 28*** presents the spatial coverage of water quality stations in the St. Lucie River and Estuary watershed.

Table 39. List of water quality stations in the St. Lucie River and Estuary watershed

Station Name	Basin	Period of Data Availability	DEP or STORET Dataset	BMAP List and GIS Shapefile	Types
A18	North Fork	2018-2023	Yes	Yes	A-18 (Structure)
A22	North Fork	2018-2023	No	Yes	A-22 (Structure)
ACRA1	C-23	2008-2010, 2020-2022	Yes	Yes	Canal
C-107/ 7-01	North Fork	2018-2023	Yes	Yes	7-01 (Structure)
S48/C23S48	C-23	2012-2023	Yes	Yes-S-48	Canal
S49/C24S49	C-24	2008-2023	Yes	Yes-S-49	Canal
C44SC14	C-44/S-153	2014-2015, 2020-2023	Yes	Yes	Canal
C44SC19	C-44	2020-2023	Yes	Yes	Canal
C44SC2	C-44	2020-2023	Yes	Yes	Canal
C44SC23	C-44	2020-2023	Yes	Yes	Canal
C44SC24	C-44	2020-2023	Yes	Yes	Canal
C44SC5	C-44	2020-2023	Yes	Yes	Canal
E8	North Fork	2018-2023	Yes	Yes	B-2 (Structure)
Elcam Spillway	North Fork	No data	No	Yes	EW-1 (Structure)
G79	C-24	2010-2023	Yes	Yes	Canal
G81	C-24	2012-2023	Yes	No	Canal
GORDYRD	Ten Mile Creek	2008-2023	Yes	Yes	Canal
H16/H60	North Fork	2018-2023	H-60 structure	Yes	H-60 (Structure)
HR1	North Fork	2008-2023	No	Yes	Estuary
Kingsway WW	North Fork	2018-2023	Yes	Yes	Kingsway WW (Structure)
Monterey WW	North Fork	2018-2023	MW-1 (Structure)	Yes	MW-1 (Structure)
PC22C23	C-23	2010-2015	Yes	No	Canal
PC24AC24	C-24	2010-2012	Yes	No	Canal

Station Name	Basin	Period of Data Availability	DEP or STORET Dataset	BMAP List and GIS Shapefile	Types
PC32C23	C-23	2010-2012, 2014-2015, 2020-2023	Yes	Yes	Canal
PC38C24	C-24	2010-2023	Yes	Yes	Canal
PC39C24	C-24	2020-2023	Yes	Yes	Canal
PC41C23	C-23	2010-2015	Yes	No	Canal
PC49C23	C-23	2010-2023	Yes	Yes	Canal
PC54C23	C-24	2015-2023	Yes	Yes	Canal
S153	C-44	2020-2023	Yes	Yes	Canal
S308LDS/S308C	C-44	2023	listed as C44 canal-S308C	listed as S308C	Canal
S80/C44 at S80	C-44/S-153	2016-2023	Yes	No	Structure
SE 01	South Mid-Estuary	2008-2023	Yes	Yes	Estuary
SE 02	North Mid-Estuary	2008-2023	Yes	Yes	Estuary
SE 03	Compliance Station	2008-2023	Yes	Yes	Estuary
SE 08B	South Fork	2008-2023	Yes	Yes	Estuary
SE06B/SE06	North Fork	2012-2015	Yes	Yes	Estuary
SE-06	North Fork	2015-2023	Yes	No	Estuary
SE-09	South Fork	2008-2023	Yes	Yes	Estuary
SE 11	South Coastal	2008-2016	Yes	Yes	Estuary
SE-12/SE12B	North Fork	2012-2014	SE12B	SE12	Estuary
SE-12	North Fork	2015-2023	SE-12	-	Estuary
SLT-1	South Fork	2013-2023	Yes	Yes	River/stream
SLT-29	North Fork	2008-2023	Yes	Yes	Canal
SLT-2A	South Fork	2013-2023	Yes	Yes	Wetland
SLT-3	South Fork	2013-2023	Yes	Yes	Canal
SLT-10A	North Fork	2013-2023	Yes	Yes	Canal
SLT-10B	North Fork	2013-2016	Yes	Yes	Lake
SLT-11	North Fork	2008-2023	Yes	Yes	Canal
SLT-17	North Fork	2008-2023	Yes	Yes	Canal
SLT-19	North Fork	2008-2023	Yes	Yes	Canal
SLT-21	North Fork	2008-2023	Yes	Yes	Canal
SLT-22A	North Fork	2012-2023	Yes	Yes	Canal

Station Name	Basin	Period of Data Availability	DEP or STORET Dataset	BMAP List and GIS Shapefile	Types
SLT-26	North Fork	2008-2023	Yes	Yes	Canal
SLT-30A	North Mid-Estuary	2013-2023	Yes	Yes	Wetland
SLT-31	South Fork	2008-2023	Yes	Yes	Canal
SLT-34A	South Fork	2008-2023	Yes	Yes	Canal
SLT-35	South Coastal	2013-2023	Yes	Yes	River/stream
SLT-36	South Coastal	2008-2023	Yes	Yes	Canal
SLT-37A	South Coastal	2008-2023	Yes	Yes	Canal
SLT-38	South Mid-Estuary	2008-2023	Yes	Yes	Canal
SLT-38A	South Mid-Estuary	2012-2023	Yes	Yes	Canal
SLT-39	North Fork	2008-2016	Yes	Yes	Canal
SLT-4	South Fork	2013-2023	Yes	Yes	River/stream
SLT-40	South Fork	2008-2023	Yes	Yes	Canal
SLT-40A	South Fork	2012-2023	Yes	Yes	Canal
SLT-41	North Fork	2012, 2020-2023	Yes	Yes	Canal
SLT-42B	North Fork	2013-2023	Yes	Yes	Canal
SLT-44	South Coastal	2008-2023	Yes	Yes	Canal
SLT-5	South Fork	2013-2023	Yes	Yes	Land Runoff
SLT-6	South Fork	2013-2023	Yes	Yes	Land Runoff
SLT-7	Basin 6	2008-2023	Yes	Yes	Canal
SLT-9	Basin 4,5	2008-2023	Yes	Yes	Canal
U16-D016/CS-1	North Fork	2018-2023	Yes- CS-1	Yes	Structure

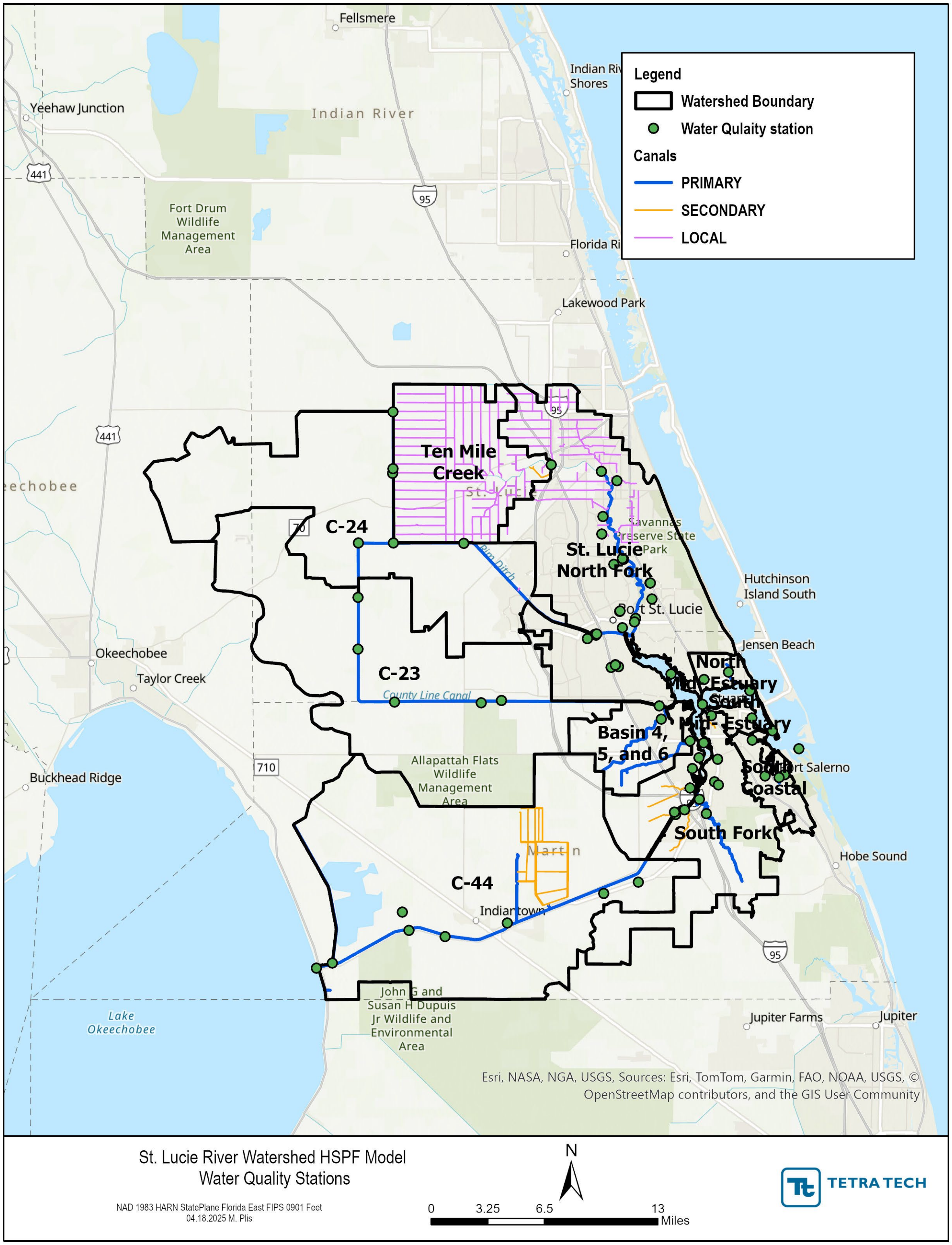

Figure 28. Spatial coverage of water quality stations in the St. Lucie River and Estuary watershed

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