Final Draft

INDIAN RIVER COUNTY

Stormwater Management Plan

Prepared for
Indian River County

July 2025

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List of Acronyms

3DEP	3D Elevation Program
BMAP	Basin Management Action Plan
BMP	Best Management Practice
CDS	continuous deflector separators
CIRL	Central Indian River Lagoon
CLC	Cooperative Land Cover
COS	City of Sebastian
COVB	City of Vero Beach
CRS	Community Rating System
DEM	digital elevation model
ENR	Engineering-News Record
EPA	Environmental Protection Agency
ERPs	Environmental Resource Permits

ERU	Equivalent Residential Unit
ESA	Environmental Science Associates
ESC	Erosion & Sediment Control
FDEM	Florida Department of Emergency Management
FDEP	Florida Department of Environmental Protection
FDOR	Florida Department of Revenue
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FIND	Florida Inland Navigation District
FIRM	Flood Insurance Rate Map
FLUCCS	Florida Land Use and Cover Classification System
FNAI	Florida Natural Areas Inventory
FTE	full-time employees
FWC	Florida Fish and Wildlife Conservation Commission
FWCD	Fellsmere Water Control District
GIS	Geographic Information Systems
GSP	Green Stormwater Infrastructure
HUC-10	level 10 Hydrologic Unit Codes
IRB	Indian River Boulevard
IRC	Indian River County
IRFWCD	Indian River Farms Water Control District
IRL	Indian River Lagoon
IUP	Intended Use Plan
IWR	Impaired Waters Rule
LET	Load Estimation Tool
LID	low impact development
LMP	Lagoon Management Plan
LULC	Land Use Land Cover
MS4s	municipal separate storm sewer systems
MSSW	Management and Storage of Surface Waters
NAVD88	North American Vertical Datum 1988
NFIP	National Flood Insurance Program
NIRL	Northern Indian River Lagoon
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NRCS	Natural Resources Conservation Service
NSP	Natural Shoreline protection
RUN 66	FDEP Impaired Waters Rule database
SAMS	Stormwater Asset Management System
SJRWMD	St. Johns River Water Management District
SKT	Seasonal Kendall Tau
SLR	sea level rise
SMP	Stormwater Management Plan
SMR	Stormwater Management Regulations
SRF	State Revolving Fund

STA	stormwater treatment and storage area
SWIL	Spatial Watershed Iterative Loading Model
SWMM	Storm Water Management Model
SWU	stormwater utility
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSR	Technical Staff Report
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VA	Vulnerability Assessment
WBID	Waterbody Identification
WMDs	Water Management Districts
WQ	Water Quality

SECTION 1
Introduction

1.1 Background

This document prepared by Environmental Science Associates (ESA) serves as the Stormwater Management Plan (SMP) for Indian River County (IRC). The SMP is intended to provide IRC an initial framework for the allocation of resources related to stormwater improvement projects. The primary objectives of this SMP are improving water quality in the Indian River Lagoon (IRL) and improving flooding and resilience throughout IRC. The SMP aims to enhance the County's ability to manage runoff, reduce nutrient loading to the IRL, and mitigate the adverse effects of flooding, specifically in nine (9) Priority Areas identified by IRC as particularly prone to flooding, as shown in **Figure 1**. The SMP focuses on potential conceptual improvements that can provide both water quality improvement and flood mitigation. By integrating both traditional infrastructure and nature-based solutions, the SMP seeks to modernize aging systems, promote sustainable stormwater management practices, and provide a long-term approach to investing in the County's regional stormwater infrastructure. Through strategic investment and collaborative efforts, this SMP sets the foundation for a healthier IRL and a more resilient future for Indian River County’s stormwater systems.

1.2 Current Stormwater Program Recognition

1.2.1 Basin Management Action Plan

Indian River County is an active participant in the Florida Department of Environmental Protection (FDEP) Basin Management Action Plan (BMAP) developed to reduce nutrient loading to the Central Indian River Lagoon (CIRL) and restore seagrass coverage in the lagoon. Specifically, the BMAP addresses a total maximum daily load (TMDL) adopted in 2009 calling for a reduction in total nitrogen and total phosphorus loads to the IRL. For both the TMDLs and BMAPs, the IRL system was subdivided into the Northern Indian River Lagoon (NIRL), Banana River, and CIRL. The CIRL was further subdivided into four (4) project zones, each with their own load reduction requirements which went into effect in 2021. The county contributes to two of the project zones: SEB and B.

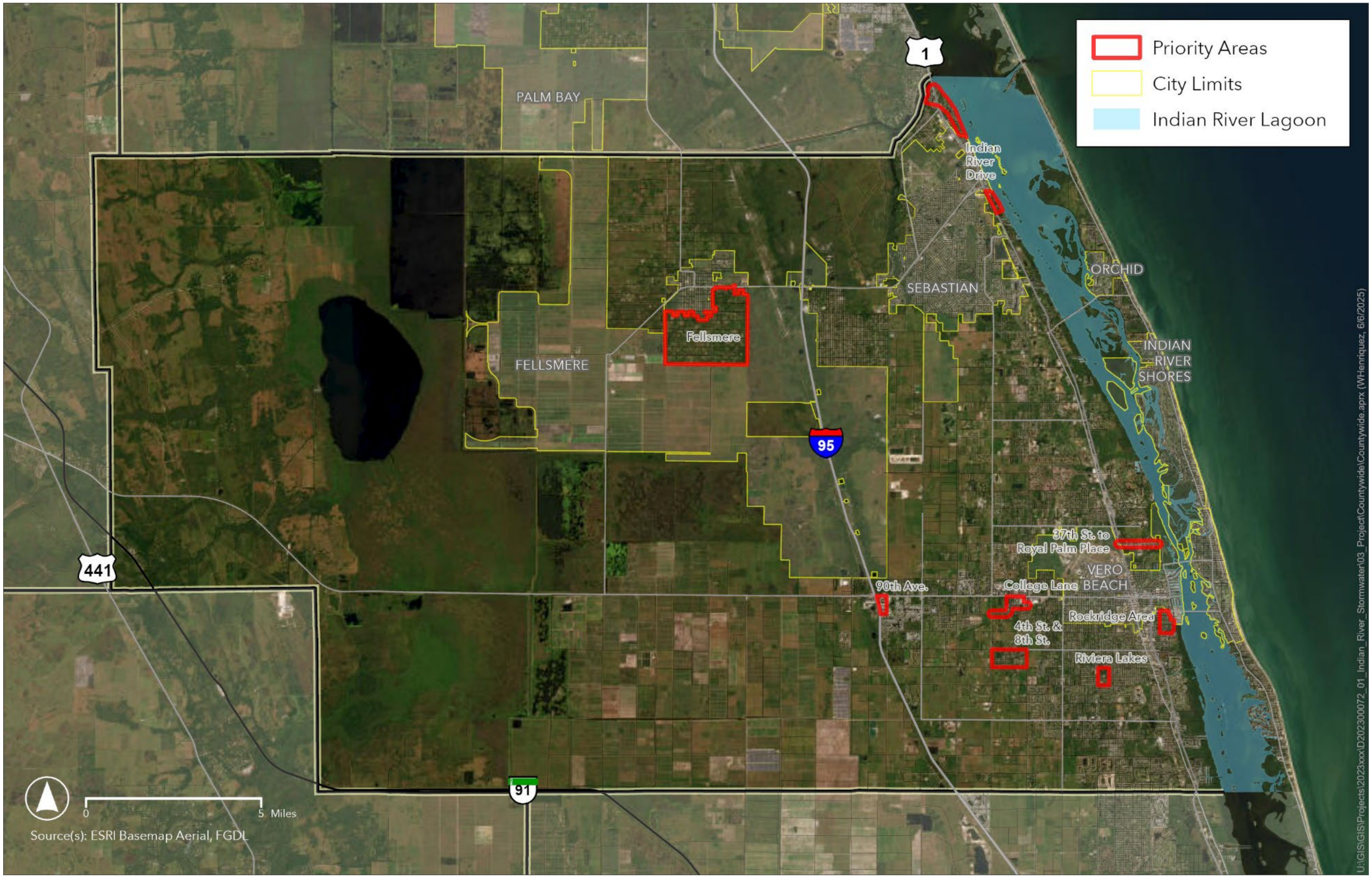

Figure 1
Priority Areas Identified by IRC

As part of the BMAP process, each contributing entity is assigned a starting nutrient load and a required load reduction based on loading models developed for FDEP. According to FDEP's 2023 Statewide Annual Report, as of 12/31/2023, IRC has completed projects in both project zones in an effort towards meeting the required reductions (FDEP 2023). The projects ranged from a County-wide fertilizer ordinance, constructed wetlands, regional stormwater facilities, detention ponds, and wastewater treatments upgrades including septic to sewer conversions. Combined, the projects were credited with reducing 44,534 lbs/yr of nitrogen and 8,574 lbs/yr of phosphorus. Some of the completed projects have yet to have reductions assigned. IRC also has some ongoing efforts related to education and maintenance activities. These account for an additional 23,431 lb/yr reduction in nitrogen and 3,779 lbs/yr reduction of phosphorus. **Table 1** shows the CIRL required load reductions, the reductions to date and the remaining required reductions by project zone.

TABLE 1
CIRL REQUIRED LOAD REDUCTIONS

	Total Nitrogen (lbs/yr)			Total Phosphorus (lbs/yr)		
Project Zone	**Required Reductions**	**Project Reductions**	**Remaining Reductions**	**Required Reductions**	**Project Reductions**	**Remaining Reductions**
SEB	47,223	13,239	33,984	8,580	2,871	5,709
B	169,639	54,726	114,913	22,231	9,842	12,389

The required reductions shown do not include the latest SWIL model updates. The County's allocations are in dispute with the FDEP; however, IRC is committed to implementing projects to improve the water quality of the lagoon.

1.2.2 Lagoon Management Plan

The Indian River County Lagoon Management Plan (LMP) was published in October 2023 and was prepared by Tetra Tech. The LMP, facilitated by IRC's Natural Resources Department, identifies 17 key factors affecting the health of the IRL, including water quality, harmful algal blooms, sea level rise, and wastewater management. Designed as a living document, the LMP is intended to be updated and modified based on emerging research to support the restoration and conservation of the IRL.

The LMP establishes goals and objectives to address these factors while providing recommended projects and best management practices for County departments and for residents. Inventories of projects to achieve the LMP goals and objectives are included as tables in the document, categorized as Conceptual, Designed, Under Construction, and Operational, with the estimated nutrient reduction amounts provided for each project, as well as costs. As an example, a stormwater management plan was included as one of the conceptual projects for which the Primary Responsible Department is the Stormwater Division. While sharing similar objectives to the LMP, this SMP focuses on projects specific to stormwater management. Some actions outlined by the LMP and addressed in this SMP include the following:

- Identify and implement projects to meet the TN and TP required reductions for the BMAP.
- Identify areas of high nutrient concentrations and/or loads and implement nutrient reduction projects in those locations.

- Implement projects to slow untreated freshwater flows to the IRL to reduce pulsed loading of nitrogen and phosphorus.
- Support the private and public acquisition of new lands along the IRL shoreline and in key watershed locations for restoration, preservation and hydrologic connection.
- Retrofit the nearly 100 outfalls to the IRL with baffle boxes, screens or vortex units to provide pollutant removal, where appropriate.

Furthermore, several key metrics discussed in the LMP are reiterated as priorities to be addressed by this SMP. These include Water Quality, BMAP, Hydrology and Hydrodynamics, Best Management Practices, and Sustainability and Resiliency.

1.2.3 Community Rating System

Indian River County participates in the Community Rating System (CRS) administered by the National Flood Insurance Program (NFIP), a program managed by the Federal Emergency Management Agency (FEMA).

The NFIP provides federally backed flood insurance within communities that enact and enforce floodplain regulations. To be covered by a flood insurance policy (for the structure and/or its contents), a property must be in a community that participates in the NFIP. To qualify for participation in the NFIP, agencies adopt and enforce a floodplain management ordinance to regulate development in flood hazard areas. The main objective of the flood ordinance is to minimize the potential for flood damage on future development, thus protecting people and property in the county. This ordinance has been effective in requiring new buildings to be protected from damage from the 100-year base flood. However, flood damage still occurs as the result of floods that exceed the base flood, flooding in low-lying areas, flooding in unmapped areas, and from flooding that affects buildings constructed before the community joined the NFIP.

The NFIP established the CRS program to provide incentives for communities that exceed minimum requirements with their floodplain management programs. The CRS program aims to achieve three major goals:

1. Reduce damage to insurable property
2. Strengthen and support the insurance aspects of the NFIP
3. Encourage a comprehensive approach to floodplain management

Under the CRS, communities are rewarded for doing more than simply regulating construction of new buildings to the minimum national standards. Under the CRS, the flood insurance premiums for a community’s homes and businesses are discounted to reflect that community’s work efforts beyond the minimum requirements of the program. This includes efforts to reduce flood damage to existing buildings, managing development in areas not mapped by the NFIP, protection of new buildings beyond the minimum NFIP protection level, preservation and/or restoration of natural floodplain functions, helping insurance agents obtain flood data, and public education related to flood insurance and risk.

The CRS program recognizes and awards credits for floodplain management activities in four categories: public information, mapping and regulations, flood damage reduction, and warning/response. The aim of NFIP is to protect communities against flood damage and the CRS is a voluntary incentive program that awards discounts on insurance premiums for communities who exceed NFIP's minimum floodplain management standards (FEMA, 2017) at the rates shown in **Table 2**.

TABLE 2
CRS CREDIT POINTS, CLASSES AND PREMIUM DISCOUNTS

CRS Credit Points	CRS Class	CRS Discount (Premium Reduction)
4,500+	1	45%
4,000 – 4,499	2	40%
3,500 – 3,999	3	35%
3,000 – 3,499	4	30%
2,500 – 2,999	5	25%
2,000 – 2,499	6	20%
1,500 – 1,999	7	15%
1,000 – 1,499	8	10%
500 – 999	9	5%
0 – 499	10	0%

SOURCE: https://www.fema.gov/floodplain-management/community-rating-system

As of 2024, over 1,500 communities nationwide participate in the CRS program and 265 of those communities are in Florida. IRC has been participating in CRS since 1992 and is ranked as a CRS Class 5 with 2,750 points, earning a 25% discount on flood insurance premiums (FEMA, 2024). There are six Florida communities who have achieved a CRS Class lower than 5. For IRC to improve its CRS Class, at least 250 additional points would need to be earned, and it must be demonstrated that an effective regulatory program is in place to minimize flood losses, minimize increases in future flooding, protect natural floodplain functions, and protect people from the dangers of flooding (FEMA, 2017).

The CRS Program assigns points based on the following eligible activities:

- Activity 420 - Natural shoreline protection (NSP) – max. 120 points – protect the natural channels and shorelines and areas valuable for protecting the natural functions of floodplains. Local Policies adhered to on public lands or regulations on development on private lands. Lands must be in their approximate natural state; no dredging, channel alteration, riprap, levees, armoring, beach nourishment, dams, or human intervention that constrains the natural processes of the shoreline, river, stream, lake or ocean (CRS Manual, 2017). The program does give credit for allowing alterations that benefit the floodplain like removing levees, restoring habitat, or planting to preserve shoreline, dunes, etc. as long as there is no reduction in floodplain function.
- Activity 450 is broken into several parts.
  - Stormwater Management Regulations (SMR) – Max 380 points, Implementing regulations that involve stormwater detention/retention and/or promoting low impact development (LID). In

addition to regulations, the community must also maintain stormwater management infrastructure.

- Watershed Master Planning – Max 315 points, meeting all criteria of the WMP and managing runoff from the 10-, 25- and 100-year event. No net impact due to new development.
- Erosion & Sediment Control (ESC) – 40 points, credits are awarded for requiring erosion and sediment control measures for land undergoing development within the County. For credits to be awarded, the community must require these measures for all construction sites, including buildings, roads, regrading, or other activity that disturbs soil.
- Low Impact Development (LID) – 25 points, utilizing Low Impact Design principles or Green Stormwater Infrastructure to control runoff and filter stormwater on existing and new development.
- Water Quality (WQ) – 20 points, new development over 1 acre must use infiltration trenches, bioswales and grass strips to polish stormwater before leaving the site.

Therefore, focusing on Activity 450 Stormwater Management and Watershed Master Planning are approximately a 3:1 lift over Activity 420 Natural Shoreline Protection for CRS Points.

This SMP aims to evaluate projects that will generate additional CRS Points for IRC. By improving the County's CRS rating from Class 5 to Class 4, IRC homeowners could potentially save an additional 5% on premium reductions. Applicability to Activities 420 and 450 are considered as evaluation criteria in the rankings of projects, discussed in **Section 7**.

SECTION 2
Basin Characteristics

2.1 Background

This section characterizes the fundamental physical and hydrological attributes throughout Indian River County that directly influence stormwater management strategies. Understanding these basin characteristics, including geography, topography, soils, land use, hydrology, and floodplain areas, provides the context for the SMP and its proposed recommendations.

2.2 Geography

Indian River County is located in Southeast Central Florida and is bordered to the north by Brevard County, Okeechobee and Osceola Counties to the West, St. Lucie County to the south and the Atlantic Ocean to the east. Major geomorphic divisions of the Florida Peninsula were established by White (1970)[1] and are adopted herein to characterize the geography of IRC. The County lies at the intersection of two (2) physiographic divisions (**Figure 2**). These physiographic divisions were formed by the rise and fall of Pleistocene sea levels and represent former marine terraces and shorelines. The Osceola Plain is associated with the Talbot Terrace which formed approximately 125,000 years ago when sea levels were roughly 45-feet above current sea levels. The Eastern Valley is associated with the Pamlico Terrace which formed 11,000-100,000 years ago when sea level were approximately 25-feet above current sea levels.

Further sub-divisions the two major physiographic divisions are based on topographic ridges and valleys formed by the gradual rises and retreats of Pleistocene sea levels. These subdivisions were delineated by cartographer H.K. Brooks (1981)[2] and later digitized by the St. Johns River Water Management District (SJRWMD). Six such physiographic divisions or "subdistricts" occur within IRC (**Figure 3**). Within the Osceola Plain, a small portion of the Kissimmee Valley Subdistrict occurs in the extreme southwest portion of IRC and rises to meet the Holopaw-Indian Town Ridges and Swales Subdistrict to the northeast. The Eastern Valley contains the low-lying and poorly drained St. Johns Marsh and Sebastian-St. Lucie Flats Subdistricts. The St. Johns Marsh Subdistrict is bounded by ridges including the Osceola Plain to the west and the Upper St. Johns Karst to the east. The Sebastian-St. Lucie Flats Subdistrict is bounded by the Upper St. Johns Karst to the west and the Central Atlantic Coastal Strip to the east.

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1. White, William A. 1970. The Geomorphology of The Florida Peninsula. Florida Department of Natural Resources, Division of Interior Resources, Bureau of Geology.
2. Brooks, H.K. and J.M. Merritt. 1981. Physiographic Divisions [Florida]. (see https://catalog.libraries.psu.edu/catalog/1571174)

Figure 2
Division between Osceola Plain and Eastern Valley

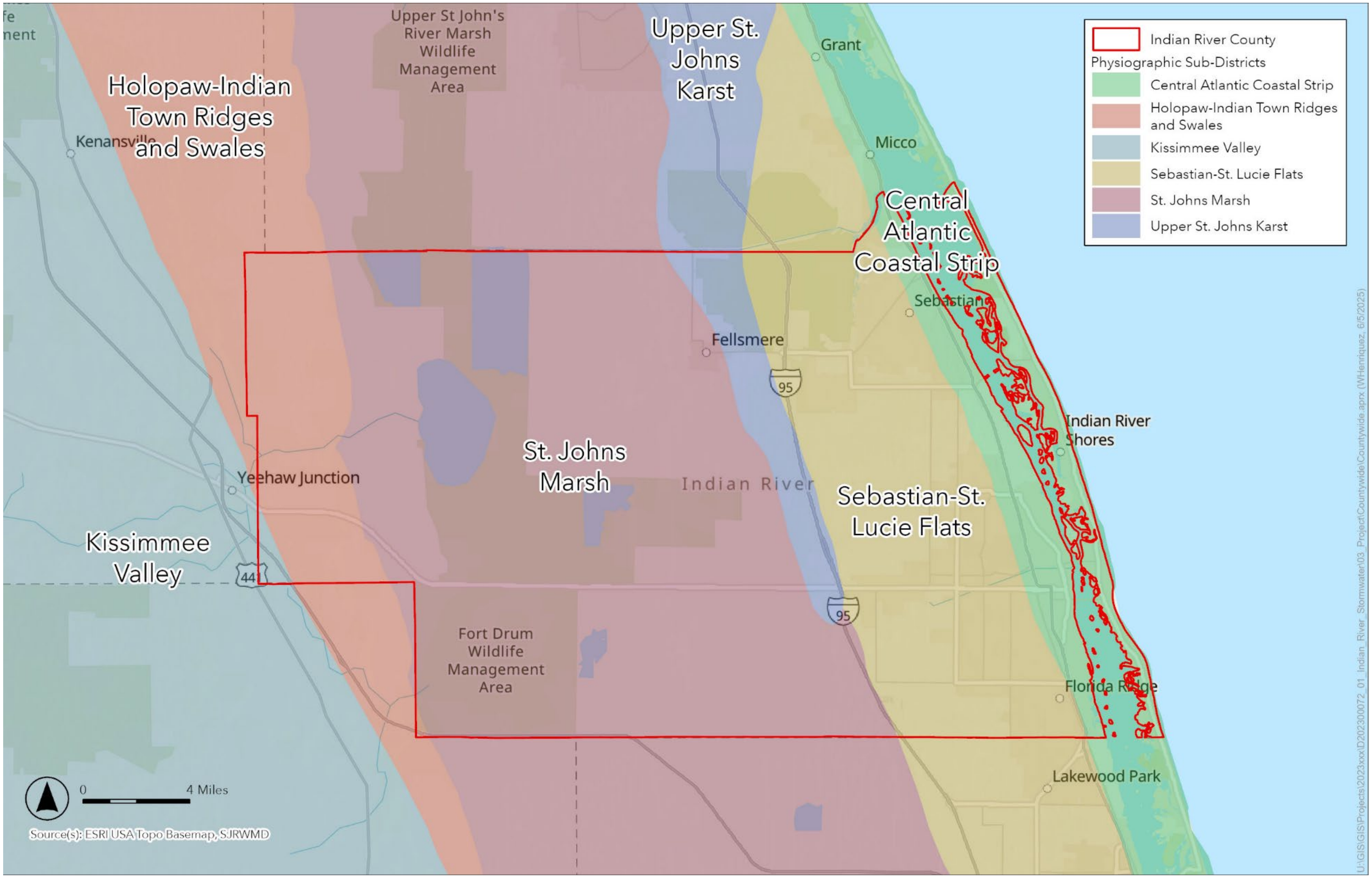

Figure 3

Physiographic regions in Indian River County

The eastern edge of Osceola Plain terminates within the western portion of IRC along a Pleistocene era marine scarp known as Talbot Terrace. This terrace is roughly coincident with the Holopaw-Indian Town Ridges and Swales Subdistrict. Significant geographic features within the Osceola Plain in Indian River County include the headwaters of several creeks such as Padgett Branch, Blue Cypress Creek and Gum Slough which drain the higher elevations along Talbot Ridge to the St. Johns Marsh and Blue Cypress Lake to the east.

The majority of IRC occurs within the Eastern Valley physiographic division. The Eastern Valley within Indian River County is mostly flat with only two distinct topographic ridges: Ten Mile Ridge (Upper St. Johns Karst) and the Atlantic Coastal Ridge (Central Atlantic Coastal Strip). Prior to modern-day drainage, these mostly flat areas consisted of swampy, poorly drained land. Large swaths of flat terrain with little to no relief are present within the St. Johns Marsh and Sebastian-St. Lucie Flats physiographic sub-districts. Here, natural drainage consisted of poorly defined, meandering flow ways and/or interconnected ponds and marshes with little to no discernable flow. Significant geographic features within the Eastern Valley include the IRL and St. Sebastian Creek to the east of Ten Mile Ridge, and the St. Johns River Marsh and Blue Cypress Lake to the west of Ten Mile Ridge.

2.3 Topography

Indian River County has a predominantly flat terrain typical of the Florida peninsula. A digital elevation model (DEM) compiled from the 2018 Florida Peninsular Project, recent United States Geological Survey (USGS) 3D Elevation Program (3DEP), National Oceanic and Atmospheric Administration (NOAA) Bathymetric Continuously Updated Digital Elevation Model Tiles, and USGS High Accuracy Elevation data is depicted in **Figure 4**. Elevations are in North American Vertical Datum 1988 (NAVD88). The latest LiDAR maps from 2019 were obtained. The County's topography is characterized by its subtle slopes and low-lying, broad basins with a few a few notable topographic features as described in USGS, 1975[3]. The highest elevations in the county occur along a narrow four (4) mile-wide swath of the Holopaw-Indian Town Ridges and Swales Subdistrict which runs north to south across approximately 12.5 miles of the northwestern portion of the County. Elevations along this terrace within IRC reach heights of approximately 65 feet. The topography slopes eastward from this ridge down into the Pamlico Terrace which contains the St. Johns River Marsh, and three distinct ridges. Within the Pamlico Terrace, natural ground elevations range from 20 to 35 feet. The eastern edge of the St. Johns River Basin is bounded by Ten-Mile Ridge. This ridge runs parallel to the coastline roughly coincident with Interstate 95. Natural ground elevations along Ten-Mile Ridge are up to 35 feet. The Atlantic Coastal Ridge occurs immediately adjacent to the IRL along US Highway 1 and is the most prominent topographic feature in Indian River County. Natural ground elevations along the Atlantic Coastal Ridge are up to 50 feet. The South Fork of the St. Sebastian River lies between these two ridges within the Sebastian-St. Lucie Flats Subdistrict with elevations ranging from near sea level to 20 feet. The third ridge feature consists of the offshore barrier islands which are low-lying with elevations up to approximately ten (10) feet.

[3] United States Geological Service. 1975. Water Resources of Indian River County, Florida. Water resources of Indian River County, Florida (FGS: Report of investigations 80)

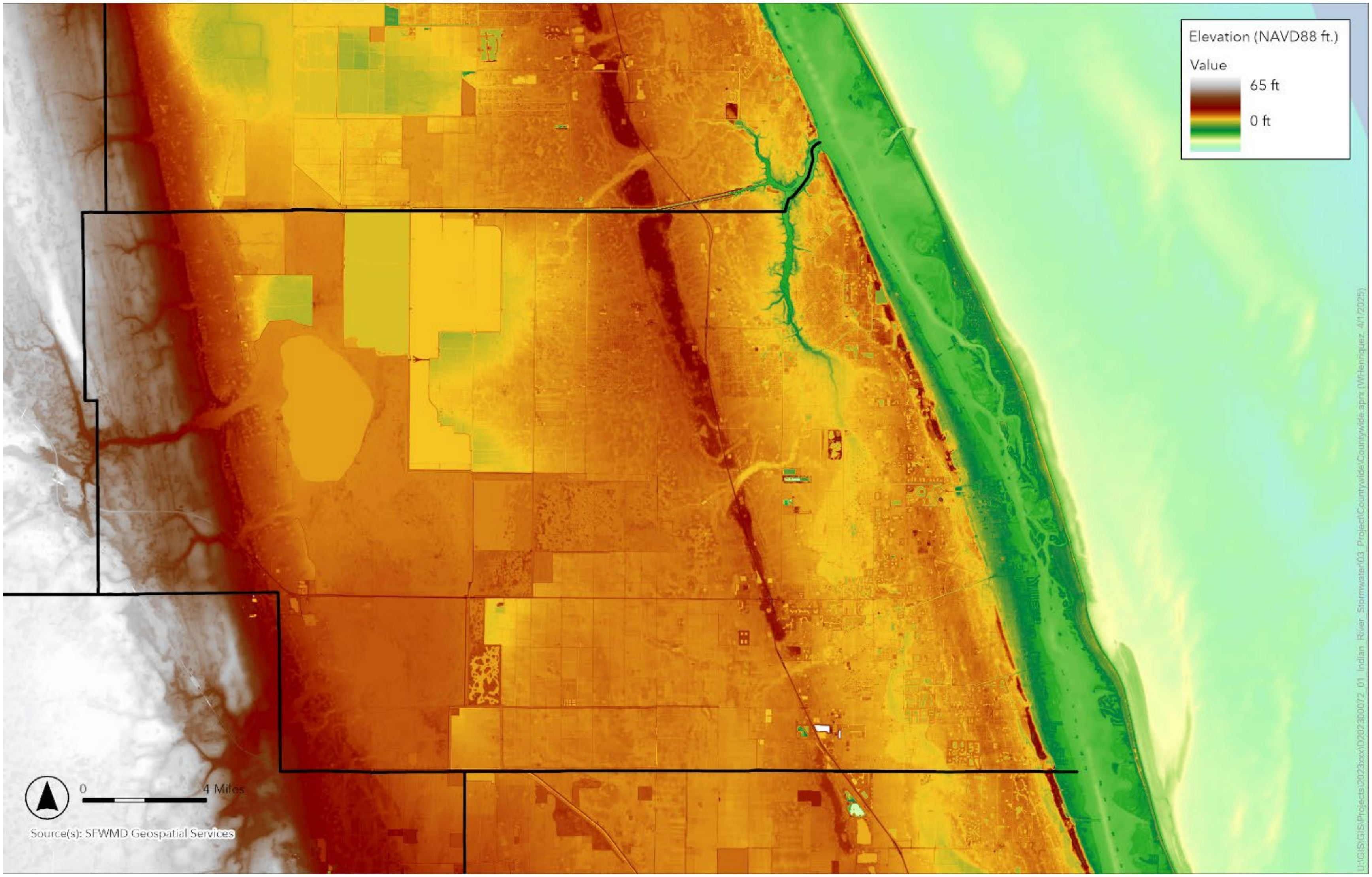

Figure 4
Elevations of Indian River County and surrounding areas

2.4 Soils

The Soil Survey of Indian River County, Florida (United States Department of Agriculture (USDA) 1987) groups and describes general soil map units based on landforms and drainage patterns. An analysis of United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) web soil survey map units and physiographic subdistricts was conducted to provide a characterization of soils within each physiographic subdistrict. The Kissimmee Valley and Holopaw-Indiantown Ridge subdistricts were grouped together due to their similarities and small extent of the Kissimmee Valley Subdistrict within the county. Given the scale of the County and number of soil map units, soil map units were grouped by Great Group soil taxonomic class (a broader level of classification than soil series) according to the USDA Natural Resources Conservation Service (NRCS) (1999[4]). This Great Group classification groups soils of similar pedological formation processes, the type and sequence of soil horizons and other physical properties. Soil Great Groups within IRC are provided in **Figure 5** and discussed below.

Soils within the Central Atlantic Coastal Strip Subdistrict are characterized by sandy to fine sand textured quartz sand entosols (Quartzipsamments) and mucky clay soils (Hydraquents) along the IRL. The dominant soil map unit is McKee Mucky Clay which occurs along terrestrial areas immediately adjacent to the IRL. The mainland portion of this Subdistrict is dominated by Alaquods including the Immokalee Sand and Myakka Sand map units which occur along the gentle side slopes of the mainland ridge. The highest elevations of the mainland ridge contain well-drained Quartzipsamments including Astatula Sand and St. Lucie Sand. The barrier islands are typified by relatively young Quartzipsamments with poorly developed soil horizons. Dominant soil series include Canaveral Sand and Captiva Sand which occurs in lower elevations, and Palm Beach Sand directly along the coastline. Areas of sandy fill material are mapped as Quartzipsamments and are also common within the physiographic subdistrict.

Soils within the Holopaw-Indiantown Ridge and Kissimmee Valley Subdistricts are dominated by Alaquods including Immokalee Sand and Myakka Sand which occupy the broad, flat expanses along the Talbot Terrace. Higher ridges and knolls contain well-drained Quartzipsamments, namely Satellite Sand. Drainageways, sloughs and creeks along the Talbot Terrace are typified by poorly drained sandy or loamy soils in the Argiaquoll, Glossaquolf and Psammaquent Great Groups. Typical soil series within these areas include Pompano Sand, Floridana Sand and Riviera Sand. Mucky textured soils in the Haplosaprist Great Group including Samsula Muck and Floridana Mucky Fine Sand are common within poorly drained and larger wetland areas.

Soils within the Sebastian-St. Lucie Flats Subdistrict are typified by poorly drained soils with aquic (saturated) moisture regimes and shallow “hardpans” in the form of either an argillic (clay) or spodic (fine-textured organic-aluminum complexes) horizons which dramatically slow the downward movement of water. Dominant soils in this subdistrict include those in the Glossaqualf Great Group characterized by a shallow argillic horizon such as Winder Sand, Pineda Sand and Riviera Sand, and Alaquods with a shallow spodic horizon including Eau Gallie Sand, Wabasso Sand and Oldsmar Sand. Better-drained

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[4] United States Department of Agriculture. 1999. Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. Second Edition. https://www.nrcs.usda.gov/sites/default/files/2022-06/Soil%20Taxonomy.pdf

spodisols including Immokalee Sand and Myakka Sand are common along the slopes of the ridges that bound the Sebastian-St. Lucie Flats.

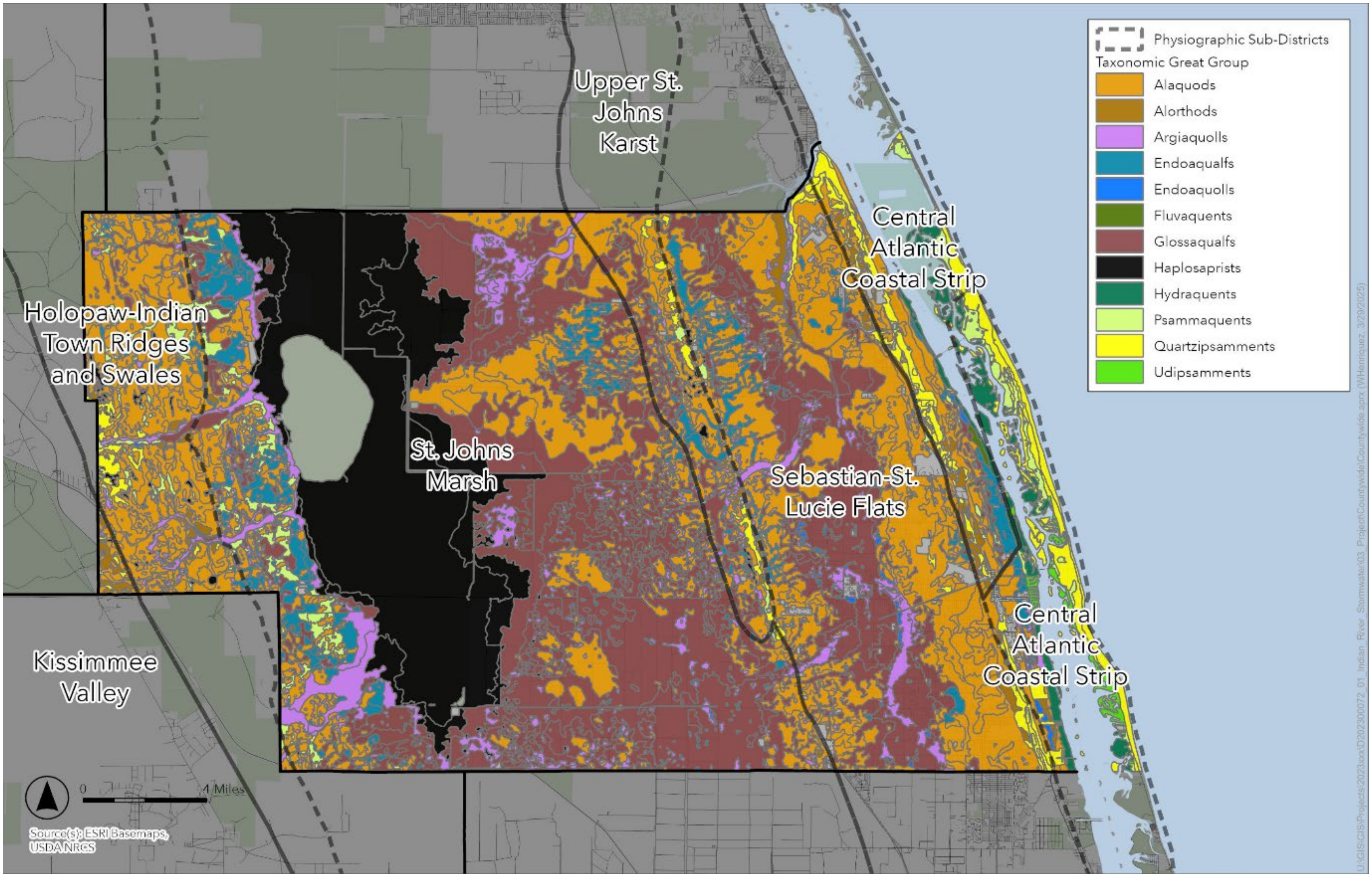

Figure 5

General Soil Map of Indian River County

Soils within the St. Johns Marsh Subdistrict are characterized by wet, very poorly drained soils with mucky or sandy textures in the Haplosaprist Great Group. Terra Ceia Muck is the dominant soil map unit and occurs in close association with the St John River marsh and areas around Blue Cypress Lake in the central portion of the subdistrict. This soil series has a profile entirely comprised of organic material to a depth of 65 inches. Gator Muck and Samsula Muck occur along the outer margins of the Terra Ciea Muck map unit and consists of a relatively shallow muck layer on top of sandy or loamy material. Canova Muck, in the Glossaqualf Great Group, occurs along the outer margins of the St. John's Marsh and is differentiated from the Haplosaprists by well-defined sub-surface horizons of sand underlain by an argillic horizon. Poorly drained Alaquods and Glossaqualfs including Riviera Sand, Pineada Sand, Wabasso Sand and Winder Sand are dominant along the periphery of the St. Johns River marsh.

Soils within the Upper St. Johns Karst Subdistrict are characterized by sandy to fine sand textured soils. Alaquods including Immokalee Sand and Myakka Sand occur along the length of Ten-Mile Ridge. Higher terraces along Ten-Mile Ridge contain Quartzipsamments, primarily Satellite Sand. The western side slopes and flats within the Upper St. Johns Karst Subdistrict contain poorly drained Alaquods and Glossaqualfs with shallow restrictive layers including Riviera Sand, Pineada Sand, Wabasso Sand and Eau Gallie Sand.

2.5 Land Use/Land Cover

Land use and land cover varies across Indian River County and is closely related to topography and soils. In this section, land use and land cover is discussed in the context of physiographic regions given the correlation between dominant land uses and physical geography. Land uses throughout IRC have been altered from their natural state, with abundant residential development along the east coast, and vast swaths of farmland dominating the low-lying valleys. Most of the natural land cover within IRC occurs along the far-western interior portions of the county and along Ten-Mile Ridge. The Cooperative Land Cover v3.8 (CLC) Map by the Florida Fish and Wildlife Conservation Commission (FWC) and Florida Natural Areas Inventory (FNAI) was analyzed by physiographic region. **Figure 6** illustrates generalized land use by the CLC within IRC, with similar land uses grouped together. Dominant land uses by physiographic region are provided in **Table 3**.

Significant variations in agricultural land classifications throughout IRC were observed when comparing different datasets: SJRWMD 2020 Land Use Land Cover (LULC), statewide generalized Florida Land Use and Cover Classification System (FLUCCS), FWC/FNAI CLC, and Florida Department of Revenue (FDOR) 2024 parcels. These discrepancies most likely arise from differences in purpose, methodology, and timing of each dataset. The FDOR 2024 parcel data classifies agricultural land based on tax codes at the parcel level, including non-farmed areas within agricultural parcels. This dataset most closely resembles land uses by IRC Property Appraiser. In contrast, SJRWMD 2020 LULC, the statewide FLUCCS, and FWC/FNAI CLC v3.8 classify land based on observable characteristics from remotely sensed imagery, independent of property boundaries. The generalized FLUCCS layer uses broader categories and older data, leading to further divergence. The FWC/FNAI CLC v3.8 emphasizes ecological attributes, while SJRWMD 2020 LULC uses detailed classifications and higher resolution imagery.

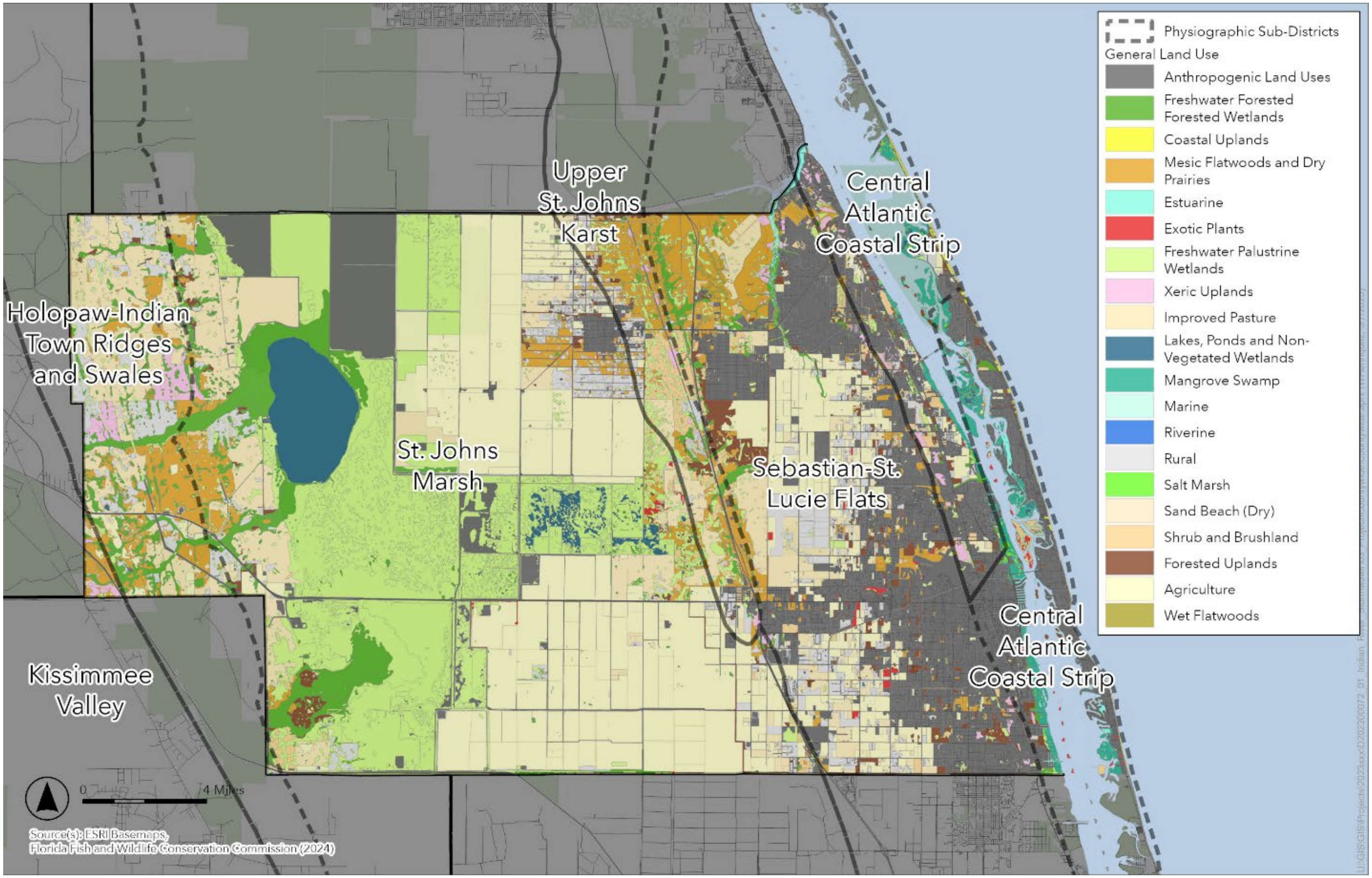

Figure 6

Land Uses in Indian River County

TABLE 3
DOMINANT LAND USES BY PHYSIOGRAPHIC PROVENCE

CLC Code: Description	Acres	% of Region
Atlantic Coastal Ridge		
18221: Residential, Med. Density - 2-5 Dwelling Units/AC	4585.292	15.44%
1840: Transportation	3939.444	13.27%
5250: Mangrove Swamp	3627.638	12.22%
None: Golf courses	1780.156	5.99%
18222: Residential, High Density > 5 Dwelling Units/AC	1718.946	5.79%
Indiantown-Holopaw Ridges and Swales		
None: Improved Pasture	10700.84	38.01%
1311: Mesic Flatwoods	4184.761	14.87%
183314: Unimproved/Woodland Pasture	2580.107	9.17%
2233: Mixed Wetland Hardwoods	1301.39	4.62%
1230: Upland Coniferous	1210.966	4.30%
Kissimmee Valley		
1311: Mesic Flatwoods	411.7672	32.60%
1312: Scrubby Flatwoods	213.8394	16.93%
1210: Scrub	130.9174	10.36%
None: Improved Pasture	73.2285	5.80%
1840: Transportation	69.71205	5.52%
St. Johns Marsh		
None: Citrus	52687.9	29.57%
2120: Marshes	32692.6	18.35%
2112: Mixed Scrub-Shrub Wetland	15929.2	8.94%
None: Improved Pasture	15665.71	8.79%
3220: Artificial Impoundment/Reservoir	10498.88	5.89%
Sebastian-St. Lucie Flats		
18221: Residential, Med. Density - 2-5 Dwelling Units/AC	10722.05	13.79%
None: Citrus	9006.851	11.59%
1840: Transportation	7833.315	10.08%
None: Improved Pasture	7202.955	9.27%
1311: Mesic Flatwoods	6834.177	8.79%
Upper St. Johns Karst		
1311: Mesic Flatwoods	3376.117	22.98%
1500: Shrub and Brushland	1887.388	12.84%
None: Improved Pasture	1573.133	10.71%
2120: Marshes	911.0506	6.20%
2111: Wet Prairie	764.3764	5.20%

The discrepancies among land use classifications by these various sources create complexity in evaluating nutrient loading amounts generated by lands in IRC. **Table 4** shows a summary of agricultural land areas as categorized by various sources. County-wide, there is a difference of approximately 25,625 acres between the CLC agricultural land area and the FDOR agricultural land area.

TABLE 4
AGRICULTURAL LAND AREA IN INDIAN RIVER COUNTY FROM VARIOUS SOURCES

Area	Total Area (acres)	Agricultural Land Area (Acres)			
		CLC 2024	FDOR 2024	SJRWMD 2020	FLUCCS 2017
County-wide	329,735.1	110,595.5	136,220.1	116,978.2	144,564.3
Within BMAPs Combined	139,903.4	33,018.3	41,705.8	36,966.4	45,813.8
Within Central IRL B BMAP	71,018.2	17,596.7	27,574.0	21,406.3	30,054.1
Within Central IRL SEB BMAP	68,884.9	15,421.6	14,131.8	15,548.6	15,759.7

To improve accuracy in identifying agricultural parcels, IRC should integrate high-resolution LULC datasets with field assessments and stakeholder engagement. Overlaying SJRWMD 2020 LULC and FWC/FNAI CLC v3.8 on parcel data can refine classifications. Periodic field surveys and collaboration with local stakeholders can provide ground-truth data. Implementing a GIS-based workflow and encouraging property owners to report land use changes will help maintain accurate records and support informed land use planning and conservation efforts. It is recommended that IRC's Planning Division ensure that all lands with agricultural exemptions be removed from IRC's BMAP load requirements.

2.6 Hydrology and Drainage

IRC falls within two (2) distinct drainage basins as defined by SJRWMD (**Figure 7**). The basin divide is roughly coincident with Ten-Mile Ridge with areas to the west of Ten-Mile Ridge lying within the Upper St. Johns River Basin, and areas east of Ten-Mile Ridge lying within the IRL Basin. Natural waterflow through these basins has been highly altered to suit various land uses including agriculture and residential development. Scores of canals and hundreds of smaller ditches bisect these drainage basins. These two (2) basins are further sub-divided into eight (8) sub-basins as defined by USGS level 10 Hydrologic Unit Codes (HUC-10) (**Figure 8**).

The Upper St. Johns River Basin contains four (4) HUC-10 basins. Three (3) of these basins including Blue Cypress Creek, Blue Cypress Lake-St. Johns River and Fort Drum Creek originate from the higher elevations of the Osceola Plain to the west and contain numerous creeks and interconnected wetlands that convey water generally eastward towards the St. Johns River Marsh and Blue Cypress Lake. The fourth basin; Melbourne Tillman Canal-St. Johns River, has a boundary roughly along the Brevard County-Indian River County line and has a nominal footprint within IRC. Water from within these basins flows north to the St. Johns River.

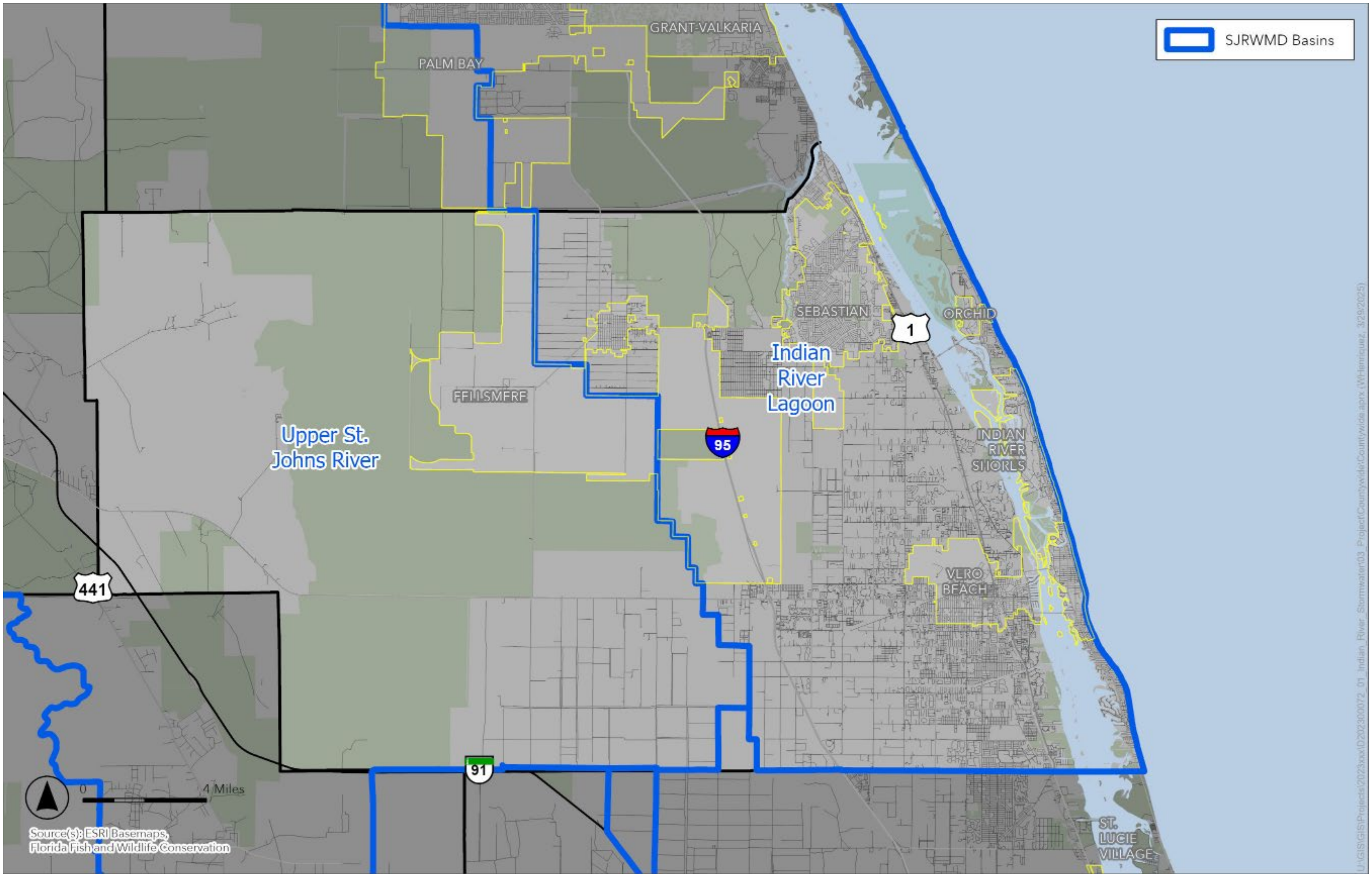

Figure 7

Drainage Basins in Indian River County per St. Johns River Water Management District

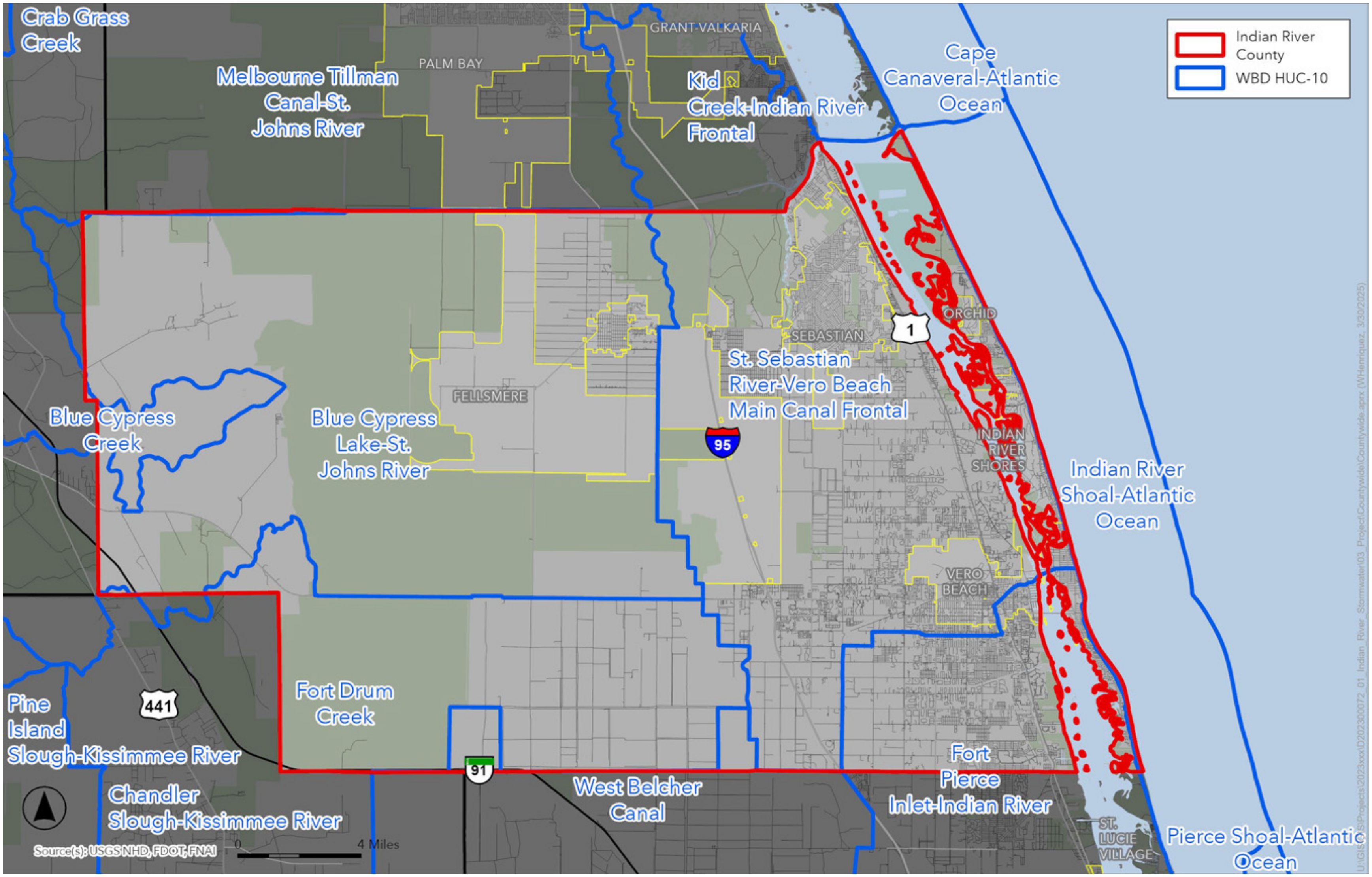

Figure 8
HUC Watersheds in Indian River County per United States Geological Survey

The majority of the land area east of Ten-Mile Ridge lies within the St. Sebastian River-Vero Beach Main Canal Frontal Basin. This basin contains several prominent man-made drainage features including North Canal near the center of the HUC-10 basin and Main Canal, in the southern third of the HUC-10 Basin. These canals and their extensive network of man-made tributary canals and ditches serve to drain the low-lying areas of the Sebastian-St. Lucie Flats east towards the IRL. The South Prong of the St. Sebastian River provides natural drainage for the northern half of the HUC-10 Basin.

The southeastern corner of IRC lies within the Fort Pierce Inlet-Indian River HUC-10 Basin. The primary drainage feature within this basin is the South Canal, which, like North Canal and Main Canal, drains low-lying portions of the Sebastian-St. Lucie Flats east towards the IRL. Additional HUC-10 basins within IRC have minimal land area and include the West Belcher Canal Basin within the southern portion of the county, and the Indian River Shoal-Atlantic Ocean Basin which includes areas immediately along the coast.

2.7 Floodplain

The FEMA Flood Insurance Rate Map (FIRM) flood zones for IRC closely follow the terraces, swales and ridges of the physiographic regions within the County (**Figure 9**). Over two-thirds of the land area within IRC lies within the 100-Year Floodplain, with the majority of this area occurring within the St. Johns Marsh physiographic subdistrict. Significant portions of the Coastal Atlantic strip along the IRL, and Atlantic Ocean are also within the 100-Year Floodplain. The Sebastian-St. Lucie Flats contains broad areas within the 100-Year Floodplain, in addition to low-lying areas outside of the 100-Year Floodplain due to the extensive network of man-made drainage canals within this physiographic region. The Holopaw-Indian Town Ridges and Swales physiographic region has relatively unaltered drainage patterns with numerous creeks, sloughs and interconnected wetlands accounting for the area within the 100-Year Floodplain. **Table 5** provides the percentage of land area within each FEMA Flood Zone by physiographic region (see **Figure 3** for the map of physiographic regions within IRC). A comprehensive flood study has not been completed to date for IRC. To aid in the process of applying for grants and other improvement efforts, it is highly recommended that an annual flood study be conducted within the County, to reduce flood zones A and AO each year. This would enable IRC to provide FEMA with updated modeling data and could potentially convert to AE elevations on future FEMA flood maps.

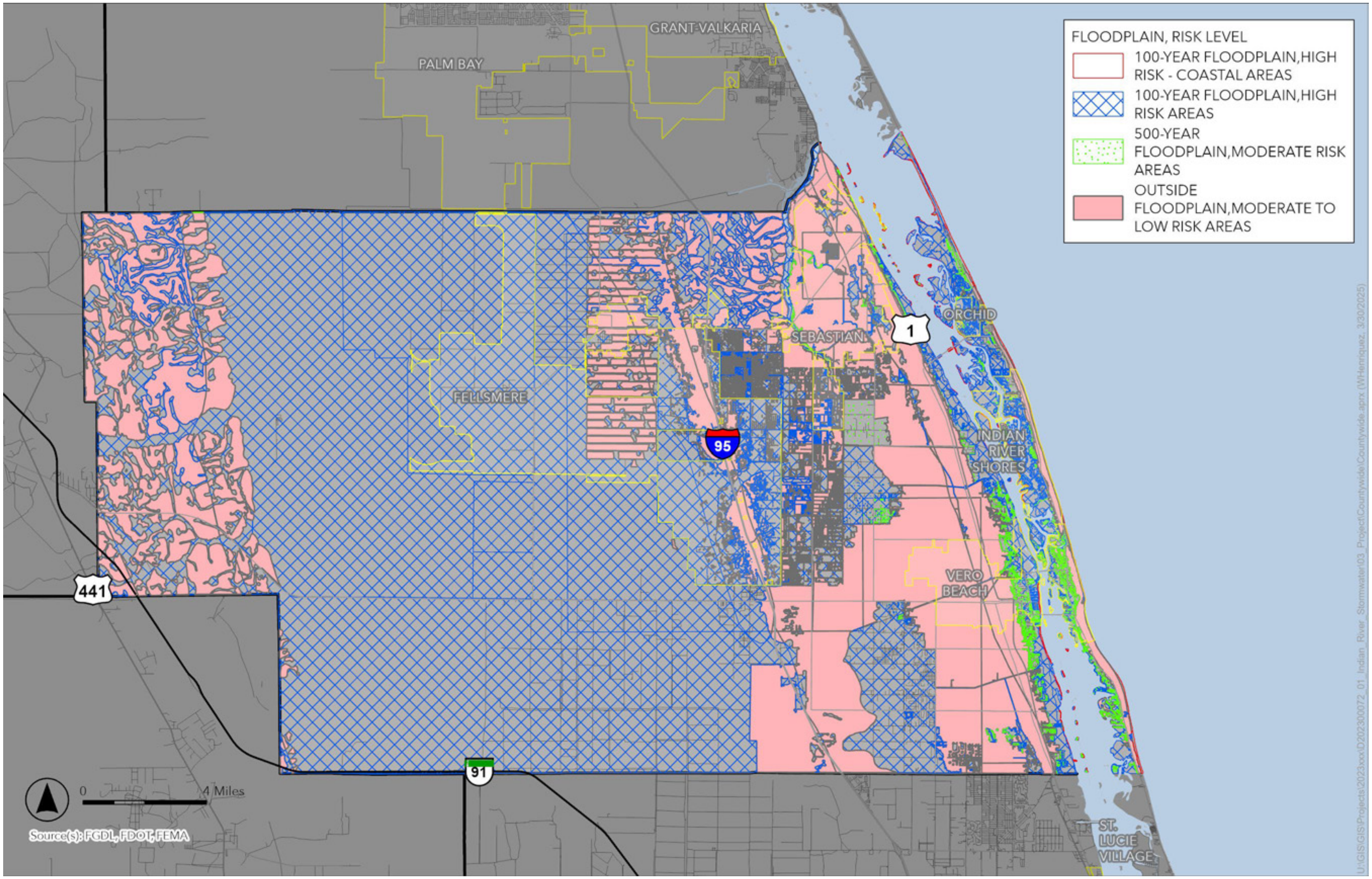

Figure 9

FEMA Floodplains in Indian River County

TABLE 5
FLOOD ZONES BY PHYSIOGRAPHIC REGION

Physiographic Sub-District	Floodplain	Flood Zone	Acres	% of Sub-District
Central Atlantic Coastal Strip	100-Year Floodplain	A	292.26	0.98%
	100-Year Floodplain	AE	10814.83	36.42%
	100-Year Floodplain	AO	70.83	0.24%
	100-Year Floodplain	VE	853.30	2.87%
	500-Year Floodplain	X	4180.29	14.08%
	Outside Floodplain	X	13482.97	45.41%
Holopaw-Indian Town Ridges and Swales	100-Year Floodplain	A	10604.85	37.69%
	100-Year Floodplain	AE	3.01	0.01%
	Outside Floodplain	X	17527.26	62.30%
Kissimmee Valley	100-Year Floodplain	A	394.34	31.21%
	Outside Floodplain	X	869.17	68.79%
Sebastian-St. Lucie Flats	100-Year Floodplain	A	5181.46	6.67%
	100-Year Floodplain	AE	23318.18	30.00%
	100-Year Floodplain	AH	0.12	0.00%
	500-Year Floodplain	X	1459.81	1.88%
	Outside Floodplain	X	47773.91	61.46%
St. Johns Marsh	100-Year Floodplain	A	82419.62	46.25%
	100-Year Floodplain	AE	80615.44	45.24%
	500-Year Floodplain	X	4.74	0.00%
	Outside Floodplain	X	15153.81	8.50%
Upper St. Johns Karst	100-Year Floodplain	A	3699.58	25.18%
	100-Year Floodplain	AE	4150.16	28.24%
	Outside Floodplain	X	6844.09	46.58%

SECTION 3

Water Quality Assessment

3.1 Background

The IRL lies along the eastern coast of Florida and runs throughout the length of IRC. The portion of the lagoon adjacent to IRC is part of the Central IRL, for which a basin management action plan (BMAP) has been adopted to address the total maximum daily loads for total nitrogen (TN) and total phosphorus (TP) developed to recover the loss of seagrasses in that portion of the IRL. Originally adopted in February 2013, and updated in 2021, the BMAP establishes loads reductions required to be met by each entity within the CIRL watershed and identifies projects or other activities to meet these reductions. Within IRC, numerous projects have been identified through the BMAP that are either planned or underway by various stakeholders throughout the County.

The CIRL BMAP is separated into four (4) project zones based on annual residence times: CIRL A, CIRL SEB, CIRL B, and CIRL SIRL. These project zones are shown in **Figure 10,** which was obtained from the BMAP document via FDEP. Of these, IRC has permitted point and non-point discharges to CIRL SEB and CIRL B which have different CIRL BMAP load reduction requirements as shown in **Table 6**.

TABLE 6
IRC CIRL BMAP REQUIRED LOAD REDUCTIONS (LBS/YEAR)

Project Zone	Total Nitrogen	Total Phosphorus
SEB	47,223	8,580
B	169,639	22,231
Total	**216,862**	**30,811**

Pollutant sources for CIRL include agriculture, municipal separate storm sewer systems (MS4s), septic systems, urban non-point sources, and wastewater treatment facilities. IRC is designated as a Phase II MS4 under permit number FLR04E068. A Phase II MS4 is designated as such if any portion of the municipal stormwater management system is located within an urban area defined by the U.S. Census Bureau serving a population between 1000 and 100,000 as of 1989.

Urban non-point sources within IRC, and particularly surrounding the areas of interest, include Fellsmere Water Control District (FWCD), Indian River Farms Water Control District (IRFWCD), Sebastian River Improvement District, and Vero Lakes Water Control District. Other municipalities contributing to nutrient loading are the City of Fellsmere, City of Vero Beach, City of Sebastian, Indian River Shores, and Town of Orchid. As mentioned throughout this SMP, there are several stormwater canals owned by IRFWCD throughout IRC which ultimately discharge into IRL.

Additionally, smaller drainage structures exist that discharge into the lagoon, although the full extent of these structures and their ownership is not readily known. See Section 6.1.9 for further discussion of these structures.

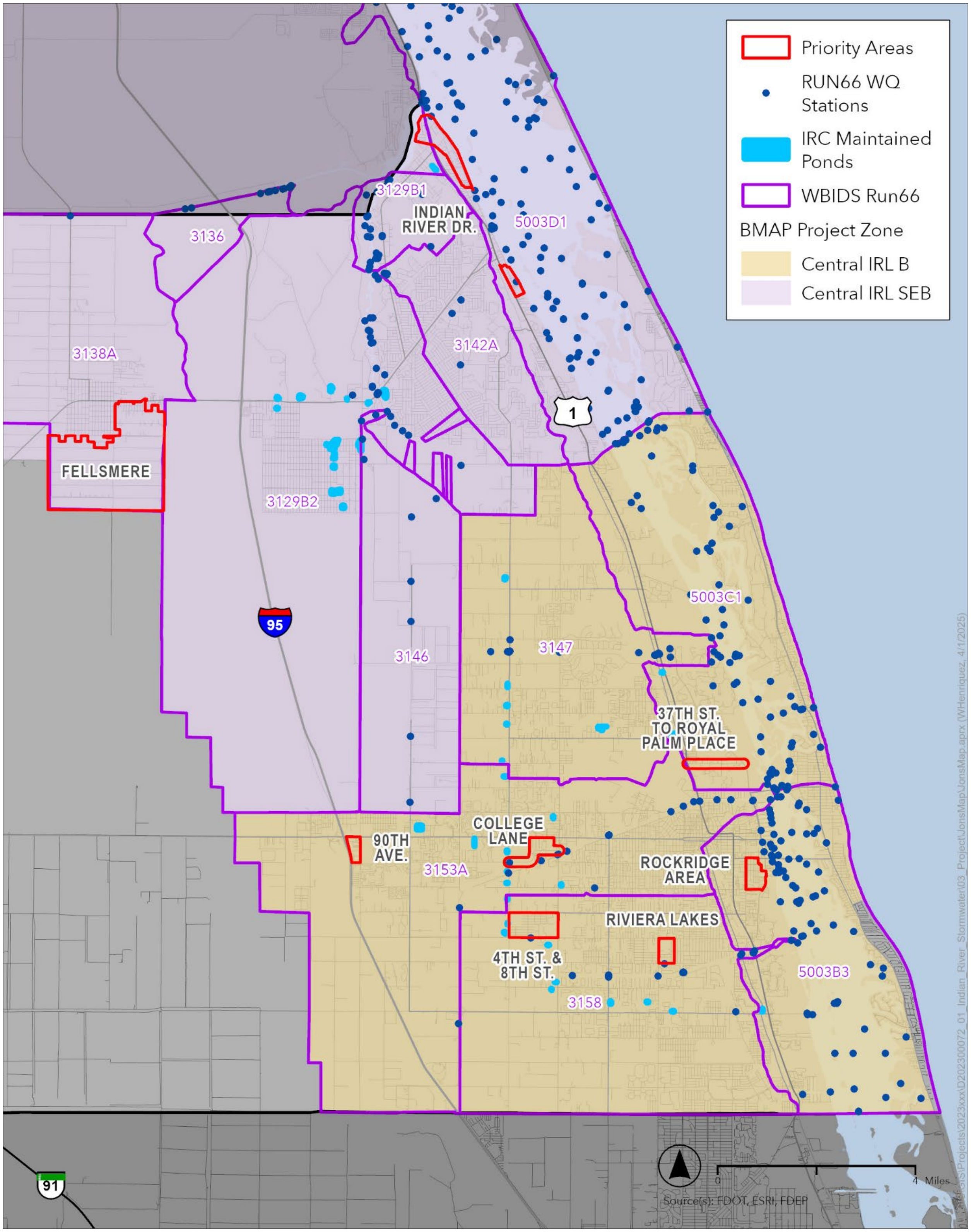

Figure 10

BMAP Project Zones and RUN66 Stations with Priority Areas in IRC

3.2 Water Quality Evaluation

The FDEP Impaired Waters Rule (IWR) database (RUN 66) was queried for water quality data pertinent to the proposed project areas (**Figure 10**). The retrieved water quality data were primarily concentrated in the CIRL, Sebastian River and the Main Canal with sparsely spread stations throughout the watershed. These data allow us to track the trends in water quality over time. Those trends take into account the cumulative effect of changes from within the contributing area.

An understanding of the spatial and temporal variation in the water quality of those waterbodies is a critical element in the plan development. These tests are performed using the Seasonal Kendall Tau (SKT) test for trend based on monthly data grouped by Waterbody Identification (WBID). The WBID polygon represents a waterbody segment and the contributing area to that segment. Each WBID is assigned a waterbody type and class. Waterbody types include estuaries streams, lakes, springs, coastal, and beaches. Waterbody classes include:

- Class I or 1 – Potable Water Supplies
- Class II or 2 – Shellfish Propagation or Harvesting
- Class III or 3 – Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife
- Class III-Limited
- Class IV or 4 – Agricultural Water Supplies
- Class V or 5 – Navigation, Utility, and Industrial Use

Class 3 waters may be marine (3M) or freshwater (3F). Data provided to the State for assessments are assigned to a WBID according to their geographic coordinates.

These trend analyses identify which waterbodies are experiencing trends, either increasing or decreasing, in the various water quality parameters most relevant to the BMAP including:

- Total nitrogen
- Total phosphorus
- Chlorophyll *a*
- Dissolved oxygen

Monthly means of each of the parameters were used for the analysis. The period of record analyzed was 2016 through June 2024, inclusive. The results of the trends analysis are depicted as green and red arrows. Green indicates conditions are improving while red denotes degrading trends (**Table 7**). For many parameters, decreasing trends are indicative of improving conditions as concentrations decrease. For dissolved oxygen, the opposite is true, lower values are indicative of degrading conditions as lower concentrations of oxygen are less desirable. A black dash indicates that there is no trend, either improving or degrading.

TABLE 7
RESULTS FROM THE SEASONAL KENDALL TAU TREND TEST

Waterbody (WBID)	Total N (mg/l)	Total P (mg/l)	Chlorophyll a (µg/l)	Dissolved Oxygen %
Main Canal (3153A)	-	-	-	-
South Canal (3158)	-	-	-	-
South Indian River (Below SR 60) (5003B3)	↓	↑	↓	-
South Indian River (Above SR 60) (5003C1)	-	↑	-	-
South Indian River (St. Sebastian River) (5003D1)	↓	↓	↓	↓

The two canal WBIDs (WBID 3153A and 3158) exhibit no trends with respect to the parameters analyzed. The St. Sebastian River portion of the South Indian River WBID (WBID 5003D1) showed decreasing trends in all parameters, including dissolved oxygen. The South Indian River WBID below SR 60 (WBID 5003B3) had deceasing trends in nitrogen and chlorophyll a. An increasing trend in total phosphorus was observed in both segments of the South Indian River above and below SR60 (WBIDs 5003B3 and 5003C1). Overall, the estuarine waters in both Project Zones of the CIRL BMAP are experiencing decreasing trends in total nitrogen and chlorophyll a in two of the three WBIDs but an increasing trend in total phosphorus.

3.3 Summary of Indian River County Pollutant Loads

All of the proposed projects fall within the CIRL BMAP Project Zones “SEB” and “B”, the FDEP Load Estimation Tool is available to compare projects and provide a way to rank them based on their potential water quality benefit (**Figure 11**). The tool, which is based on the Spatial Watershed Iterative Loading Model (SWIL) developed for FDEP for tracking progress towards meeting the BMAP, will provide an estimate of the current loading estimate and potential reductions depending on the best management practice (BMP) proposed. This information will be incorporated into the project prioritization matrix to qualitatively rank the projects based on the projected load reduction potential.

Each of the priority areas was ranked based on the current condition loads using the SWIL Load Estimation Tool (LET) 3.0 developed for FDEP for the CIRL BMAP. The LET coverage was clipped to the priority areas polygons and loads were calculated using two methods; as a total load (lbs/year) and a normalized load (lbs/acre/yr). The proposed projects were then ranked by the BMAP project zone and subsequently, total nitrogen runoff load and normalized load respectively (**Table 8** and **Table 9**).

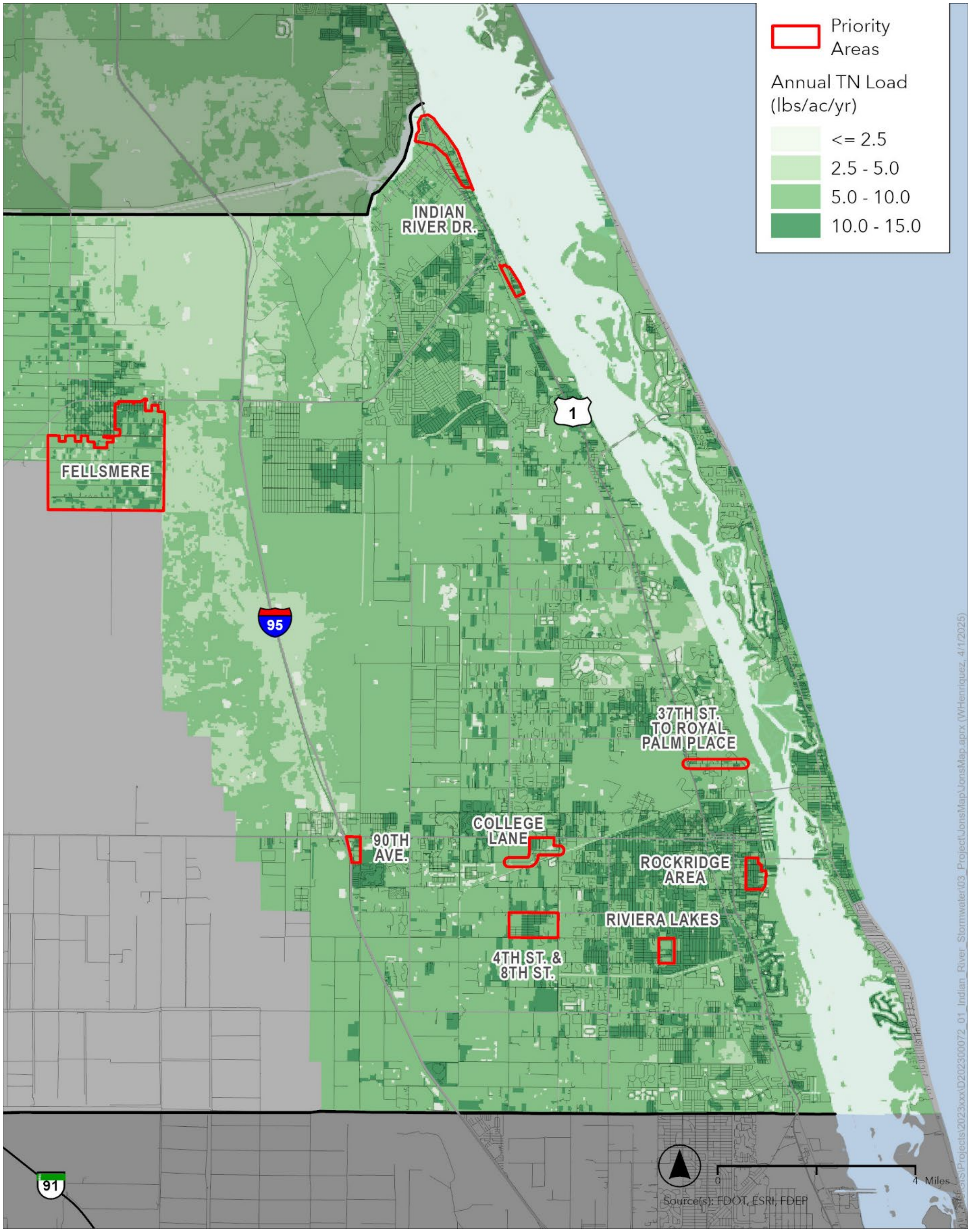

Figure 11
Annual Total Nitrogen Loads in Indian River County

TABLE 8
PRIORITY AREA TOTAL LOADS OF NITROGEN AND PHOSPHORUS FROM FDEP LOAD ESTIMATION TOOL

Priority Area	BMAP	Project Zone	Acres	Direct Runoff (lbs/year)		Baseflow (lbs/year)		Total (lbs/year)		Project Zone Rank
				Total nitrogen	Total phosphorus	Total nitrogen	Total phosphorus	Total nitrogen	Total phosphorus	
4th St. & 8th St.	Central IRL	Central IRL B	321	1350	210	1711	236	3061	446	1
Rockridge Area	Central IRL	Central IRL B	195	878	165	1092	150	1970	316	2
37th St. to Royal Palm Place	Central IRL	Central IRL B	156	512	70	853	117	1364	188	3
90th Ave.	Central IRL	Central IRL B	71	431	56	274	38	705	94	4
College Lane	Central IRL	Central IRL B	162	378	43	895	123	1273	167	5
Riviera Lakes	Central IRL	Central IRL B	99	314	44	589	81	902	125	6
Fellsmere	Central IRL	Central IRL SEB	2593	10125	1319	11053	1522	21178	2841	1
Indian River Dr.	Central IRL	Central IRL SEB	18	67	11	90	12	157	23	2

TABLE 9
PRIORITY AREA NORMALIZED LOADS OF NITROGEN AND PHOSPHORUS FROM FDEP LOAD ESTIMATION TOOL

Priority Area	BMAP	Project Zone	Acres	Direct Runoff (lbs/ac/year)		Baseflow (lbs/ac/year)		Total (lbs/ac/year)		Project Zone Rank
				Total nitrogen	Total phosphorus	Total nitrogen	Total phosphorus	Total nitrogen	Total phosphorus	
90th Ave.	Central IRL	Central IRL B	71	6.0	0.8	3.8	0.5	9.9	1.3	1
Rockridge Area	Central IRL	Central IRL B	195	4.5	0.8	5.6	0.8	10.1	1.6	2
4th St. & 8th St.	Central IRL	Central IRL B	321	4.2	0.7	5.3	0.7	9.5	1.4	3
37th St. to Royal Palm Place	Central IRL	Central IRL B	156	3.3	0.4	5.5	0.8	8.8	1.2	4
Riviera Lakes	Central IRL	Central IRL B	99	3.2	0.4	5.9	0.8	9.1	1.3	5
College Lane	Central IRL	Central IRL B	162	2.3	0.3	5.5	0.8	7.9	1.0	6
Fellsmere	Central IRL	Central IRL SEB	2593	3.9	0.5	4.3	0.6	8.2	1.1	1
Indian River Dr.	Central IRL	Central IRL SEB	18	3.8	0.6	5.1	0.7	8.9	1.3	2

As stated, the results from loadings analyses were calculated two (2) ways with different units: pounds per year (lbs/year) and pounds per acre per year (lbs/acre/year). Loads reported in pounds per year are important to better understand the amount of a pollutant entering a waterbody from a specific area. These loads can be directly related to the loading allocations presented in the 2023 CIRL BMAP update which are also reported in lbs/year. The issue with this reporting unit though is its inability to make real direct comparisons between the priority areas as the load is dependent primarily on the size of the basin. To directly compare the loads generated by different priority areas of different sizes, the loads are normalized by the area of the priority area, in lbs/acre/year. This method allows for the identification of “hot spots” or areas of relatively higher loads than others that could benefit from additional management action.

Table 8 and **Table 9** present the total and normalized TN and TP loads for each of the priority areas. In terms of total nitrogen runoff load, the 4th & 8th Street priority area ranks highest in the CIRL B project zone with 1,350 lbs/year and Fellsmere ranks highest in the CIRL SEB project zone with 10,125 lbs/year. In the CIRL B Project Zone in terms of normalized loads, the 4th & 8th Street priority area fell to third place and the 90th Ave project ranks the highest, with a normalized runoff load of 6.0 lbs/acre/year. In the CIRL SEB Project Zone, Fellsmere still ranks highest but by only 0.1 lb/acre/year.

3.4 Nutrient Load Reduction Options and Feasibility

IRC has numerous existing wet detention ponds throughout the County which provide initial treatment for stormwater loads. The potential increase load reduction attributed to placing vegetated floating mats in the County-maintained ponds was evaluated. The SWIL BMP tool utilized by FDEP would credit the vegetated mats with an additional 10% reduction after the reduction from being a stormwater pond. The comprehensive potential load reduction was derived by identifying a representative pond that is already credited by FDEP for the BMAP and extrapolate that result to the remaining 39 ponds (ponds shown in **Figure 10**). In lieu of current maintenance protocols of cutting and leaving in place, harvest and removal of vegetative growth including cattails could potentially provide some amount of nutrient load reduction.

The East Gifford Stormwater Improvement Project was selected as the existing representative pond. The TN starting load was 388.1 lbs. The system’s reduction was credited at 129 lbs. The remaining 259.1 lbs would be further credited by 10%, or 25.9 lbs. This system is one of the largest of the County-maintained ponds and was used as a conservative estimate for the other maintained ponds. Multiplying the additional 25.9 lbs by the remaining 39 ponds in IRC’s inventory ends up with an estimated reduction of 1,010.5 lbs/year. This is likely an overestimation and assumes that each of IRC’s ponds are designed as stormwater treatment systems.

Another suggestion is to mechanically remove aquatic plants rather than use herbicides. Herbicide allows the dead vegetation to release sequestered nutrients back into the water column and wash downstream. The mechanical removal of vegetation allows for the complete removal of the sequestered nutrients and through proper composting can be used as a soil amendment.

FDEP has recently approved granting credits for aquatic vegetation removal (FDEP 2023). For it to be credited, the practice must occur in freshwater canals and ditches filled with exotic/nuisance aquatic vegetation and not be considered a part of routine maintenance of an existing BMP. Native vegetation provides a habitat benefit and should not be harvested. Additionally, the amount of credit available is based on several factors, such as the distance from a waterbody that the removed material is disposed of and the type and weight of the material removed. FDEP provides protocols for determining the appropriate amount of credit.

There are additional pros and cons to vegetation removal. The removal of plant material could increase the volume in the canals and ditches for stormwater runoff. An additional improvement in waterbodies deemed impaired for nutrients due to the presence of excessive macrophytes could be potentially delisted since you remove the exotic plant material. Adverse effects include a short-term nutrient imbalance which may result in algal blooms. There will also be a short-term loss of habitat until native vegetation replaces the exotics.

Floating aquatic mats and aquatic vegetation removal are scalable BMPs. Either or both could be implemented at County-maintained ponds to varying degrees to provide nutrient loading reduction for IRC. In addition to County-maintained ponds, BMPs, such as bulk removal devices, could be implemented at numerous outfall locations along the IRL, such as bulk removal devices.

Two hypothetical scenarios were examined where two different bulk removal devices were deployed to remove nutrients at outfalls along IRL. Both locations were comparable in size and discharged directly to IRL. The devices selected were a hydrodynamic separator (vortex and continuous deflector separators (CDS) units) and a second-generation baffle box. The goal of the exercise was to gauge the effectiveness of these types of systems to reduce nutrients to the lagoon which could be used to look at other outfalls along the coast.

Starting loads were estimated using the FDEP Load Estimation Tool. The treatment areas were 85 and 94 acres respectively. The hypothetical analyses indicated annual runoff nitrogen loads of 325 and 249 lbs./yr and annual phosphorus loads totaled 44 and 39 lbs./yr, respectively. Using the FDEP estimated load reductions for each of the devices, the reductions for each of the systems can be calculated. The hydrodynamic separator is not credited with removing nitrogen but does provide a 10% reduction in phosphorus. The second-generation baffle box provides a 19.05% reduction in nitrogen and a 15.55% reduction in phosphorus. The results were averaged, and for an 89-acre site, the loads removed by the hydrodynamic separator was 0 lbs of nitrogen and 4 lbs of phosphorus. The baffle box averaged 55 lbs of nitrogen and 6.5 lbs of phosphorus removed. The results of the treatment scenarios are shown in **Table 10**. It should be noted that the efficiency of the baffle boxes can be increased with the use of a media filter. In addition, these devices could be installed at multiple or at all of the outfall structures across the IRL to maximize the water quality benefit.

Multiple BMP options exist to provide some degree of water quality treatment for County-maintained ponds and outfalls along IRL. It is important to note that the results presented here are hypothetical and that load reduction amounts will likely vary if implemented. The actual results will be dependent on several factors, including the existing loading quantities being received by the stormwater feature to be treated. The advantage of these BMPs is their scalability and they offer the opportunity to retrofit existing infrastructure. **Section 5** of this SMP further discusses these options.

TABLE 10
RESULTS OF HYPOTHETICAL TREATMENT SCENARIOS

Hydrodynamic Separators									
Project Area	Acres	Direct Runoff		Percent Removal		Final Load		Total Reduction	
		TN (lbs/year)	TP (lbs/year)	% TN Reduction	% TP Reduction	TN (lbs/year)	TP (lbs/year)	TN (lbs/year)	TP (lbs/year)
1	85	325	44	-	10	325	40	0	4
2	94	249	39	-	10	249	35	0	4

Second-generation Baffle Box									
Project Area	Project Area	Project Area		Project Area		Project Area		Project Area	
		TN (lbs/year)	TP (lbs/year)	% TN Reduction	% TP Reduction	TN (lbs/year)	TP (lbs/year)	TN (lbs/year)	TP (lbs/year)
1	85	325	44	19.05	15.5	263	37	62	7
2	94	249	39	19.05	15.5	202	33	47	6

SECTION 4
Flooding Assessment

4.1 Background

The flooding assessment section of this stormwater management report evaluates the flooding concerns and impacts associated with stormwater runoff within the County and acknowledges the Priority Areas identified by IRC.

4.2 Stormwater Management System

IRC's stormwater infrastructure faces several challenges due to aging systems and a lack of comprehensive connectivity. The County has a mix of infrastructure, consisting of three (3) dedicated stormwater treatment areas, 40 County-maintained stormwater ponds, privately owned wet and dry retention areas, and drainage systems comprised of a combination of shallow swales, ditches, inlets, and culverts, most of which generally lead to canals that ultimately discharge to the IRL. **Figure 12** shows an overview of the major systems in IRC. **Figure 13**, **Figure 14**, and **Figure 15** show the County's stormwater treatment areas. In some areas, particularly older neighborhoods, these drainage systems are often outdated, in disrepair, or undersized, and they are not well interconnected. As existing infrastructure struggles to cope with increased volumes of runoff, localized flooding worsens. Additionally, many of the existing systems do not include advanced water quality treatment features, allowing pollutants, such as nutrients from fertilizers and urban runoff, to flow into the IRL. All of these are factors resulting in inefficient management of stormwater.

Multiple municipal surface water management districts exist within IRC, as discussed in Section 3. These include Indian River Farms Water Control District, Fellsmere Water Control District, and Sebastian River Improvement District. The IRFWCD, established in 1923, covers approximately 44,000 acres of primarily agricultural land west of Interstate 95, along with an extensive network of canals and drainage infrastructure all draining to the IRL. The district's primary function is maintaining this system of gravity-fed and pump-assisted drainage channels that prevent flooding, control water levels, and support agricultural productivity in an area historically characterized by seasonal inundation. IRFWCD has three (3) major relief canals, including the South Relief Canal, the Main Relief Canal, and the North Relief Canal. The Fellsmere Water Control District, located in the western portion of IRC, focuses on managing water resources for a smaller area in and around the City of Fellsmere. The district was established to support agricultural development and flood control. The Sebastian River Improvement District represents another significant component of water management infrastructure within IRC. This district focuses on the drainage and water control needs of the Sebastian area, managing water resources that impact both agricultural and residential lands. The district's systems interact closely with natural water bodies, including the Sebastian River and surrounding wetland areas. In addition, there are smaller agricultural water control districts within IRC, including Delta Farms Water Control District, St. Johns Improvement District, and Vero Lakes Water Control District.

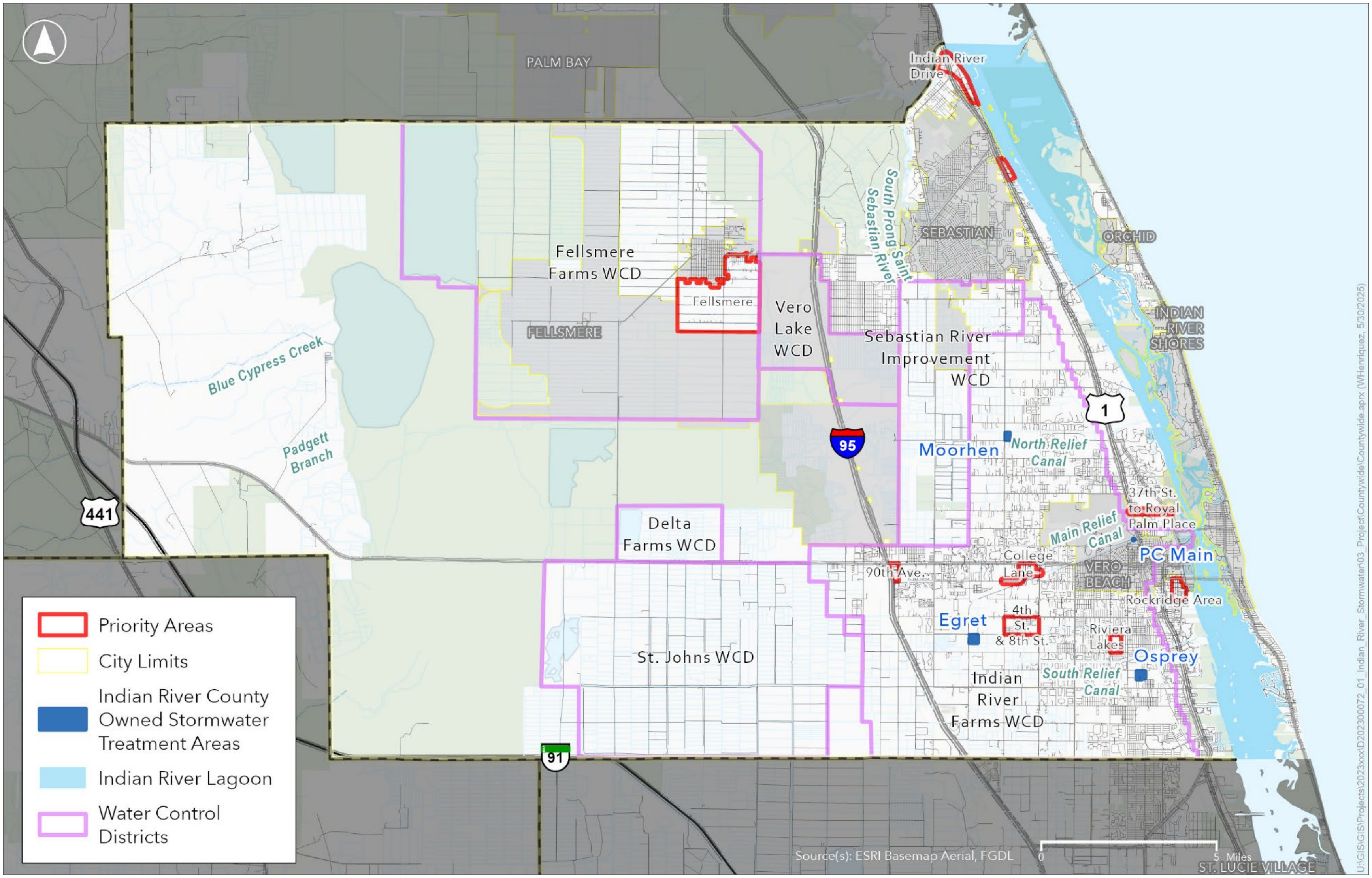

Figure 12

Major Stormwater Infrastructure in Indian River County

Figure 13
Egret Marsh Stormwater Treatment Area

Figure 14
Moorhen Marsh Stormwater Treatment Area

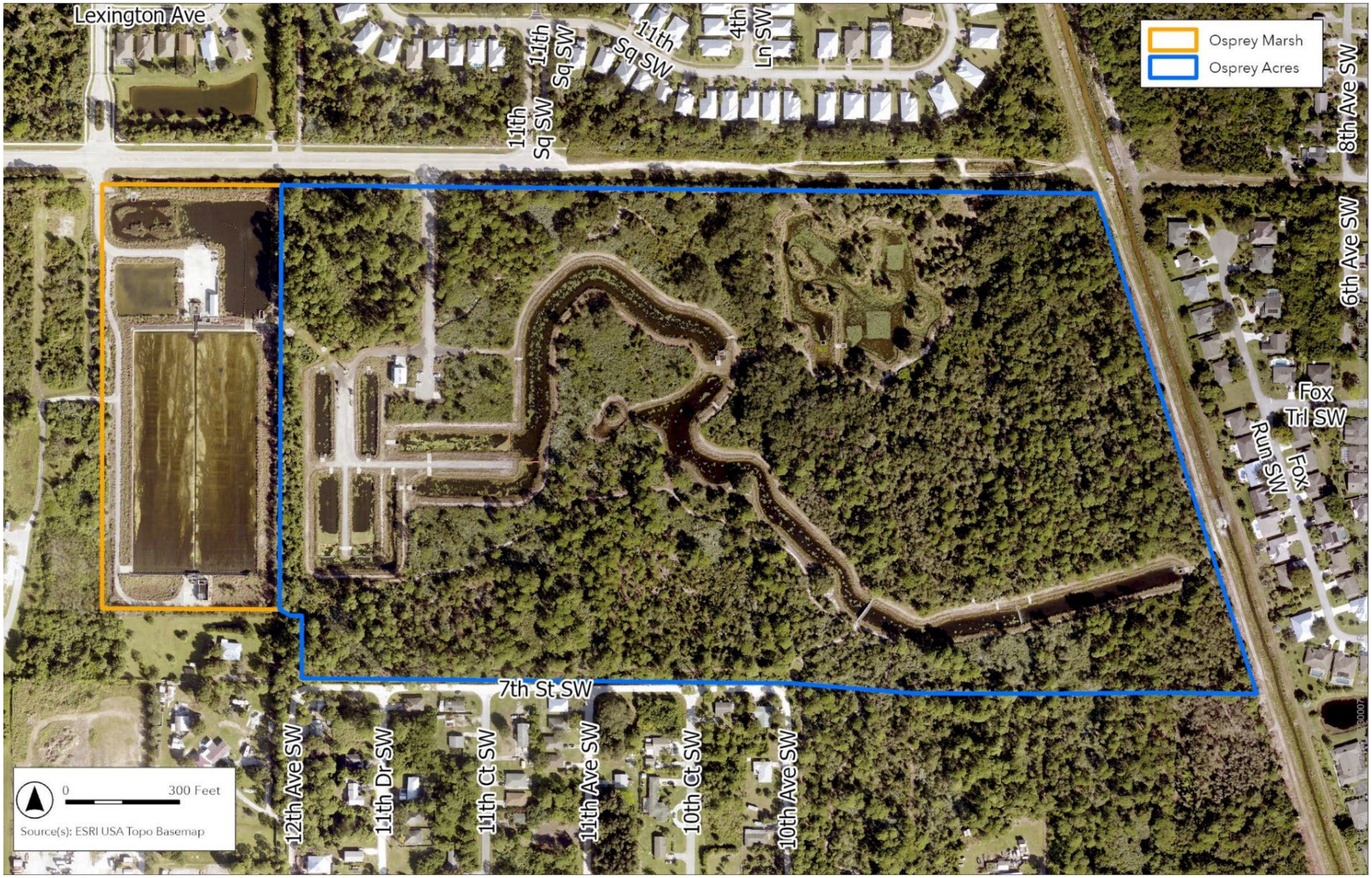

Figure 15

Osprey Acres Stormwater Treatment Area

Besides the Water Management Districts (WMDs), there are several cities within the borders of IRC, including City of Sebastian, City of Vero Beach, City of Fellsmere, Indian River Shores, and the Town of Orchid. Many of these entities have their own stormwater division with various projects underway to support the CIRL BMAP and for flood mitigation purposes. Coordination efforts with these stakeholders are summarized in Section 8.

IRC has made substantial progress in improving and updating its stormwater infrastructure in the last couple of decades. In addition to the There are three (3) stormwater treatment areas within IRC: Egret Marsh, Moorhen Marsh, and Osprey Marsh. Egret Marsh, constructed in April 2010 for $7.3 million, removes dissolved nitrogen and phosphorus from eight to ten million gallons of canal water daily using a 4.6-acre algae farm. Moorhen Marsh, completed in 2023 and situated between 58th and 66th Avenue, processes up to 10 million gallons per day through 8 cells using a low-energy aquatic plant system that grows water lettuce to absorb nutrients. Osprey Marsh, operational since spring 2015, treats ten million gallons of canal water and 1.5 million gallons of reverse osmosis brine discharge daily, also utilizing a 4.6-acre algae farm. Osprey Acres was added to Osprey Marsh as an additional treatment train in 2019. Additionally, IRC operates the PC Main Screening System, located within the Main Relief Canal at the outfall of IRL. Beginning operation in August 2008 at a cost of $5.3 million, the facility removes particles as small as 1/16th inch in diameter, preventing thousands of tons of aquatic plants and debris from entering the IRL. **Appendix A** includes aerial imagery of each of these stormwater treatment facilities.

While IRC has made efforts to address stormwater issues, there is still great opportunity to retrofit existing infrastructure and explore new projects to both address the water quality in IRL and to improve flood resilience.

4.3 Flood Impact Factors/Influences

Several natural and human-made factors influence flood impacts within Indian River County. Topography is highly influential across IRC since the flat, low-lying terrain makes water accumulation easier, especially during heavy rainfall or storm surges. Areas near the IRL and close to sea level are particularly vulnerable to flooding.

As discussed in Section 2, soils in IRC are primarily sandy. Although sandy soils have high permeability and tend to drain well, they are prone to erosion and have limited capacity to hold water, especially once already saturated. Combined with the likelihood of compaction due to development, the sandy soils in IRC are a factor to consider that impacts flooding in the area. In addition, changes in land use over time across IRC have increased the area of impervious surfaces. This has further reduced the ground's ability to absorb water, leading to more runoff and higher flood risks. The continued disruption of natural features such as wetlands and marshes further exacerbates this risk.

Another influence on the frequency and intensity of floods within IRC is the increased occurrence of severe weather events as a result of changing weather patterns due to climate change. The risk is especially great when storms occur that exceed the designed capacity of drainage systems, combined with the prevalence of aging infrastructure throughout the County. Finally, sea level rise is a growing concern, particularly in areas of the County along IRL. The rising water levels reduces drainage efficiency which leads to more frequent flooding, especially during storm surges and high tides.

4.4 Flood Management Considerations

4.4.1 Sea Level Rise and Flood Resiliency

Sea level rise (SLR) and flood resiliency are critical considerations in stormwater management, especially so in coastal regions like Indian River County, where low-lying areas are increasingly vulnerable to consequences from climate change. As sea levels continue to rise, traditional drainage systems become less effective, increasing the risk of chronic flooding, saltwater intrusion, and potential infrastructure damage.

Effective planning of stormwater infrastructure improvements requires understanding and consideration of projected sea level rise scenarios. Indian River County's Vulnerability Assessment (TetraTech, 2025) utilized Virginia Key Station due to the length of record for relative sea level rise trend. However, despite having a shorter record of data, the Trident Basin at Port Canaveral also has water level data from the last 20 years and is significantly closer in proximity to IRC.

Figures 16 and **17** show that over the last 20 years, there has been an acceleration in sea level rise, and therefore the relative rate of sea level rise is more than double what it was earlier this century. These data are also consistent with the observations from the Sebastian Inlet District State of the Inlet Report, (Zarillo, 2023).

NOAA predicts between 10 **-** 14 inches of SLR along the east coast by 2050 (NOAA, 2022). That means the predicted rise in sea level over the next 30 years is more than the total amount recorded over the past 100 years as shown by the Virginia Key Tide Station.

For coastal areas, this means:

- Minor flooding is expected to occur, on average, more than 10 times as often as it does today, and can be intensified by local factors.
- Moderate flooding will occur more frequently than minor flooding does today.
- Major flooding is expected to occur five times as often as it does today.

Predictions are based on the best available science and as much as the ability to measure water levels has improved over the last decade, we are sometimes surprised by results. Global sea level rose faster than expected in 2024, mostly because of ocean water expanding as it warms, or thermal expansion. According to NASA, last year's rate of rise was 0.23 inches (0.59 centimeters) per year, compared to the expected rate of 0.17 inches (0.43 centimeters) per year. 2024 was the warmest year on record, so not only did more water enter the ocean from iceberg/glacial melt, but overall the sea levels rose due to thermal expansion, or the overall increase in the volume of water in the ocean due to the increase in average temperature over the oceans worldwide (NASA, 2025).

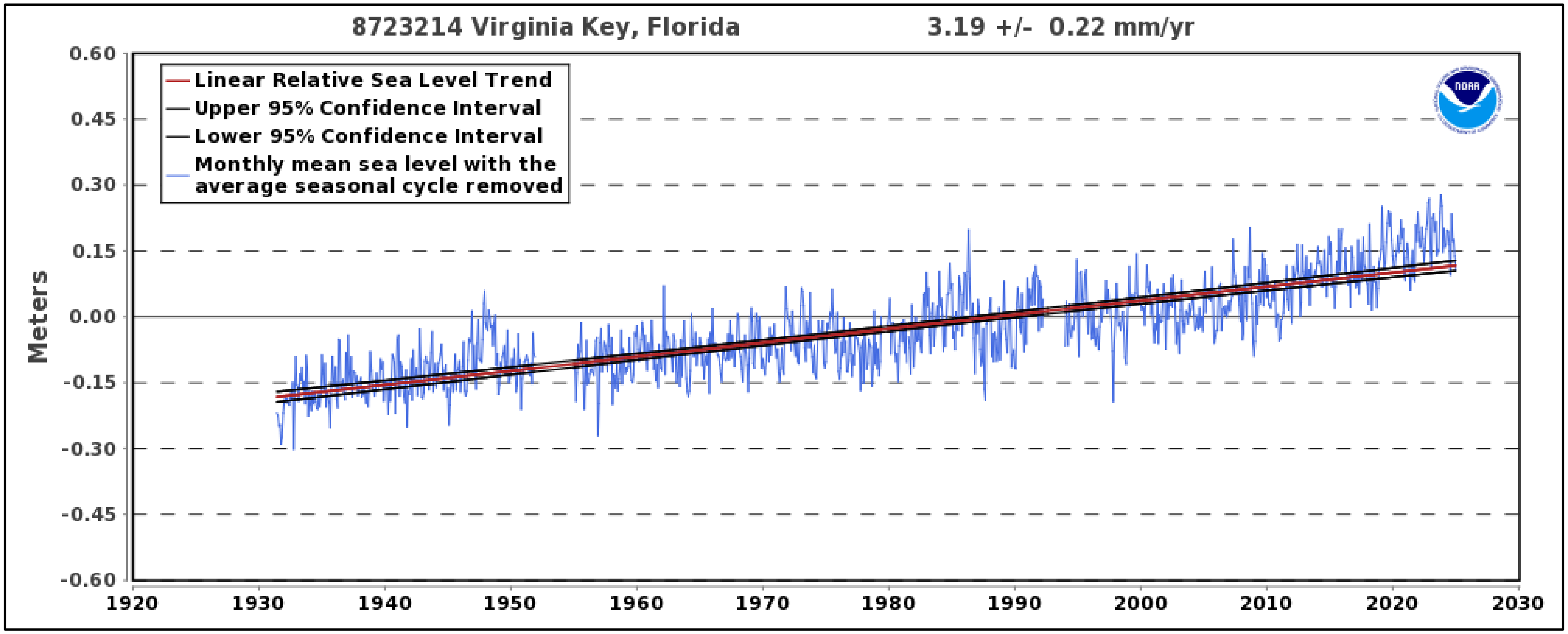

Figure 16

Relative Sea Level Rise (Virginia Key, FL 1930 to present)

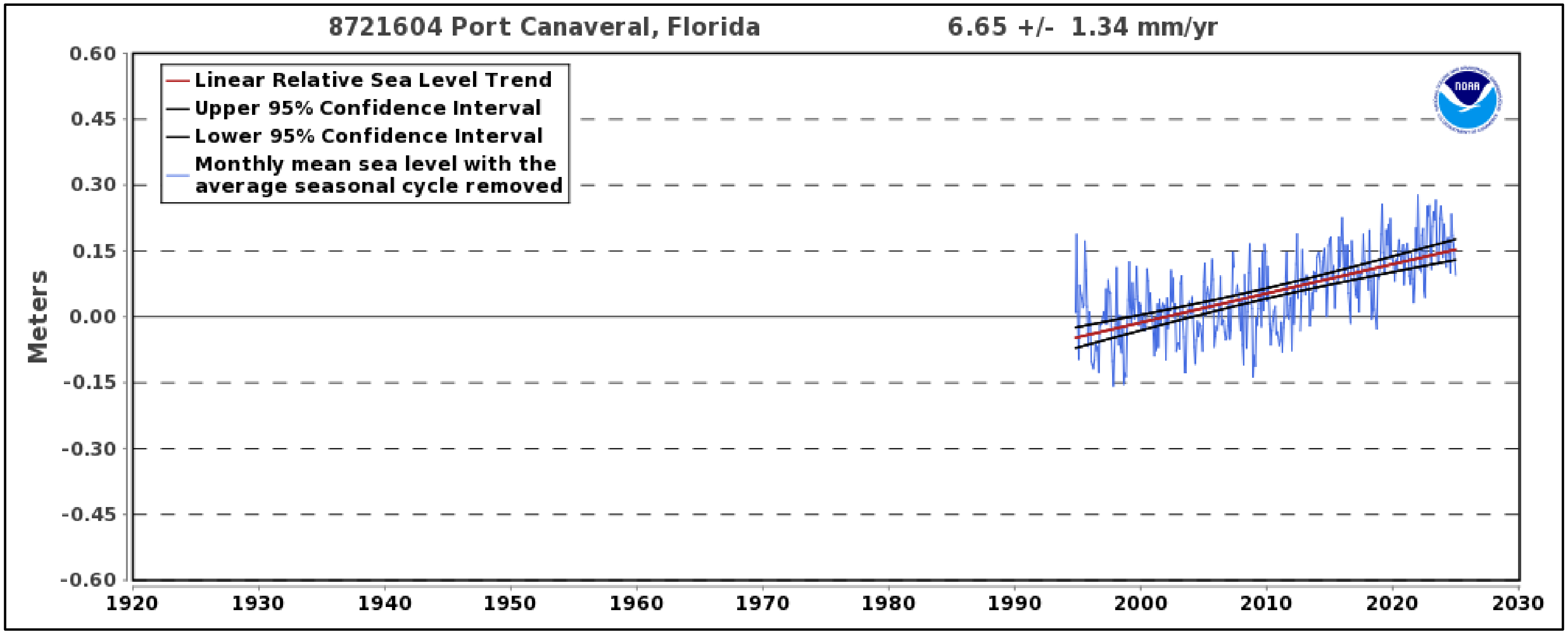

Figure 17
Relative Sea Level Rise (Port Canaveral, FL 1995 to present)

4.4.1.1 Impact on stormwater

For coastal areas, sea level dictates the tailwater condition for all of the barrier island as well as much of the area east of US Highway 1 throughout the County. Tailwater is the water level of the receiving water downstream of an outfall. When the receiving water has no capacity to carry additional volume then the water backs up into the culvert/ditch system and it takes longer for flood waters to recede.

By expanding coastal buffer areas — natural, undeveloped, pervious areas along the Indian River Lagoon — the benefit is two-fold; not only does it increase the ability to capture and treat stormwater during times when there are lower water levels, but it also acts to absorb the effects of storm surge, king tides and alleviate sunny day flooding. The design of these areas requires the ability to manipulate the facility's control structures at varying elevations including in-line valves to prevent back flow into the facility.

The County can key in on areas that are continually inundated on an increasing basis and potentially repurpose these areas for stormwater treatment/buffer areas to provide that extra capacity and increase flood resilience.

SECTION 5

Strategies for Improved Stormwater Management

5.1 Potential Projects for Indian River County

The primary objective of this SMP is to provide IRC with potential solutions to generate BMAP credits and the secondary objective is to relieve flooding in the priority areas that will be subsequently discussed in **Section 6**. There are multiple potential projects that could be implemented at varying scales with the ability to accomplish both objectives. These include:

- End treatments such as vortex or screening structures at outfalls, baffle boxes
- Floating aquatic plant mats installed at stormwater ponds
- Retrofits, reconnection, and establishing connections of drainage structures throughout IRC
- Rain gardens
- Establishing a stormwater treatment and storage area

Site-specific projects and recommendations are proposed for the nine (9) Priority Areas in Section 6 under each Area's Proposed Conceptual Improvements.

5.1.1 End Treatments

Implementing end treatments on existing stormwater infrastructure offers a versatile, scalable approach to improving the overall function of the drainage system within IRC. Targeted modifications and additions to existing infrastructure can enhance water quality, assist with flood mitigation and can be implemented incrementally, allowing for strategic investment of limited resources.

Vortex structures are cylindrical or conical devices installed within stormwater systems that use centrifugal force to separate pollutants from stormwater flows. As the vortex spins the water, contaminants such as sediment, trash, and debris are forced to the outer walls of the structure and down towards the bottom of the chamber. A consideration for this type of treatment is that it often requires some level of minimum head pressure, so specific watershed characteristics and placement of vortex structures must be evaluated carefully before installation. Maintenance requirements include periodic inspection and cleanout of accumulated sediment within the structures. **Figure 18** is a sample diagram of a vortex structure, sourced from the Vortechs® Guide from Contech® Engineered Solutions.

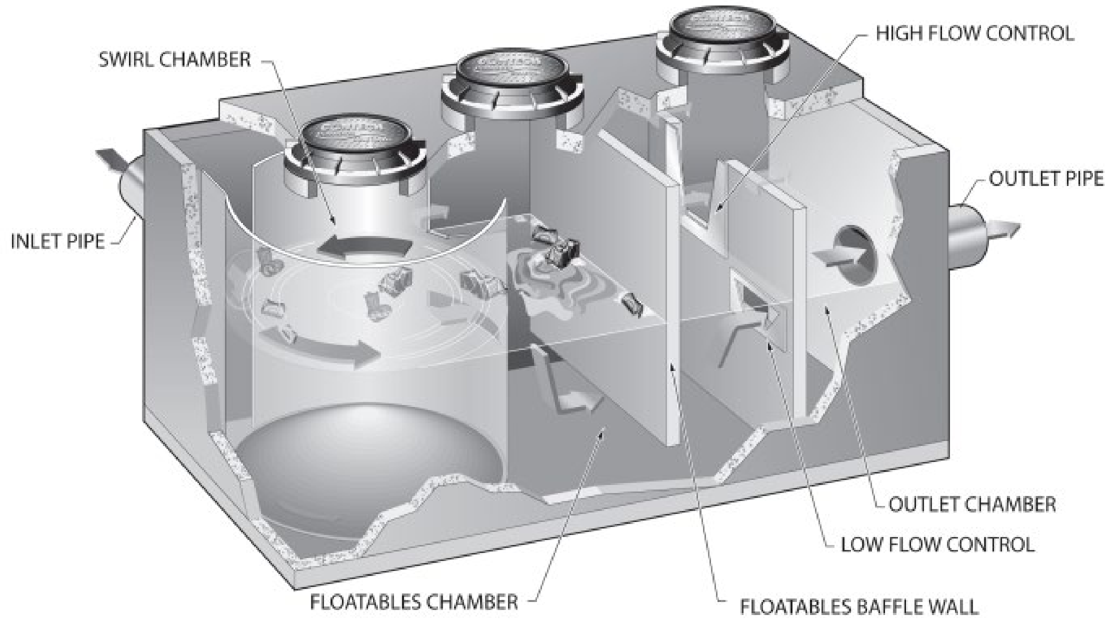

Figure 18
Vortex structure diagram from Contech® Engineered Solutions

A similar treatment mechanism occurs with screening structures or baffle boxes. Screening structures can be installed at various points throughout stormwater systems, such as at outfalls or within channels. They work by capturing debris using trash racks, nets, screens, baffles, or other media, and allow cleaner water to flow out, reducing pollutants that enter waterways. Water quality benefits derive primarily from the capture of visible pollutants like sediment, vegetation debris, and other floatable trash that would otherwise degrade habitat and water quality. These structures are particularly useful for controlling large volumes of stormwater runoff, reducing water pollution, and prevent clogging in drainage systems, which can help mitigate flooding by improving drainage efficiency. Like vortex structures, screening structures require regular maintenance consisting of routine inspections and cleanouts, especially following heavy rainfall events. In some municipalities, it has been discussed that screening structures specifically are more difficult and complex to maintain in comparison to vortex structures. **Figure 19** is a sample diagram of a screening structure, sourced from Suntree Technologies, Inc.

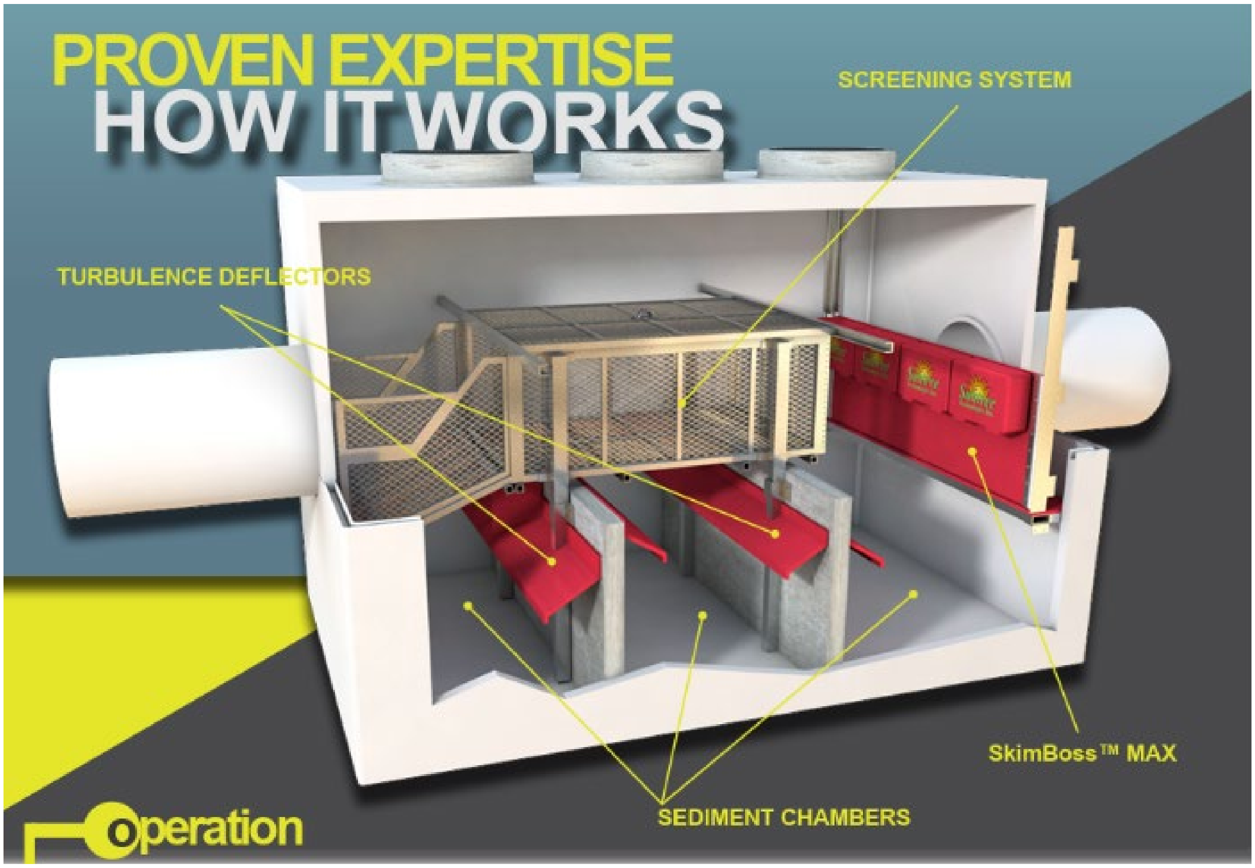

Figure 19
Screening Structure Diagram from Suntree Technologies

Similarly, baffle boxes are multi-chambered structures that remove pollutants through screening and sedimentation and can be installed in-line with existing pipes or at outfall locations. Inside the structure, a series of chambers separated by baffles or weirs slows water flow, allowing suspended solids to settle in the first chambers while screens capture floating debris in subsequent sections. Water quality improvements come from the removal of sediment, trash, and associated nutrients, with some advanced designs incorporating additional treatment mechanisms such as nutrient-absorbing media. Baffle boxes may marginally contribute to flood management by reducing downstream clogging of pipes and culverts. Maintenance requirements include quarterly to semi-annual cleanout of accumulated sediment using vacuum trucks, with access hatches needed for inspection and cleaning. Final design and location selection of baffle boxes would require knowledge of existing pipe sizes, flow rates, and overall basin characteristics such as drainage areas and site-specific pollutant loading.

There are varying scales of applications for baffle boxes, from end-of-pipe treatments to major pieces of infrastructure. As an example, the City of Melbourne installed the largest baffle box east of the Mississippi River (Ferguson Waterworks). Cliff Creek Baffle Box is an in-line structure consisting of a skimmer, three sets of baffles, and a nutrient scrubber. It serves a 515-acre basin and is estimated to reduce 3,952 lbs/year of TN and 727 lbs/yr of TP, at a cost of $347,781, according to the Save Our Indian River Lagoon Performance Table Q1 2025. **Figure 20** shows an image of the baffle box being installed, sourced from Indian River Lagoon News.

Figure 20
Baffle box being installed at Cliff Creek in Melbourne, Florida from Indian River Lagoon News

All these systems have an initial cost of design, permitting and installation. There is not a one-size fits all approach so each system must be tailored to site conditions. The design must also account for the other subsurface utilities and determining optimal siting locations throughout the watershed is important.

5.1.2 Floating Aquatic Mats

Floating aquatic plant mats, or floating wetlands, are structures that support plant growth on the surface of water bodies such as ponds, lakes, or stormwater retention basins. These mats provide a platform for aquatic plants to grow while floating on the water's surface. The plants' roots dangle into the water, where they filter pollutants such as nitrogen, phosphorus, and other excess nutrients that can cause water quality issues such as algal blooms. Floating wetlands help improve water quality by absorbing and breaking down these pollutants. Additionally, they can provide habitat for wildlife. In terms of flooding, the mats slow down stormwater runoff as the plants and their root systems act as a physical barrier. This can help to prevent flooding during heavy rainfall events.

There are several installations of floating aquatic plant mats in the Space Coast Area of a vendor specific material called BeeMats, by Ferguson Waterworks. An image of these floating wetlands installed in a pond, sourced from BeeMats, can be seen in **Figure 21**. These installations are primarily added to existing stormwater ponds. As an example, shown in **Figure 22**, the North Fiske Stormwater Pond floating aquatic wetlands project implemented by the City of Cocoa is estimated to provide 200 lbs/year of TN reduction and 32 lbs/yr of TP reduction, according to the Save Our Indian River Lagoon Performance Table Q1 2025.

Figure 21
Floating wetlands in a pond, sourced from BeeMats

Figure 22
Aerial image of floating wetlands at North Fiske Stormwater Pond in Cocoa, Florida (Google Imagery)

IRC owns approximately 40 stormwater ponds, according to their GIS records. The total nutrient removal may vary, but as an estimation, floating aquatic mats would provide approximately 10% of reduction over and above the overall reduction already allocated for existing stormwater ponds. ESA has evaluated the impact of applying floating aquatic mats to three of the County's ponds in Vero, Gifford, and Vero Lake Estates. The BMAP credits for the 10% reduction on these ponds was then extrapolated to the other 39 ponds and the total for the County would be approximately 100 credits. While these remain an option, and every pound of credit helps, the initial cost and maintenance cost for this solution compared to the number of credits has it ranking lower on the primary focus.

5.1.3 Retrofits / Reconnecting

Stormwater structures throughout IRC have been built over several decades. Many of them now function in isolation, disconnected from the original watersheds they were designed to serve. Reconnecting these fragmented elements represents a significant opportunity to address both flood risks and water quality challenges.

Connected drainage systems reduce flood risks through several mechanisms. These systems distribute water more evenly across the landscape providing multiple pathways for water to flow and reducing pressure on any single point in the network. Storage capacity is also optimized in connected systems. When culverts, swales, ditches, canals, and detention basins are linked, they can function as a coordinated network, with upstream structures holding water temporarily to reduce downstream flows. This approach can help to decrease peak flow rates during storms protecting infrastructure that might otherwise be overwhelmed. Additionally, water quality is benefitted by well-connected drainage systems. This reduces stagnant water, increases interactions with soils and vegetation for nutrient uptake, and helps to control sediment transport and deposition. All these factors help to minimize pollutants being transported in waterways.

Reconnecting drainage structures requires a multi-faceted approach. Physical reconnection typically involves strategic modifications to existing infrastructure. This might include replacing undersized culverts with larger capacity structures, removing barriers between swales and basins, or creating new channels to link isolated drainage components. In some cases, previously piped components may be returned to open channels that can more effectively connect to the broader system. Specific examples of retrofits and recommendations of connections to make are described as potential conceptual improvements for multiple Priority Areas in **Section 6**.

This initiative would require substantial data collection and significant coordination among various stakeholders throughout IRC, including municipalities and private owners. Modeling may be needed to identify areas particularly lacking connectivity and to evaluate the flooding impacts of modifications to the system. Reconnections and retrofits could be accomplished incrementally, starting with Priority Areas identified by IRC. The quantity of potential BMAP reduction credits would be determined on a case-by-case basis for this initiative.

5.1.4 Rain Gardens

Rain gardens or bioretention areas are intentionally designed, man-made landscape features that serve as natural stormwater management systems capturing and filtering runoff from impervious surfaces like roofs, driveways, and parking lots. They are typically shallow depressions that utilize native plants with deep root systems established in specialized soil mixtures that enhance water absorption and filtration. Rain gardens help to intercept stormwater before it enters traditional drainage systems, slowing water movement, increasing infiltration and reducing runoff volume, all of which directly mitigate flooding risks. A sample schematic of a rain garden can be seen in **Figure 23**, sourced from the Massachusetts Clean Water Toolkit hosted by GeoSyntec.

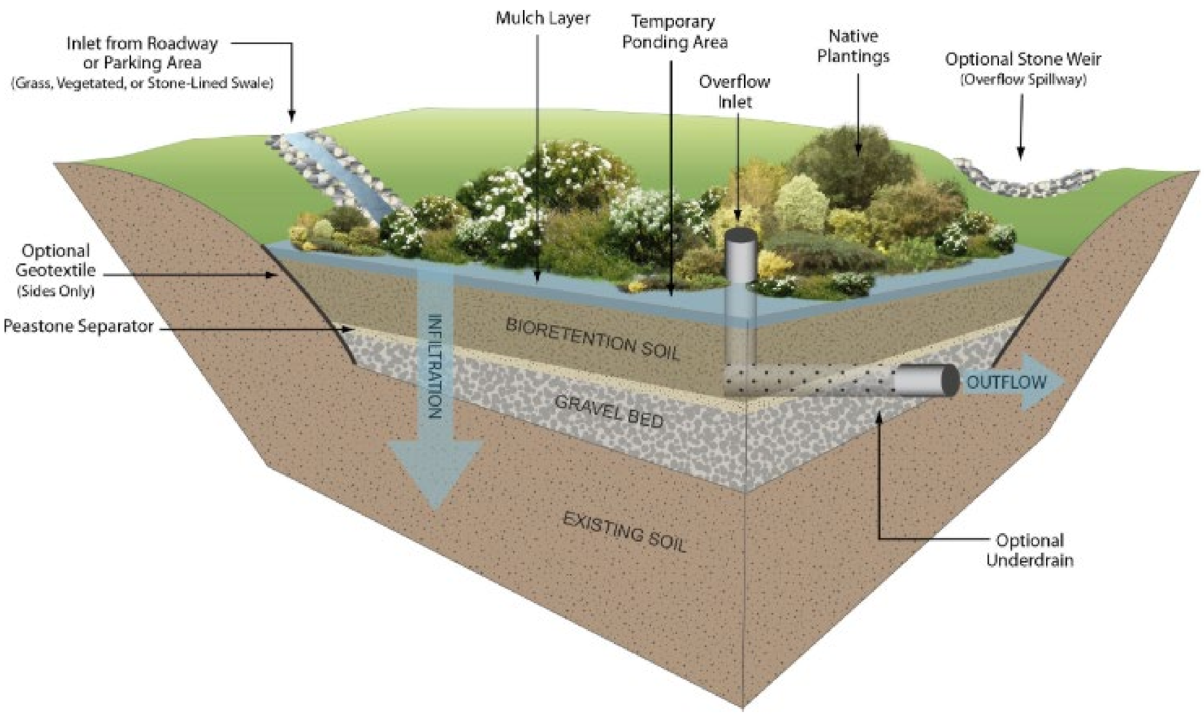

Figure 23
Sample schematic of a rain garden from Massachusetts Clean Water Toolkit

Versatility is an advantage rain gardens have to other large-scale stormwater treatment options. They can be implemented across various scales, from small residential applications to large municipal or commercial installations and can be customized with plants specific to local ecosystems or tailored to target specific pollutants. They can also provide habitat in urban environments and offer aesthetic appeal to local communities.

The Cocoa Beach Downtown Stormwater Improvement Project provides a relevant case study for stormwater management in IRC, addressing challenges common to coastal Florida environments. Implementing techniques such as rain gardens, pervious pavers, and exfiltration systems, the project demonstrated a method of treating stormwater that could be adapted to similar landscapes within the County. **Figure 24** shows a snapshot from Google Street View of one of the planted depressions. For IRC, the project's key metrics provide important context for local stormwater management efforts. The 98.5% hydraulic retention rate, coupled with modest nutrient reduction (10% total nitrogen and 9% total phosphorus), offers a baseline for understanding potential performance of similar systems in the region.

The project's focus on the Indian River Basin and Banana River Lagoon watershed parallels IRC's critical need to provide nutrient loading reduction to the IRL.

Figure 24
Planted depressions along Minuteman Causeway in Cocoa Beach, Florida (Google Street View)

5.1.5 Stormwater Treatment Areas

A stormwater treatment and storage area (STA) is an engineered infrastructure system designed to manage stormwater runoff. These systems capture stormwater from surrounding land areas, allowing water to be temporarily stored, treated, and strategically released or filtered back into the natural environment. The primary objectives of STAs are to reduce the volume and velocity of surface water runoff, remove pollutants, and minimize the potential for water quality degradation from nutrient loading and property damage from flooding impacts. STAs can be a strategic infrastructure investment for areas where little drainage infrastructure exists or where existing infrastructure is unequipped to handle heavy rainfall exists, both of which are factors currently experienced by IRC.

Within an STA, water quality improvement can be achieved through multiple treatment mechanisms. In its simplest form, an STA can be established as a retention basin that collects runoff, slows water velocity, and enables suspended pollutants to settle to the bottom. The system can further improve water quality with the addition of other treatments, such as vegetative filtration, media layers, and biological treatment methods. For example, native plants can be introduced for nutrient uptake, engineered soils can act as filtration media, and specialized organisms can enhance pollutant removal. Additionally, flood mitigation is another critical function of STAs. By providing controlled storage capacity, STAs can significantly reduce the risk of flooding during heavy rainfall events. They are designed to capture excess water then slow its movement and gradually release it at a rate that prevents the overwhelming of existing drainage systems. This is particularly important in low-lying areas with limited drainage, such as coastal regions with sandy soils, which are characteristics possessed by much of IRC. Finally, STAs can offer valuable habitat for wildlife in otherwise developed areas.

Establishing an effective stormwater treatment and storage area requires a comprehensive approach from site assessment to construction and operation. Since IRC currently owns and operates three (3) existing STAs, as discussed throughout this document, the location for an additional facility must be considered carefully to maximize the efficiency of regional stormwater drainage. There are several Priority Areas where IRC aims to mitigate existing flooding impacts, therefore, establishing an additional STA within or near one of them is ideal. Initial site assessment involves evaluating local topography, soil conditions, hydrology, and environmental characteristics. The design process incorporates hydraulic modeling, treatment technology selection, and infrastructure planning. Implementation involves site preparation, construction of storage and treatment infrastructure, and installation of monitoring systems. Ongoing operation requires regular maintenance, performance monitoring, and adaptive management to ensure the system continues to effectively manage water quality and flooding risks. The most outstanding factor in evaluating this initiative is its high cost as a result of the land acquisition it would entail. The purchasing of land combined with costs related to design, modeling, and permitting efforts would constitute the most significant investment by IRC out of all options discussed in this SMP.

As a case study, IRC's Egret Marsh Stormwater Park and Wildlife Sanctuary cost $7.5 million to construct and costs around $200,000 in annual operations and maintenance (LMP). This does not include the purchase cost of the land. The park became operational in April 2010 and includes a 4.6-acre algae farm. **Figure 25** and **Figure 26** sourced from Indian River County show an overview of the park and its processes. Egret Marsh is estimated to reduce Total Nitrogen by 8,550 pounds per year and Total Phosphorous by 2,331 pounds per year. Even accounting for the factors, costs, and the extensive timeline this initiative would require, the immense benefits it offers in terms of BMAP credits and additional stormwater storage puts this option high on the ranking of potential projects.

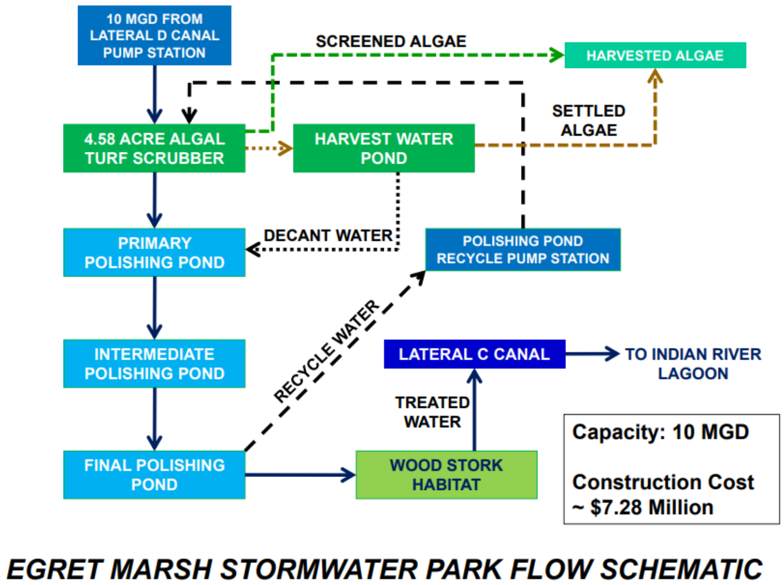

Figure 25

Egret Marsh Stormwater Park Flow Schematic, from IRC

Figure 26

Aerial image and schematic of Egret Marsh Stormwater Park, from IRC

5.2 Operation and Maintenance Practices

Routine maintenance and operating procedures on existing and proposed future stormwater infrastructure can increase the efficiency of structures for both water quality and flooding impacts. One of the greatest factors limiting IRC from attaining a well-functioning stormwater management system is the lack of maintenance of County-owned infrastructure. This is due to understaffing as well as the absence or limited amount of maintenance equipment, both of which are a result of insufficient funds. The drainage system throughout IRC has been installed over several decades, with incomplete documentation and unclear ownership boundaries between IRC, municipal, and private entities. Therefore, it is highly recommended that IRC invest in a comprehensive survey of the existing structures and drainage easements throughout the County to establish a GIS database of stormwater infrastructure. Subsequently, IRC should develop a comprehensive maintenance schedule and asset management system, invest in proper equipment, and attain sufficient staff to begin to restore and maintain County-owned infrastructure. This sequence of tasks should be prioritized to accelerate the progress of stormwater improvements and aid the development of future projects.

5.2.1 Survey and GIS Database

Throughout IRC, there is uncertainty regarding what stormwater infrastructure exists, who owns it, and its condition, all of which contributes to delayed maintenance of these structures or no action at all. A comprehensive survey cataloging all stormwater infrastructure potentially under IRC’s jurisdiction, including swales, easements, culverts, outfalls, tide gates, ditches, and canals, is essential to creating a robust GIS database, which is the foundation for facilitating maintenance and improvements of the County’s infrastructure. ESA has compiled an initial GIS database of stormwater infrastructure throughout the County, but it has not been field verified and requires further investigation of ownership.

In addition to conducting an inventory of existing structures, bathymetric survey on canals could be useful to evaluate the potential for increasing storage and measuring the rates of sediment infilling. Topographic survey of ditches and swales would be similarly beneficial. Canals, ditches, and swales may need to be re-measured periodically to account for erosion, deposition, or settling over time. Additionally, surveys should incorporate elevation and dimension measurements of structures, such as invert elevations and sizes of culverts. This would allow IRC to establish a hydraulic network in GIS which would enable stormwater modeling, further facilitating the IRC’s ability to assess inundation risks and evaluate future improvements. Once this inventory is completed and drainage basins can be mapped, IRC can conduct a comprehensive analysis to determine which of their stormwater ponds installed after 2009 are not currently catalogued by FDEP and have the potential to receive nutrient reduction credits.

Conducting this survey will require coordination with neighboring municipalities, including City of Fellsmere, City of Vero Beach, City of Sebastian, and other water control districts within IRC, as well as consultation with private property owners and historical records research. Survey work should account for tidal cycles to inspect outfalls in IRL and along canals during low tides. Legal counsel involvement may be necessary to resolve ownership questions through property records and historical maintenance patterns. The database’s schema should accommodate uncertain ownership designations while still enabling effective management. In addition, the database must be maintained by documenting stormwater infrastructure from new developments.

Along with aiding in the task of collecting an inventory of assets a GIS database will assist in developing a maintenance schedule. Conducting survey and establishing a GIS database will identify critical vulnerabilities of the drainage system in IRC, particularly aging and underperforming structures contributing to flooding. This initiative addresses the fundamental uncertainty of the extent and ownership of stormwater infrastructure throughout IRC and would enable the County to move forward with stormwater improvement projects.

5.2.2 Maintenance Schedule for Stormwater Structures

Regular maintenance of stormwater structures would help to accomplish both primary objectives of this SMP, improving water quality and enhancing flood protection. For example, regular vegetation removal also removes nutrients from stormwater, thereby improving water quality. Sediment removal from drainage channels helps to maintain their capacities, keeping the system functioning properly and reducing the risk of flooding. A systematic maintenance program should establish appropriate inspection intervals based on each structure's condition, criticality, and along IRL in particular, coastal-specific issues such as sand accumulation and saltwater corrosion. Additionally, maintenance of any new infrastructure projects must be incorporated into the schedule.

Implementation of a maintenance schedule will require specialized equipment. The purchase of an aquatic tractor (e.g., Weedo, Truxor) or Menzi Muck Machine with a brush cutter attachment would assist greatly with the removal of cattails and other weeds and debris in the County's ditches, canals, and within IRL. Additionally, a street sweeper would help to remove nutrients from roads and prevent them from entering waterways. Supplementary equipment that IRC may consider for maintenance includes vacuum trucks for sediment removal from baffle boxes and culverts, water quality monitoring instruments, and corrosion-resistant replacement components. With the acquisition of such equipment and the establishment of a routine maintenance schedule, this initiative would require additional investments in personnel. This would entail either hiring multiple full-time employees (FTE) to drive the aquatic tractor and street sweeper (such as a Heavy Equipment Operator) or the hiring of a regional contractor with this specialized equipment to perform maintenance.

With IRC's limited maintenance resources, a public reporting system could supplement scheduled procedures while encouraging community engagement. A platform enabling residents to report observed stormwater issues could provide real-time intelligence on failures and developing problems across the drainage network. The reporting system should include mobile and web-based interfaces with mapping capabilities, photo submission options, and status tracking. Educational components should help users distinguish between normal post-rainfall conditions and reportable issues requiring intervention.

The importance of establishing an inventory of IRC's drainage assets and implementing a routine maintenance schedule with both adequate staff and equipment must be emphasized. Beginning work on other improvement projects discussed in this SMP without addressing the lack of maintenance of existing structures and working to correct it is an impractical and inefficient use of resources. It is highly recommended that IRC first invests in long-term sustainable stormwater management through obtaining survey, hiring staff, and acquiring necessary equipment.

5.3 Funding Sources

Significant and reliable funding will be necessary to execute the management measures proposed within this SMP. Once secured, funding should be allocated for the various solutions discussed in this SMP according to their level of priority. In addition to prioritizing maintenance of existing infrastructure as discussed in the preceding section, the establishment of a land acquisition fund is critical for IRC's Stormwater Division to have the ability to seize land opportunities as they become available. This fund would greatly hasten the timeline by which stormwater management projects could be implemented throughout the County.

Implementation of this SMP will require stakeholder and community support through coordination and a variety of financial resources. A combination of securing federal, state, and local funding, and creating public-private partnerships is encouraged. Such partnerships are recommended because government jurisdiction will not necessarily be confined to the County owned/managed boundary, and partnerships can better facilitate the available resources. Examples of partnerships include arrangements between landowners and governments, or collaboration between civic groups and government. Together, public and private entities can explore financial assistance opportunities such as grants and cooperative agreements. Funding across an entire watershed is a challenging endeavor, and some financing alternatives are better suited for targeted areas. By leveraging multiple funding opportunities amid organized partnerships, the success of the SMP implementation can be maximized.

Policies and local ordinances such as those discussed in the subsequent sections are designed to ensure regulatory compliance with state and federal stormwater management requirements and to establish a sustainable and equitable funding mechanism for stormwater projects.

5.3.1 Local Funding

5.3.1.1 Stormwater Utility Fee

A stormwater utility operates similarly to a water or electric utility and collects fees associated with the controlling and treating stormwater (Environmental Protection Agency (EPA) 2009). A stormwater utility would provide stable, long-term support of stormwater management through equitable and transparent funding. Fees may be based on the parcel size, property type, and/or the degree of impervious area, or fees may be fixed in a specific geographic area. For example, lots within a residential development may be subject to predetermined stormwater user fees, which are not a function of the lot characteristics. Property owners could also earn credits or be subject to surcharges as a function of stewardship. Individuals who implement on-site attenuation or related Low Impact Development measures could experience reduced fees. In contrast, those that increase industrial activity or modify the land use in a way that negatively impacts stormwater management could see an increase in fees. Additionally, certain roadways, rights-of-way, or undeveloped areas may be exempt from fees. The utility fee generally appears as an individual bill, as a line item on a water and/or sewer bill, or as a component of property tax bills. This revenue source would support the stormwater utility with planning and executing programs that address stormwater issues identified within County. Citizens might not be educated or knowledgeable regarding issues related to local water quality and stormwater management. As such, it can be expected that they would likely approach the development of a stormwater utility with skepticism. Extensive education and outreach would be needed to support the successful implementation of a stormwater utility.

The stormwater utility fee should be assessed annually, with fees applied based on property impervious area classifications. Revenue will be used for ongoing maintenance, infrastructure improvements, and compliance with environmental regulations.

In July 2022, the Vero Beach City Council approved the implementation of an annual stormwater utility (SWU) fee aimed at funding projects to reduce flooding and improve water quality, particularly benefiting the IRL (City of Vero Beach FAQ). The fee is determined based on the amount of impervious surface on a property—such as roofs, driveways, and patios—which affects stormwater runoff. For single-family residential properties, the fee structure is divided into tiers:

- Small (100 - 1,300 sq ft): $30.07 annually
- Medium (1,301 - 3,400 sq ft): $75.17 annually
- Large (3,401 - 6,500 sq ft): $135.31 annually
- Very Large (over 6,500 sq ft): $239.00 annually

These fees are calculated using the Equivalent Residential Unit (ERU) method, where one ERU represents 3,972 square feet of impervious surface. Non-residential properties, including those that are commercial, institutional, municipal, and so on, incur stormwater fees based on the quantity of impervious area within the property. Their stormwater fees equal the amount of impervious surfaces divided by the billing unit value of 3,972 multiplied by the rate of $75.17 per ERU. The stormwater assessment appears under the non-ad valorem section on property tax bills. All property owners within the City of Vero Beach, regardless of tax-exempt status, are required to pay this fee, as all properties contribute to stormwater runoff. The associated revenue is exclusively allocated to stormwater-related projects.

The City of Vero Beach's fee is set at the lowest dollar amount of $0.58 per ERU per month, but generated $99,000 in 2024 (FSA SWU report). If the number of homes in a given area is a good indicator of the coverage of impervious surfaces, then an expansion of the same ERU across all of Indian River County can be expected to generate approximately over $1,125,000 annually to fund stormwater management projects. Comparably, Bay County is relatively the same size as Indian River County in population and number of residential/non-residential units. In 2024, Bay County had a Stormwater fee revenue of $1,920,080. Bay County has an average $3.33/SWU/month fee and neighboring Brevard County charges $5.33/SWU per month. So, there is precedent for charging a higher rate to support the stormwater program's initiatives. In fact, Bay and Brevard County's fees were below the average rate per month of $8.86/SWU for the entire state of Florida.

5.3.1.2 Property, Sales, or Other Taxes (General Fund)

The use of public "general funds" to finance projects is how IRC currently funds the stormwater division and their projects (stormwater budget is a part of the Transportation fund which comes from the General Fund). Another major source of funding is the gas tax. Each year stormwater projects, expenditures and budget items compete with maintenance and construction projects county-wide for funding and no dedicated source of continuing and consistent funding exists. This can limit the success of funding SMPs as these programs are often considered less essential than priorities such as police, fire, and emergency medical personnel and therefore are also vulnerable to budget cuts (Spitzer 2010).

5.3.1.3 Impact Fees

Impact fees are paid by developers (usually at the time of development) to obtain a building permit. The fee is designed to reimburse the government for the additional impact a development may have on the community. They may be for transportation (i.e., increased impact on roads and bridges as a result of constructing a development), water and sewer (i.e., the impact on the system capacity as a result of increased volume and demand), as well as other public infrastructure impacts. Typically, a direct relationship between the development and the impact fee must exist. These fees must often be authorized by statute and are used for capital improvements, not for maintenance. They are a one-time, up-front charge for new construction (Mustian 2010).

5.3.1.4 Property Management Program

Based off the Florida Department of Transportation (FDOT) Office of Right of Way program, this would need to be set up by the County to purchase lands that are strategically located at key points throughout the County or in the floodplain and of continual risk to flooding. The County could acquire property and then enter into a leaseback program with the original owners. The residents can continue to live or operate their business at the location for a mutually agreed upon term until the County is ready to construct the project, or a natural disaster impacts the property causing damage requiring repairs. The benefits of this project are twofold:

1) The property owner gets market value for their property and is able to continue to live there or operate their business while searching for a new home or place to establish their business. If the property owner tries to sell after being impacted by a storm or natural disaster generally they are not receiving full market price or are facing insurmountable construction costs before being able to place the property on the market.
2) The County can continue to plan large scale projects that may take 5-15 years to design, permit and secure funding. During that time the property values may be steadily increasing making property unrealistic.

5.3.2 State Funding

The EPA State Revolving Fund (SRF) loan program offers a reliable source of funding (Berahzer 2010). There are separate SRF programs for “Clean Water” and “Drinking Water.” Funds are provided annually to each state by the federal government with the states providing a 20% matching amount. To receive funding, a project must be on the state’s annual “Intended Use Plan” (IUP) list. The IUP contains a “comprehensive” list and a shorter “fundable” or “priority” list. A public comment process is required for the IUP. Since 2007, the SRF has moved beyond the traditional “water treatment works” projects and has begun to emphasize nonpoint sources and estuary protection as funding priorities. Projects that strengthen compliance with federal and state regulations and enhance protection of public health are eligible for consideration to receive SRF loans. There are also benefits to obtaining such funding. The engineering, inspection, and construction costs are eligible for reimbursement if a project qualifies.

Protecting Florida Together is an assembly of state grants available to local governments and NPOs to implement projects that improve resilience, stormwater treatment and water quality. **Table 11** summarizes the potential state grant funds for IRC to explore.

TABLE 11
POTENTIAL STATE GRANT FUNDS

Grant Name	Project types	Due Date	Funding Range
Non-Point Source (NPS) Management Grant Program	NPS reduction – Best Management Practices (BMPs), Green Stormwater Infrastructure/ Low Impact Development (GSI/LID), Septic to Sewer (S2S)	March 31	No set limit, $5k to $1M
Water Quality Improvement Grant Program - Statewide	WW, SW and Agricultural nutrient sources in areas with TMDLs, BMAPs, RAPs & rural areas of opportunity	July 31	$500k to $22M
Indian River Lagoon (IRL) Water Quality Improvement Grant Program	Projects that directly benefit WQ in the IRL. WW, SW, S2S	July 31	$250k to $12M
Resilient Florida – Planning	Planning, Design & Permitting of projects, vulnerability assessments and adaptation plans	Sept. 1	$55k to $700k
Resilient Florida – Implementation	Construction of Shovel Ready Stormwater and Coastal Resilience Projects	Sept. 1	$95k to $28M

SOURCE: https://protectingfloridatogether.gov/state-action/grants-submissions

Elevate Florida is another state-run residential flood mitigation program through the Florida Department of Emergency Management (FDEM) that provides funding to homeowners to proactively reduce damage from natural disasters, hurricanes and floods. It is a 75% State and 25% homeowner cost share on projects that elevate structures, reconstruct damaged buildings to new codes/elevations, voluntary acquisition/demolition of property and wind mitigation alterations to structures that cannot be elevated. Residents may apply for a Small Business Administration Loan to cover their portion of the project cost. Additionally, IRC’s Local Mitigation Strategy Workgroup voted to allocate 30% of the County’s Hurricane Milton Hazard Mitigation Grant Program funding balance toward the Elevate Florida program. Temporary relocation for residents during construction is also covered under the program.

5.3.3 Federal Funding

Federal funding opportunities, such as grants, revenue sharing, and loans, can be pursued through the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Army Corps of Engineers, and the U.S. Department of Agriculture. These funding opportunities can be used by public and private entities to execute the measures proposed in the WMP. Funding opportunities can be located and applied for through the federal portal at Grants.gov.

The EPA announced a $3.75 million grant to support local projects to protect and sustain healthy watersheds (https://www.epa.gov/hwp/healthy-watersheds-consortium-grants-hwcg). EPA has made an official award to the U.S. Endowment for Forestry and Communities, Inc. (Endowment) to support the coordinated efforts of the Endowment and its partner organizations. The Healthy Watersheds Consortium Grant Program goal is to accelerate strategic protection of healthy, freshwater ecosystems and their watersheds (http://www.usendowment.org/partnerships/healthywatershedsconsor.html). The EPA also supports the Five-Star Restoration Program by providing funds to NFWF, the National Association of Counties, National Oceanic and Atmospheric Administration’s Community-based Restoration Program, and the Wildlife Habitat Council. These groups are then able to make subgrants to support community-based wetland and riparian restoration projects. Competitive projects must have a strong on-the-ground habitat restoration component with long-term ecological, educational, and/or socioeconomic benefits to the people and their community. Preference is given to projects that are part of a larger watershed or community stewardship effort and include a description of long-term management activities. "Projects must involve contributions from multiple and diverse partners, including citizen volunteer organizations, corporations, private landowners, local conservation organizations, youth groups, charitable foundations, and other federal, state, and tribal agencies and local governments" (Private Landowner Network 2015). It is desirable that each project involve at least five partners who are expected to contribute funding, land, technical assistance, workforce support, or other in-kind services that are equivalent to the federal contribution.

The EPA provides numerous resources to support funding procurement for stormwater projects. Their Water Finance Clearing House and Water Infrastructure and Resilience Finance Center serve as a database and assistance center, respectively, to locate funding opportunities and support local decision-makers regarding stormwater infrastructure. Additionally, the Clean Water State Revolving Fund provides low-cost financing for a variety of water quality infrastructure projects. Beyond the traditional acquisition of funding, the EPA also recommends that communities explore establishing a stormwater utility. The revenue generated by the stormwater utility can be used as match-money for applying for stormwater grant funds, and making each fee dollar go further to serve the residents of the IRC.

Implementing these policies of the SMP will ensure a sustainable funding mechanism for stormwater projects in Indian River County. The stormwater utility fees will provide a dedicated, equitable, and transparent funding source to achieve the program goals.

5.4 Cost Analysis

Projecting costs for capital expenditures helps to quantify the stormwater management plan funding needs and timing the rollout of new equipment, staff additions and project implementation. Costs are separated into three categories:

1) Planning, Design & Engineering Costs – These costs are an estimate for data collection, design, permitting, bidding and construction monitoring. Based on the size and complexity of the project these costs generally range from 5% to 45% of the overall project cost.

2) Direct Costs – Costs borne by the County to acquire equipment, hire additional staff, coordinate with internal County divisions, conduct real estate/easement transactions, and cover legal fees. Direct costs of most need for the County include a Heavy Equipment Operator to operate and maintain a Vacuum Truck and a Menzi Machine. This position would require a $55,000 to $75,000 budget line item per year including benefits. As the program grows a second Heavy Equipment Operator (union equivalent position) will likely need to be added as maintenance efforts ramp up. The County should plan to hire a project manager position with the increase in project implementation in this 5-year plan. This staff hire should be $110,000 to $170,000. A vacuum truck will cost approximately $500,000 initial investment with a $5,000 per year O&M cost and a 10-year total replacement cost. Menzi Machine would cost approximately the same, $500,000. Direct costs to the County in year 2025, would be $1.2 million.

   The cost for land acquisition, specifically for stormwater projects and/or coordination of easements, is a substantial direct cost. These costs have been included in each of the priority projects, but will need a direct allocation from the Stormwater Utility Fee in order to build funds that are available to tap into as properties that are suitable for stormwater projects come onto the market. Collaboration with other municipalities and stakeholders often requires easement coordination and there are assessment and legal costs associated with completing these transactions.

3) Project Costs – these are the Capital Improvement Costs per project. ESA has compiled 2025 costs from the FDOT Historical Index, RS Means Gordian Software, and projects of similar type, size and scope recently bid by other municipalities and water management districts. Per the Engineering-News Record (ENR) the average annual construction cost increase has been 3.8% over the past 5 years. And while this increase has cooled off in the recent year, if we look at the previous 5-year span from 2016 through 2021 the average annual construction cost increase was 2.8%. In 2025 costs, to perform at least 1 project in each priority area would cost approximately $14 million.

For comparison, according to FDEP's Success Stories webpage, the Cocoa Beach Downtown Stormwater Improvement Project cost $5,100,458.24 to construct in 2021. Additional documents including the design plans are available on that webpage. In addition, IRC's own Osprey Acres Flowway and Nature Preserve Project, finishing construction in 2019, had an estimated capital cost of $7,500,000 and has annual maintenance costs of $87,000, according to the LMP.

The priority project costs have been factored into the project ranking matrix and detailed cost estimates are included in the Appendix E. Based on the planning, direct and project costs, IRC should anticipate a cost of approximately $17 million to initiate the highest ranked project in each Priority Area presented in this SMP. To implement the lowest cost option for each Priority Area, the cost would be around $14 million. Note that this value is at the low end of typical cost estimates within this management plan. At the highest end, it would cost approximately $77 million to implement the costliest project in each Priority Area, including establishing stormwater treatment areas.

SECTION 6

Priority Project Areas

6.1 Priority Flood Areas

IRC identified a total of nine (9) Priority Areas based on previous flooding concerns that this SMP focuses on (**Figure 27**). This analysis examines the existing stormwater systems, their capacity to handle various storm events, and limitations that may contribute to flooding. This was accomplished through a combination of desktop review of GIS data, historical reports, Environmental Resource Permits (ERPs) from SJRWMD, topography, and site visits. Additionally, proposed conceptual improvements for each of the Priority Areas will be discussed in this section. Photographs of site visits are included in the Appendix, along with selected ERPs and summary statistics of parcel data from each Priority Area.

The Priority Areas vary in size and in their land use, ranging from residential to commercial to mixed use. Many of the residential areas contain older homes with outdated drainage infrastructure, or none at all. The Fellsmere Priority Area is the largest of the Priority Areas, followed by 4th Street and 8th Street and then Rockridge. Larger areas will require a significant investment to alleviate flooding concerns compared to areas like 90th Avenue for example, which is limited to a specific corridor where localized conceptual improvements can be implemented. The proposed conceptual improvements presented in this section vary in significance of cost and extent of relief. **Table 12** provides a summary of the Priority Areas, their challenges and recommendations.

TABLE 12
SUMMARY OF PRIORITY AREAS

Priority Area	Location	Description of Issue	Identified Deficiency	Recommendation
1	90th Avenue	Flooding at Fire Station 7	Maintenance, Lack of Connectivity	Improve conveyance, expand storage
2	Rockridge	Flooding in residential areas	Inadequate Infrastructure	Expand storage
3	College Lane	Sheet flow along residential roads	Inadequate Infrastructure, Lack of Connectivity	Improve conveyance, expand storage
4	37th St. to Royal Palm Place	Flooding along road	Inadequate Infrastructure	Expand storage
5	Fellsmere	Flooding in residential areas	Inadequate Infrastructure	Expand storage
6	Riviera Lakes	Flooding exacerbated by partially constructed development	Lack of Infrastructure	Improve conveyance, expand storage
7	4th St. & 8th St.	Flooding in residential areas	Maintenance, Inadequate Infrastructure	Expand storage
8	Indian River Drive	Flooding in residential areas	Lack of Connectivity	Expand storage
9	Indian River Lagoon Outfalls	Outfalls need inspections, water quality treatment	Maintenance	Retrofit outfalls
10	County-maintained ponds	Water quality treatment	Maintenance	Install BeeMats, remove vegetation/muck

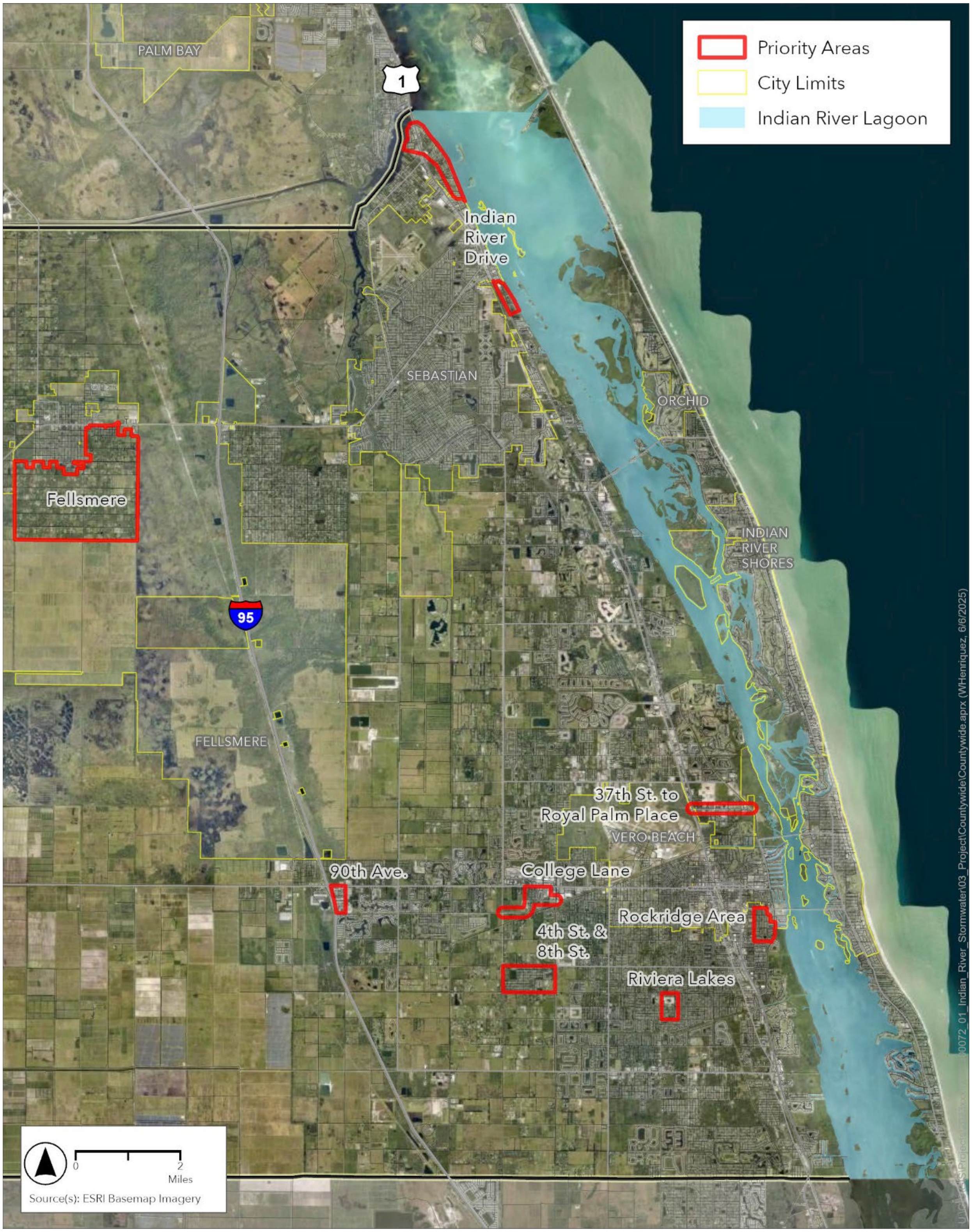

Figure 27

All Priority Areas Identified within Indian River County

6.1.1 Priority Area 1 – 90th Avenue Drainage

6.1.1.1 Background

90th Avenue lies immediately east of Interstate 95. The Priority Area is situated between 16th Street to the south and 20th Street to the north, which can be seen in **Figure 28**. The area is mostly commercial, with nearby businesses consisting of fuel stations, hotels and lodging, and automotive stores. There are neighborhoods both south and east of the Priority Area limits. It was conveyed to ESA that Fire Station 7 has experienced flooding and thus, the northwestern portion of this Priority Area has been the specific area of focus for this SMP.

The existing infrastructure within 90th Avenue consists of shallow swales, ditches, underground culverts, stormwater ponds, and canals along 20th Street and 16th Street. Sub-Lateral R-2 and Sub-Lateral R-3, both belonging to IRFWCD, run along 16th Street and 20th Street, respectively.

The closest and most prominent stormwater pond to Fire Station 7 lies west of it, between 90th Avenue and Interstate 95. The pond is owned by the hotel group in the area based on reviews of ERPs in and around 90th Avenue. This pond, hereafter referred to as the Hotel Group Pond, is part of the stormwater management system permitted via SJRWMD under ERP #18840. The system was originally intended to serve the neighboring 17-lot commercial subdivision including the Fairfield Inn and Suites and Home2Suites by Hilton and the permit has had multiple modifications and sequential permits issued since its initial approval in 1997. The most recent of these was ERP #18840 – 8, a modification issued to Petroleum Marketing Group for the 7-Eleven constructed there in 2024. There is an additional pond in the southern portion of the Priority Area at the center of several commercial and industrial buildings, along with what appears to be a canal draining into it, which is permitted via SJRWMD under Management and Storage of Surface Waters (MSSW) permit #18657 – 1.

6.1.1.2 Site Visits

During site visits in August 2024 and January 2025, ESA identified several inadequacies in the existing infrastructure. **Figure 29** shows the particular focus area examined during the site visit. First, there was sediment accumulation in culverts and pipes, particularly within structures belonging to the Amoco fuel station and Dunkin' Donuts in the northern extent of the priority area along 20th Street. Behind the Howard Johnson Inn hotel at 1985 90th Avenue, standing water was observed in multiple locations, including in storm drains in the parking lot and in swales slightly further east of the hotel along Americana Way. Vegetation was noted in the swales during site review activities. There was a berm impediment separating the swales and inhibiting the flow of water from heading north towards the Sub-Lateral R-3 canal along 20th Street.

At Fire Station 7, shallow swales were seen along the perimeter of the property and comprise much of its drainage system; there was a deeper ditch along the northern border of the property that appeared heavily vegetated. There were no inlets connecting the swales to the culvert system across the southern side of Americana Road. It is assumed that the swales were intended to connect to the swales north of the Fire Station — those mentioned previously, along Americana Way behind the Howard Johnson Inn — that seem to drain north to Sub-Lateral R-3 at 20th Avenue. Overall, it was concluded that the poor drainage in the area is concentrated east of Americana Way and west of 90th Avenue and may be contributable to isolated stormwater systems.

Figure 28
90th Avenue Priority Area Location

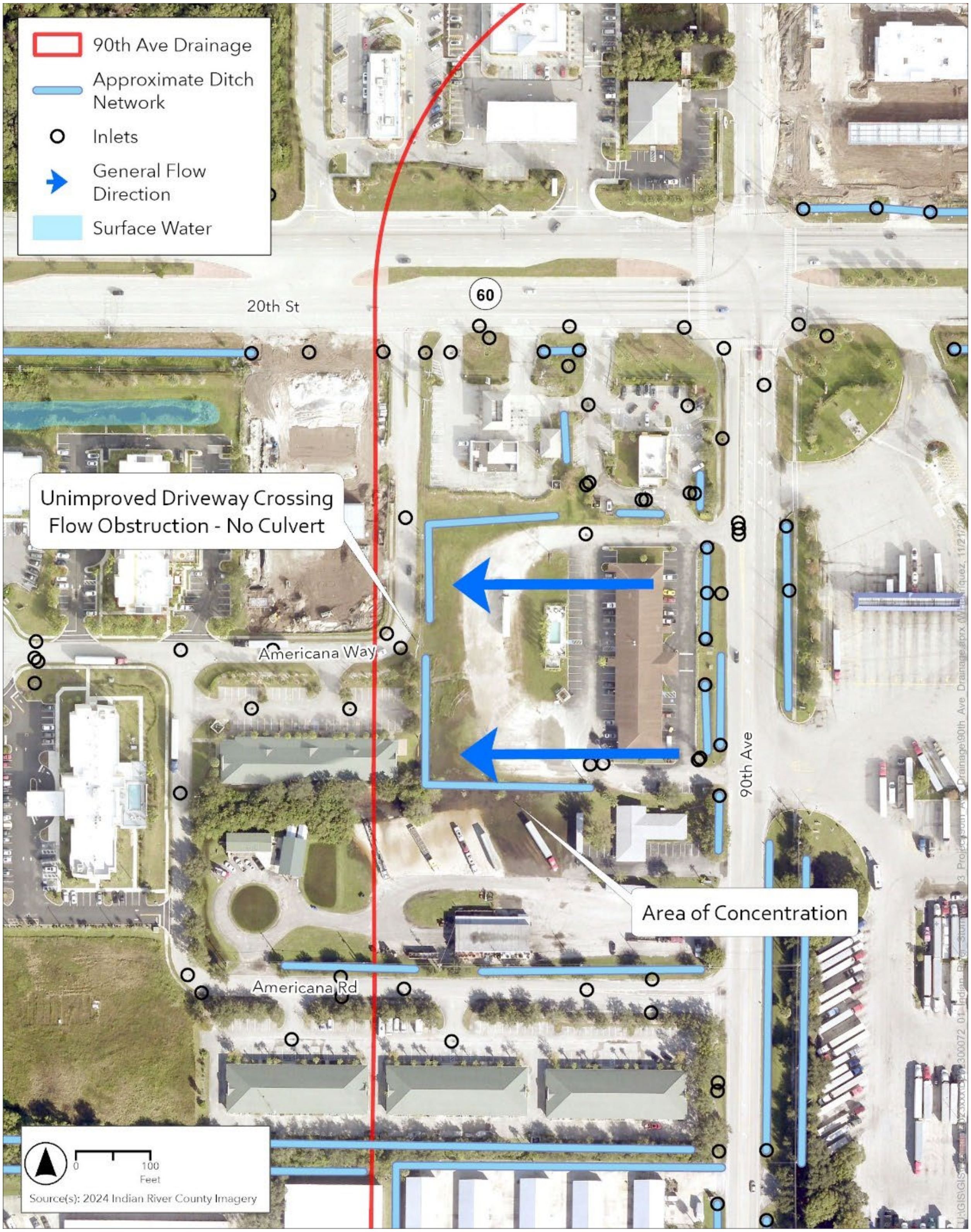

Figure 29
90th Avenue Site Visit Focus Area

6.1.1.3 Proposed Conceptual Improvements

Based on these impediments, there are multiple options that could improve water flow in the 90th Avenue Priority Area and likely relieve flooding concerns in the area. Overall maintenance is recommended on structures within the 90th Avenue Priority Area since multiple structures were overgrown with vegetation, filled with sediment or cracked or damaged in some instances. Owners would need to be engaged individually to facilitate the maintenance since they are privately owned. **Table 13** is a summary of the conceptual improvement factors and their impacts at a glance.

TABLE 13
90TH AVE. CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Install culvert and outfall structure at southwest corner of Fire Station 7	Low/medium	Medium	$818,750
Option 2	Convey water north towards the canal along 20th Street	Low	Medium	$794,400
Option 3	Convey water south towards the canal(s) south of Fire Station 7	Low	Medium	$746,600

Option 1 is to install a culvert and outfall structure in the area southwest of Fire Station 7. During heavy rainfall, this would allow excess runoff from the existing swales to disperse and avoid accumulation that hastens flooding. An inlet would be placed at the southwest corner of the Fire Station parcel and a culvert installed to cross beneath Americana Road and continue southwest, towards a new outfall. There are two (2) possible locations for the outfall, either to the Hotel Group Pond, or to the open field between the pond and Fire Station 7, also owned by the hotel group. The field could potentially serve as a dry detention area for excess runoff during storm events. Option 1 also presents an opportunity to connect to existing underground drainage on the south side of Americana Road, further enhancing connectivity of the overall drainage system in the area. The first step towards pursuing this option would be to engage with the landowner(s) and determine their willingness to participate in the project. The pond's capacity for any additional volume would need to be determined to evaluate feasibility. Survey of existing structures in the area would be required to design the conveyance system for this option, including sizing, lengths, and materials. Regarding water quality, this option could potentially reduce nutrient loading from the drainage basin if it is determined that the pond still has any treatment capacity, which is dependent on its chemistry. At a minimum, permitting efforts would involve either a modification to ERP #18840 – 2 for the master stormwater system belonging to the hotel group, or a new ERP application.

Option 2 is to convey water north towards Sub-Lateral R-3 canal along 20th Street by re-grading the berm impediment separating the swales along Americana Way. This would restore the hydraulic connectivity along the eastern side of Americana Way and allow excess runoff from the Fire Station to diffuse throughout the drainage system. Re-grading the shallow swales at the Fire Station could also be considered as part of this option to improve conveyance towards the north. Coordination and permission with the Howard Johnson Inn, IRFWCD, and other pertinent landowners would be required for this option and is the first step to determine feasibility. Survey of existing structures and of the earthen berms would be needed to design and prepare construction documents for this option. Permitting would most likely also be a component of this option.

Option 3 is to convey stormwater towards the ditches south of Fire Station 7. Like the other options, this would allow excess water from heavy rainfall events to flow away from the Fire Station which would help to reduce flooding. The ditches appear to be smaller than Sub-Lateral R-3, but they are much closer to the Fire Station, and they connect to the Hotel Group Pond. The ownership of the drainage easement where the ditches are located must be determined for this option to be initially evaluated and the owner's agreement to engage in the project. An updated survey of existing drainage structures, ground elevations, extents and depths of the ditches would need to be obtained to fully evaluate and design this option as well as to determine permitting requirements.

Figure 30 shows approximate diagrams of the proposed conceptual improvements for 90th Avenue.

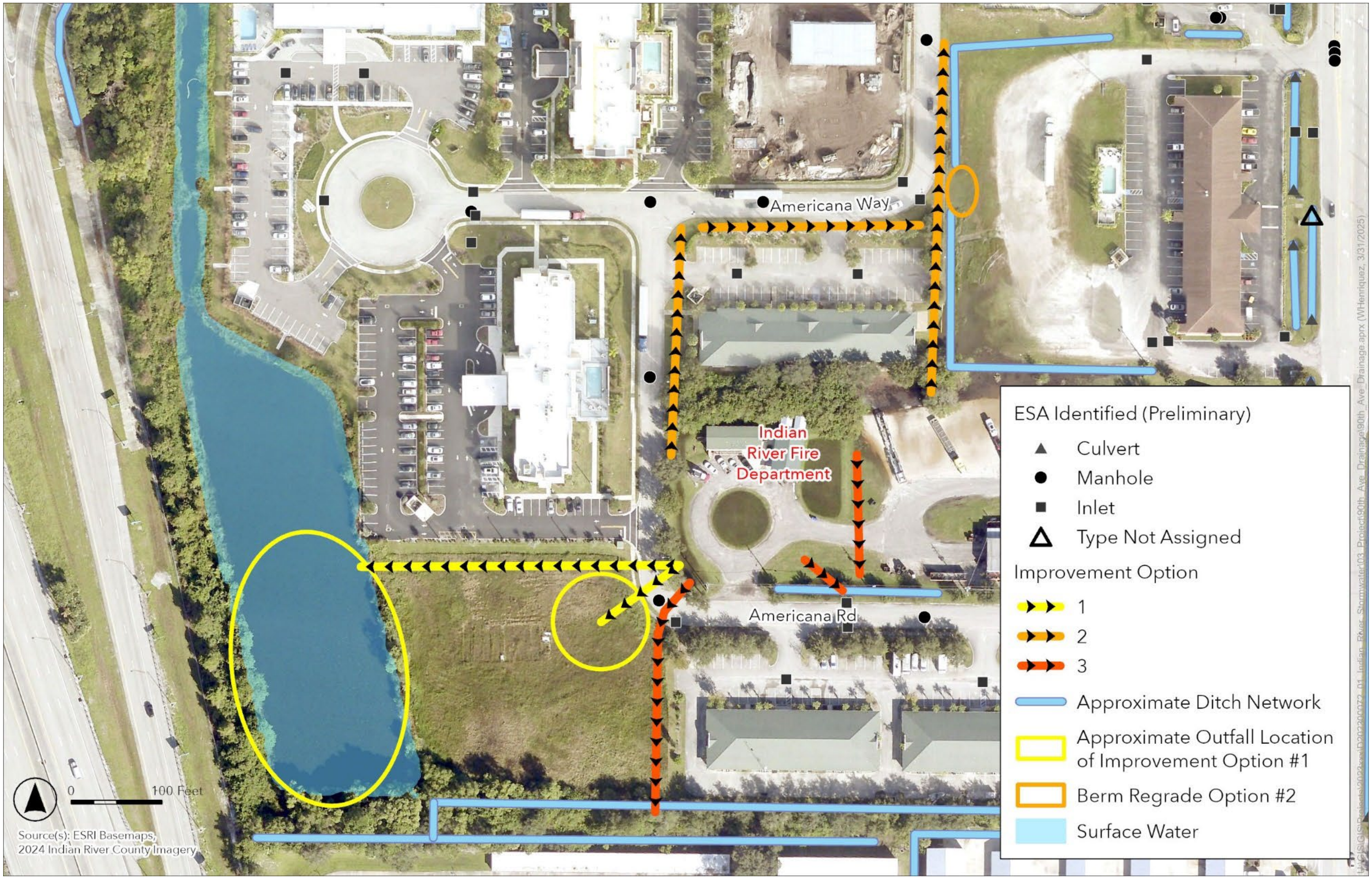

Figure 30
Proposed Conceptual Improvement Options for 90th Avenue

6.1.2 Priority Area 2 – Rockridge Area

6.1.2.1 Background

Rockridge Area is a residential subdivision located just south of the limits of the City of Vero Beach, east of Indian River Boulevard (IRB) and west of US Highway 1, with 12th Street to the south and 17th Street to the north. This area can be seen in **Figure 31**. IRL is approximately 2,000 feet away from the eastern edge of this Priority Area, across IRB. There are residential homes comprising most of the Priority Area, and at the southern boundary there are two apartment complexes, Indian River Apartments and Palms at Vero Beach, each with on-site retention ponds. As a result of its close proximity to the lagoon, this Priority Area is heavily impacted by tidal influences, particularly during full moon and king tides. This factor combined with the area's low-lying terrain makes Rockridge particularly prone to flooding.

The existing stormwater infrastructure in the Rockridge area consists of culverts, canals, and shallow swales along property edges of residential homes, in addition to the ponds noted at the apartment complexes. There are canals along 16th Street and along 14th Street that both discharge directly to IRL, and a smaller canal along 13th Street that is open channel west of the apartment complexes and continues underground toward IRL. In general, all drainage structures in this area flow east towards IRL. In 2006, a surge protection study titled Rockridge Subdivision Surge Protection Project by Malcom Pirnie identified several potential drainage improvements including flap gates, sluice gates, tide-flex check valves, a tilting weir gate within the 14th Street canal east of IRB, a stormwater pump station along the 16th Street canal, the construction of a soil berm barrier, hydraulically connecting canals between 16th Street and 3rd Avenue, and a stormwater pump station. Some of these improvements were permitted under ERP #108217 – 1, although none of them were implemented.

There is a mobile home community east of IRB just outside of the Rockridge Priority Area, south of which is a natural wetland and marsh area. A portion of that natural area is associated with wetland mitigation from the development of Indian River Apartments, according to an MSSW Individual Permit #4-061-0139 issued by SJRWMD in September 1994. The entire area is owned by Indian River Apartments, according to the IRC Property Appraiser website.

City of Vero Beach (COVB) is currently conducting their Vulnerability Assessment (VA) and published a draft in January of 2025. Storm event modeling was performed as part of the VA and multiple scenarios were assessed for 100 and 500-year storm events, sea-level rise, storm surge, and various tidal conditions. The model boundary includes three (3) areas identified as priorities by IRC: Rockridge, 37th Street, and portions of Indian River Boulevard. Based on these modeling efforts, the COVB has identified an area directly north of IRC's Rockridge Priority Area, encompassing one of the City's wastewater treatment plants, as Focus Area 2. The Rockridge area has some level of inundation in every scenario, including Current High Tide. Per communication with COVB to be detailed later in this SMP, the wastewater treatment plant may be relocated, providing a potential opportunity for stormwater treatment planning in that area. Ongoing coordination and determination of plans the COVB has for Focus Area 2 may affect the outcome of IRC's corrective actions for Rockridge Priority Area.

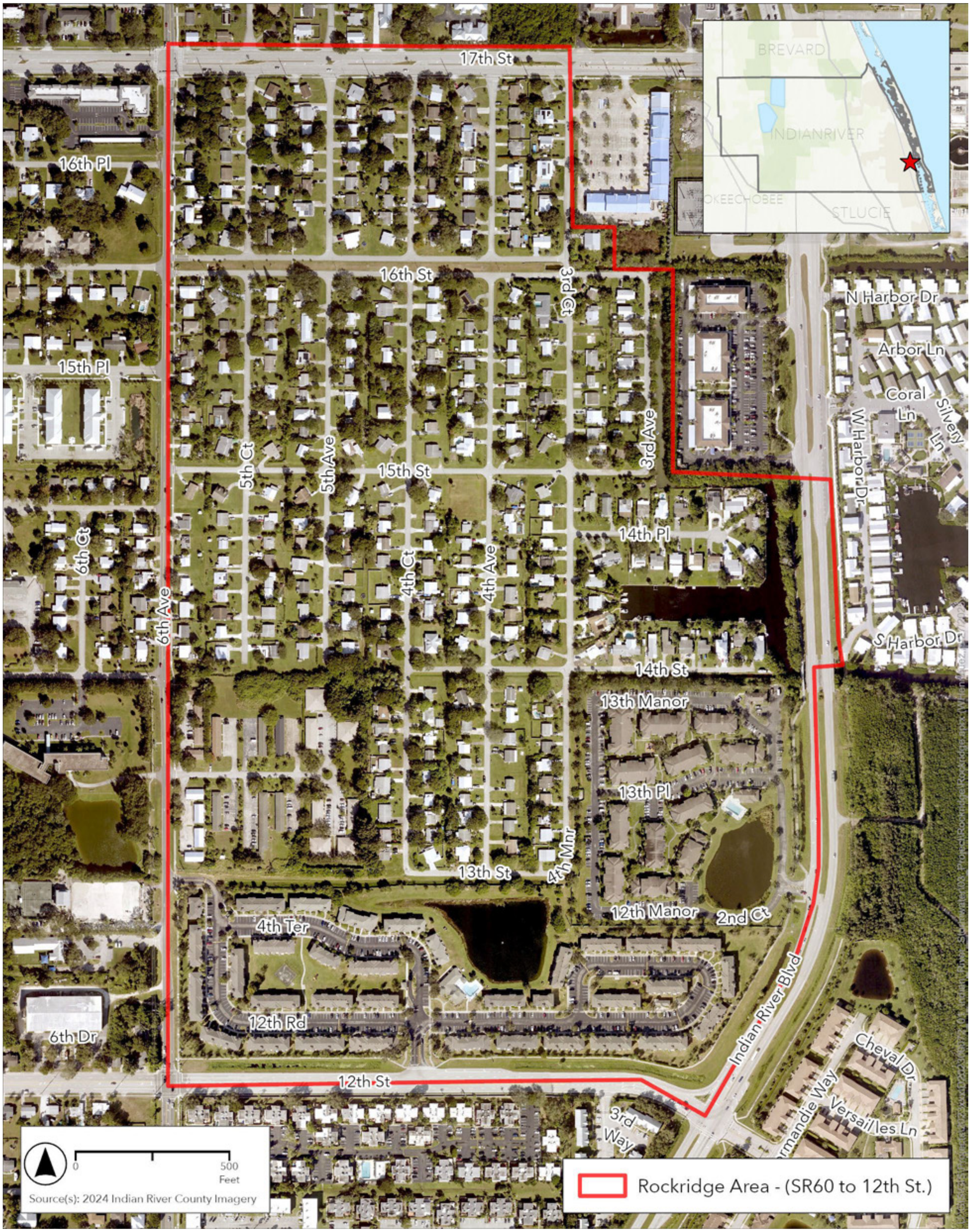

Figure 31
Rockridge Priority Area

6.1.2.2 Site Visits

Several areas within Rockridge were examined during site visits, particularly along Indian River Boulevard and around 3rd Court and 16th Street. These include the canal crossing at 16th Street, in particular, the concrete headwalls of the culvert and the surrounding riprap; drainage swales south of 16th Street along the western side of IRB, which were filled with standing water; and an outfall structure on the eastern side of IRB, which was submerged at the time of the visit and was later recognized as the outfall of the culvert shown in the construction drawings associated with the MSSW Permit #4-061-0139 for Indian River Apartments. The culvert is 42” and runs from the swales on the western side of IRB to this outfall location. The presence of standing water in these structures is contributable to the tidal influence from IRL which further strains the limited capacity of the existing drainage system. See **Figure 32**.

West of Indian River Boulevard and north of Indian River Apartments, the immediate area of 16th Street and 3rd Court were evaluated during the initial site visit, as shown in **Figure 33.** The channel along 16th Street is covered by turf grass west of 3rd Court and opens into the canal east of 3rd Court onward towards IRL. During the site visit, several pipes were identified terminating in 16th Street Canal, including one coming from along 3rd Court. Some shouldering of sediment along the canal banks was observed. Maintenance is recommended to control sediment and vegetation along 16th Street Canal. The homes on 3rd Avenue appeared to be situated the closest to the channels out of most of the residences in the area, and there is little to no elevation change between the homes and the channel banks. It appears that these homes are among the most susceptible to flooding impacts out of the entire Rockridge Priority Area. Finally, there is a channel along 3rd Avenue running north from the 14th Street Canal which is not connected to the 16th Street Canal. Connecting these channels was considered as a potential option for proposed conceptual improvements; however, this concept has been repeatedly evaluated in the past, and it was concluded that connecting these channels may further exacerbate flooding in the Rockridge neighborhood.

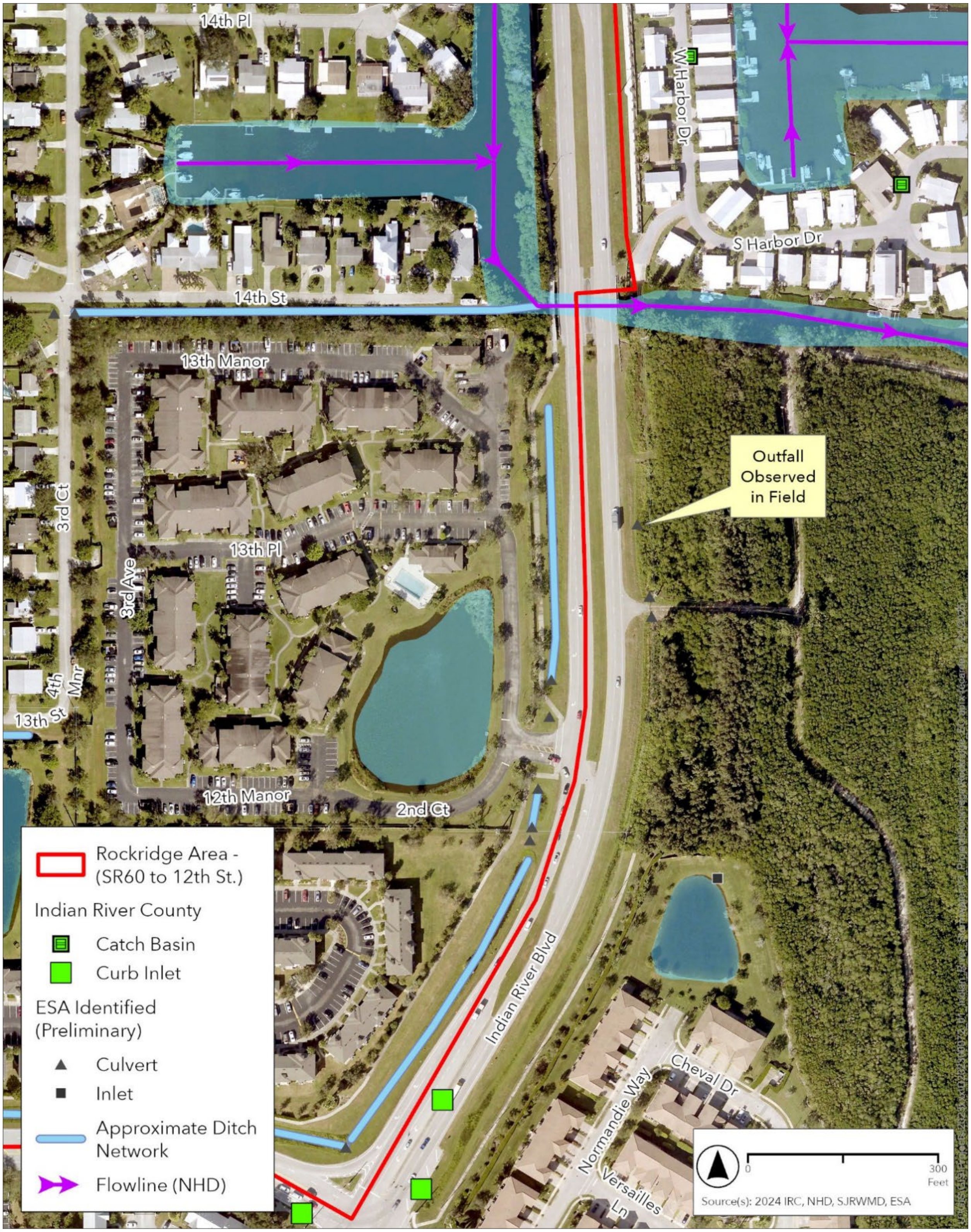

Figure 32

Rockridge Site Visit Focus Area #1

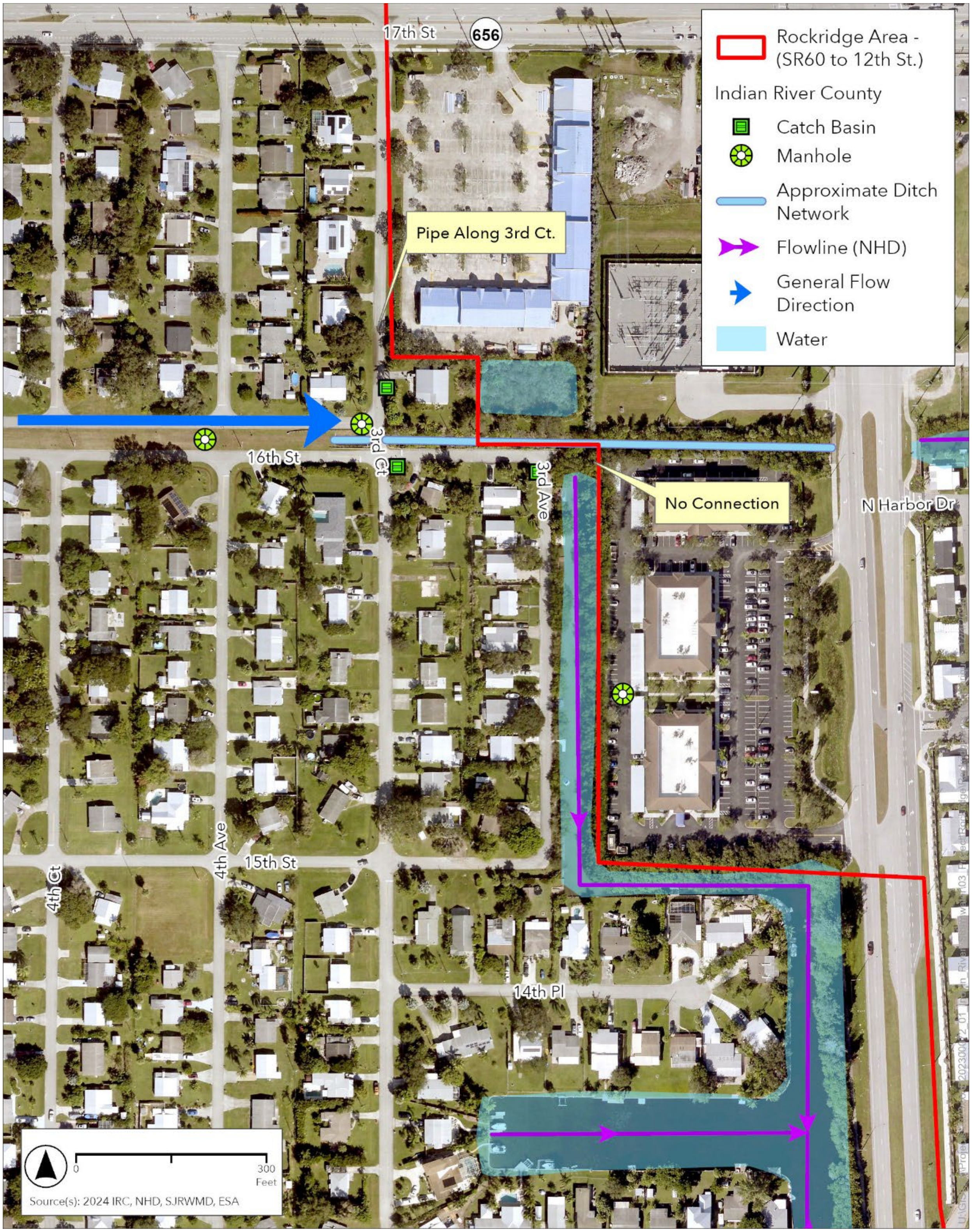

Figure 33

Rockridge Site Visit Focus Area #2

6.1.2.3 Proposed Conceptual Improvements

Overall, the Rockridge Priority Area requires significant intervention to provide long-term relief to residents experiencing consistent flooding, especially since water from IRL can enter from 14th and 16th Street canals. There are multiple potential options for improving the drainage within the Rockridge Priority Area, each having varying degrees of flood reduction, improvements in water quality, long and short-term impacts, and feasibility. Option 1 through Option 3 are unlikely to provide major reductions in flooding but are presented as options that could be implemented sooner than the others. Option 5 represents the best option to alleviate

Table 14 is a summary of these potential options and an assessment of these factors at a high level.

TABLE 14
ROCKRIDGE – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Raise Invert Elevation of 42” Culvert	Low impact	Short term	$1,071,600
Option 2	Add additional pipe across IRB	Low impact	Short term	$1,141,600
Option 3	Attach backflow prevention devices	Low impact	Short term	$778,200
Option 4	Construct stormwater treatment area	High impact	Long term	$25,688,800
Option 5	Establish rain gardens	Medium impact	Long/medium	$1,660,200

Option 1 is to raise the invert elevation of the 42” culvert across Indian River Boulevard running between the swales on either sides of the road, west or east. This option may reduce flooding impacts by allowing water in swales to stage up and store larger volumes of water before popping over to discharge across IRB. It is unlikely that Option 1 would have any impact on water quality since it would only marginally increase the conveyance of water to IRL. The amount by which to raise the culvert is not determined due to several unknowns, including the existing invert elevations on either end of the culvert and its condition since it was submerged during site visits. The age of the culvert is also unknown, although it was called out as an existing structure in the plans from 1994, so it is likely at least 30 years old. To accomplish Option 1, a survey would need to be obtained to evaluate elevations for the culvert and to assess its full extent. Easements would need to be acquired by IRC from the owner or otherwise authorized entity, which is likely to be either Indian River Apartments or FDOT. Confirmation of ownership of the culvert and swales would be required to proceed with Option 1. FDOT seems to have jurisdiction over IRB itself, and another consideration is the impact to traffic along IRB which would require a Maintenance of Traffic plan since it is a major road. Modeling efforts may be required to evaluate this option’s impact on surrounding areas and to determine the amount by which to raise the culvert, and an ERP may be needed to execute this option. As an initial assessment, Option 1 would likely provide little relief to the flooding in this Priority Area and is presented as a short-term alternative with lesser implementation costs than some of the other proposed options.

Option 2 is to add an additional pipe across IRB, the size and placement of which is to be determined. The pipe would begin in the swales on the west side of IRB and discharge potentially into the natural wetland and marsh area east of IRB, owned by Indian River Apartments. Option 2 would likely have a greater impact on the flooding conditions within Rockridge than Option 1, since it would convey more water and provide another discharge location. This option would be evaluated based on a survey of the existing culvert, topography of the swales, and possibly some modeling to determine any flooding impacts on surrounding areas. Similar to Option 1, this option would be contingent upon agreement from landowners. **Figure 34** shows an approximate diagram of the proposed conceptual Option 1 and Option 2.

Option 3 is to attach backflow prevention devices to the existing culverts on the west side of Indian River Boulevard. Installing devices such as a Wapro or Tide Flex valves would help to reduce backflow from IRL at higher tides. A similar option was proposed in the Rockridge Subdivision Surge Protection Project. The condition of the existing culverts and their ability to hold these devices would need to be assessed by a licensed structural engineer. There would be little impact on water quality since this option neither reduces nor increases discharge to IRL.

Option 4 proposes the construction of a stormwater treatment and storage area somewhere within the vicinity of the Rockridge Priority Area. Out of all options, this would have the greatest impact out of all options on both flooding concerns and water quality and is preferred as the best option to prevent the encroachment of floodwaters on residences by conveying water there instead of to the canals and IRL. Simultaneously, this option is by far the costliest since it would require IRC to purchase land to establish the treatment and storage area. See **Section 5.1.5** for further elaboration on stormwater treatment areas.

Option 5 is presented as an intermediary alternative and proposes the installation of rain gardens in areas throughout the Rockridge Priority Area. This option may be more feasible than Option 4 since IRC could acquire smaller easements for attenuation, and because available land is scarce in the area. Although this option does not provide significant volumetric storage to alleviate flooding, it would help to slow down water to prevent overwhelming the drainage swales and canals and may provide a small water quality credit. In addition, rain gardens would also provide an aesthetic benefit to the community. See **Section 5.1.4** for further elaboration on rain gardens and their benefits.

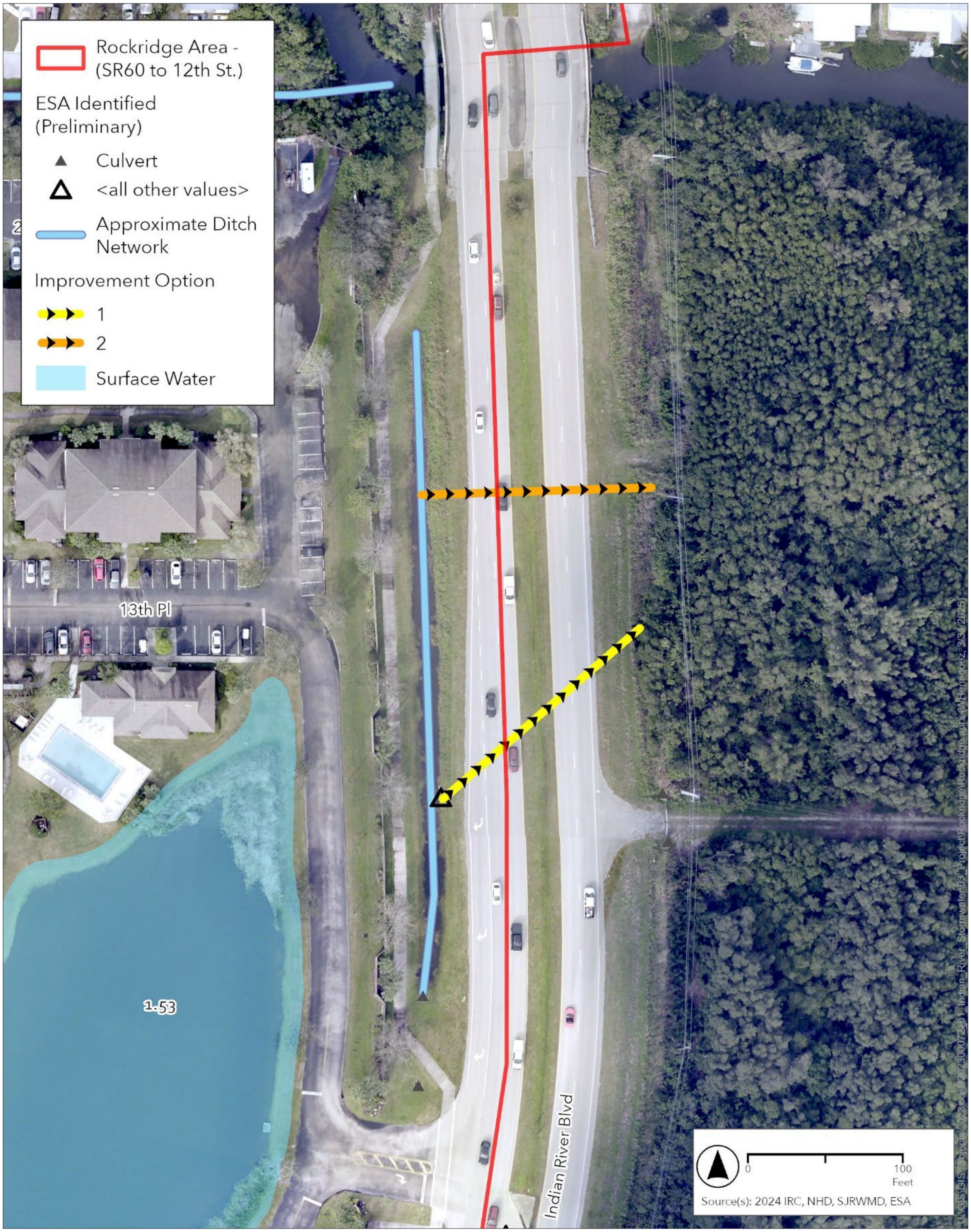

Figure 34

Proposed Conceptual Improvement Options #1 and #2 for Rockridge Priority Area

6.1.3 Priority Area 3 – College Lane

6.1.3.1 Background

As shown in **Figure 35**, College Lane lies south of State Road 60, with 66th Avenue to the west and 58th Avenue to the east. The road is approximately 500 to 1000 feet north of the Main Relief Canal owned by IRFWCD. The Sub-Lateral A-2-E canal runs along State Road 60, and there is a canal called Lateral A extending southeast from the western limits of College Lane to the Main Relief Canal.

College Lane adjoins land consisting of various uses, with residences to the north. According to IRC staff, the residential area including Charlotte Avenue, Hedden Place, Fiora Lane, and Sixty Oaks Lane experiences flooding during heavy rains as water sheet flows from these areas south towards College Lane. At its northeastern end, College Lane leads to businesses such as Home Depot, Marshalls, Petco, and multiple restaurants. Along the south of the road are institutions including Indian River Community College and Indian River Charter High School. Most of the plats along College Lane are owned by Indian River College, particularly along the western side and south side, while plats on the eastern side are primarily commercial. Much of the western side of the road remains pervious undeveloped areas that appear to be agricultural. In addition, at the southeastern end of College Lane are several currently undeveloped parcels classified as Vacant Commercial land per IRC Property Appraiser.

In the residential streets north of College Lane, the existing infrastructure consists of shallow swales along the front of the properties and ditches running north-south behind the properties. The roads are mostly flat except for a gentle downward slope towards College Lane. Along College Lane, there are multiple culverts, swales, and ditches that appear to convey water towards various retention ponds for which ERPs were reviewed as part of this analysis. The ERPs in the vicinity of College Lane consist of those that are part of Indian River Community College development, those issued for Indian River Charter High School, and an ERP #26179-1 for the master stormwater plan to accommodate discharge from the shopping centers northwest of the road, henceforth referred to as the Home Depot Pond. Note that east of the Home Depot Pond, at the farthest eastern side of College Lane, southwest of its intersection with 58th Avenue, an ERP #26179-3 was issued for a 7-Eleven Store, although it expired in 2023 and was not constructed. The vacant commercial parcel currently appears to be for sale.

According to the East Indian River County Stormwater Master Plan (year unknown), a 2001 SJRWMD Storm Water Management Model (SWMM) showed the IRFWCD Main Relief Canal to have flooding and potentially erosion during a 100-year storm event in the areas just south of College Lane.

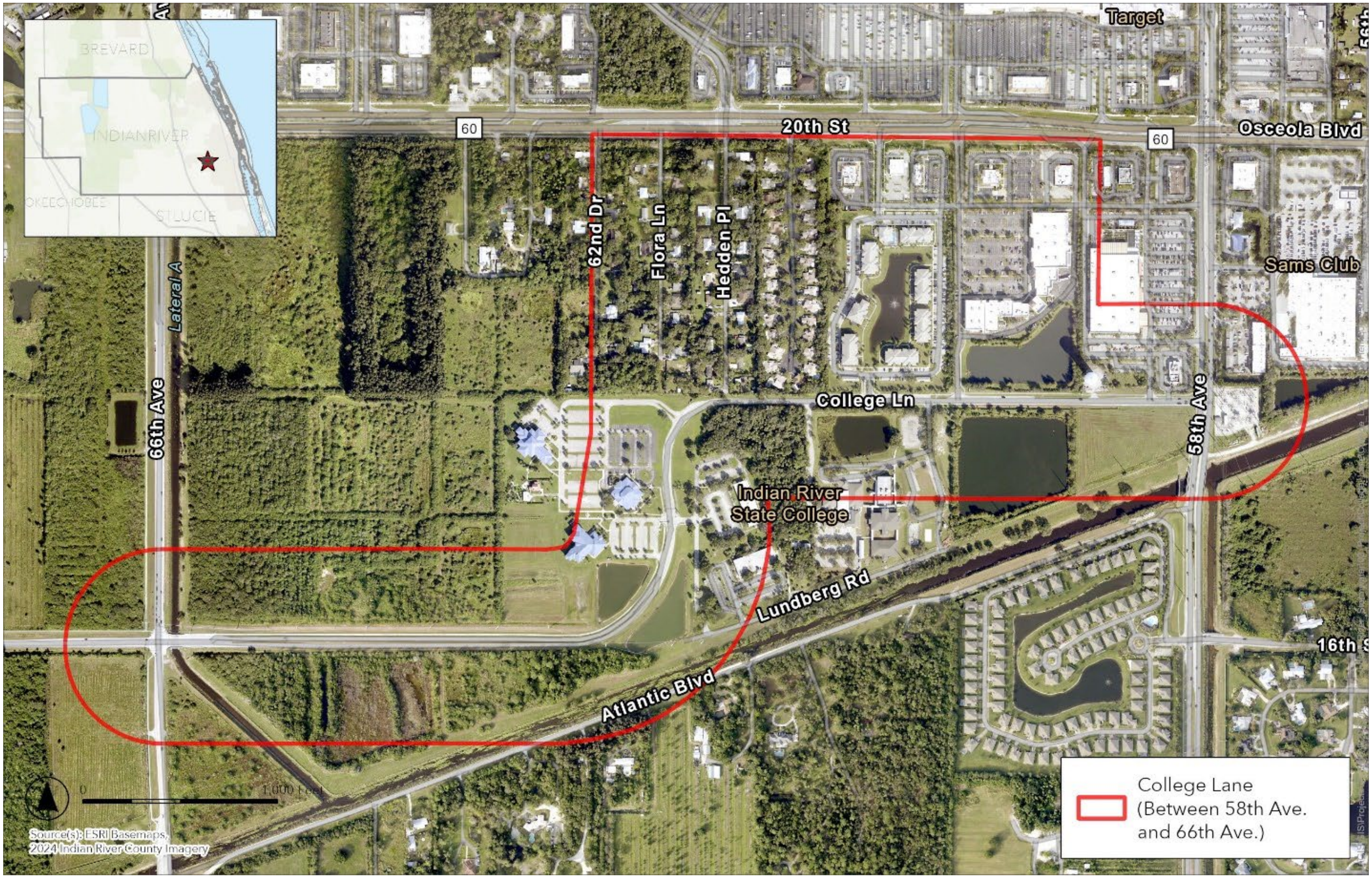

Figure 35
College Lane Priority Area

6.1.3.2 Site Visits

During the site visit in 2024, ESA examined the commercial areas northeast of College Lane and the residential streets north of the road. **Figure 36** shows the site visit focus area. The ditch between the Outback Steakhouse and Sixty Oaks Lane was observed from the restaurant's parking lot north to 20^{th} Street. At the time of the visit, the ditch was mostly dry, but some water was present upon walking to the ends at the north and south. The ditch was heavily vegetated. The vacant commercial parcels southwest of the intersection of College Lane and 58^{th} Avenue were also walked and examined during the initial site visit. The residential streets were walked, and it was observed that the residences were low-lying and most had very shallow swales in the front of them, parallel with College Lane. A low spot was identified between 1935 and 1955 Hedden Place, and between 1946 and 1956 Hedden Place. It was discussed by IRC, that this may have been associated with a drainage easement as it appeared to be a ditch running west-east between the homes. The ownership and full extent of this ditch is unknown.

In 2025, ESA revisited the neighborhood north of College Lane and walked along College Lane. Several structures were examined, including inlets, culverts, ditches, and swales. Some inlets had standing water at the time of the site visit, and some structures appeared to be disconnected along the southern side of College Lane. It was noted that swales near Indian River Charter High School were separated by driveways. The ditches behind the residential streets did not appear to connect to any drainage components along College Lane.

6.1.3.3 Proposed Conceptual Improvements

There are multiple options that could improve drainage throughout the area of College Lane and alleviate flooding concerns in the residential areas. **Table 15** summarizes these potential options.

TABLE 15
COLLEGE LANE – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Connect and restore existing structures	Low	Medium	$580,500
Option 2	Route stormwater to new ponds	Medium	Medium/long	$683,200
Option 3	Regrade ditches	Low/medium	Medium	$711,400

Option 1 is to connect the existing structures along College Lane to restore the intended hydraulic function of the drainage system (**Figure 37**). Creating a connection between the ditch east of Sixty Oaks Lane to the swales on the northern side of College Lane would both improve flow and increase storage volume in the area. On the south side of College Lane, installing a culvert beneath the driveways at Indian River Charter High School to connect the swales would help to convey water more freely there. Additionally, adding a culvert to convey water from north to south across College Lane would further expand storage volumes and alleviate excess runoff from the residential areas. There may be a slight water quality benefit to connecting these drainage system components by reducing stagnant water. To begin, updated survey would be needed to evaluate the impact these changes would produce and to determine exact invert elevations and slopes. This option would require easements to be obtained at the various places where structures are located.

Figure 36
College Lane Site Visit Focus Area

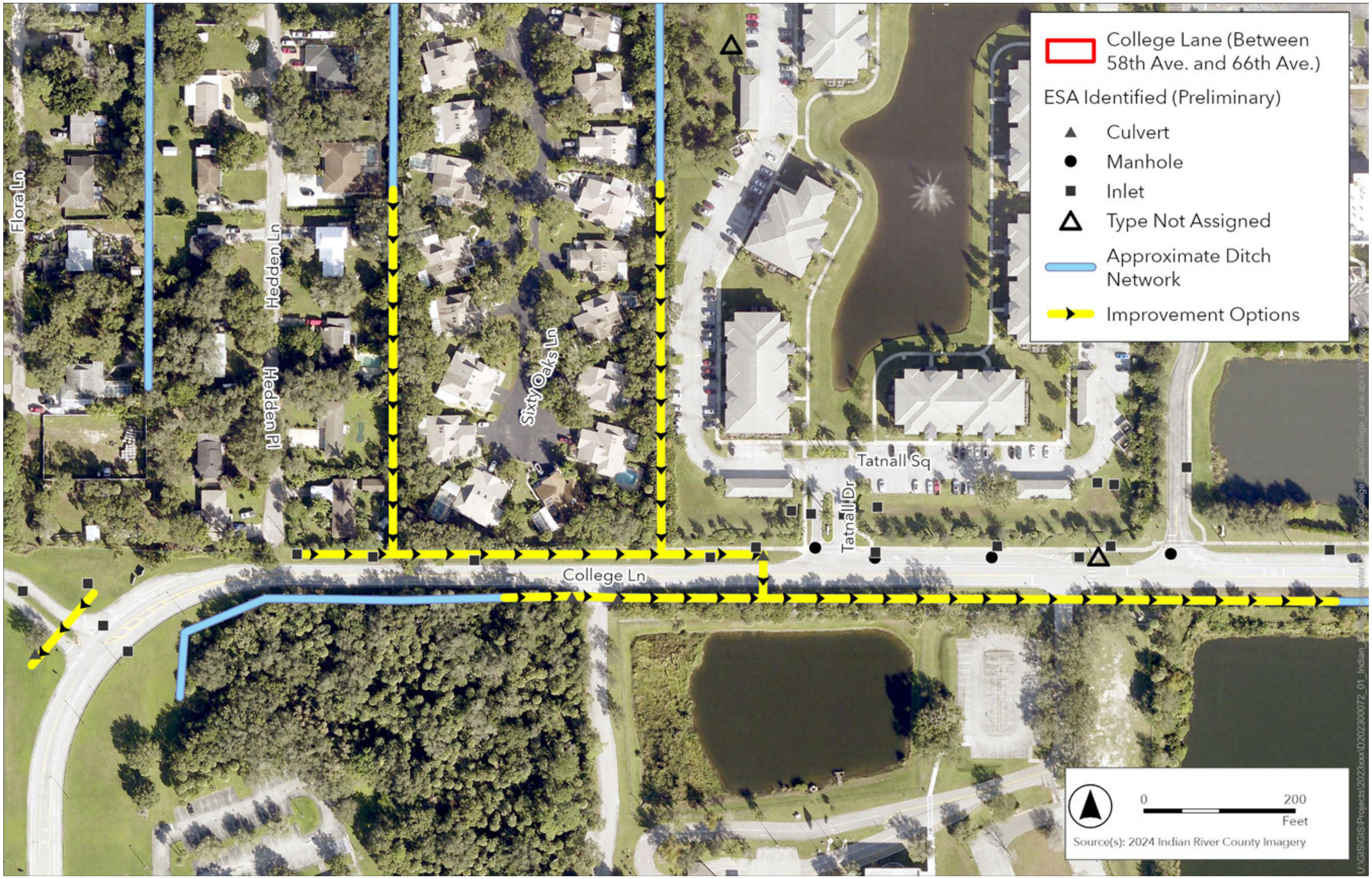

Figure 37
College Lane Proposed Conceptual Improvement Option #1

Option 2 is to route excess runoff from College Lane and the surrounding areas either to the Home Depot Pond or to the vacant commercial parcel in the southeast corner of the College Lane Priority Area (**Figure 38**). This option is similar to Option 1 in that it would require connecting structures across College Lane, so an updated survey would be needed along with easements from landowners to work on the drainage components. The Home Depot Pond would need to be evaluated to determine its storage capacity, if any; the chemistry of the pond would need to be examined and considered to determine the impact on water quality. A modification of the ERP #26179-1 would most likely be required for this option, which would entail significant coordination with SJRWMD. Hydraulic modeling may be needed to ensure that the modification does not adversely impact the original permitted system.

Option 3 is to regrade the west-east ditch in the neighborhood north of College Lane to improve the conveyance of stormwater to the north-south ditches between the streets (**Figure 39**). This option also proposes re-grading the ditch along Sixty Oaks Lane to improve stormwater conveyance north to 20^{th} Street and south towards College Lane. Like Option 1, this option would include a connection of the Sixty Oaks Lane ditch to the swales along College Lane. Option 3 largely benefits the residential area north of College Lane where the main area of concern is since it would allow excess runoff from homes to be conveyed off of residents' properties. This option would be contingent upon the landowners' willingness to engage in the project. Survey of the ditches would be required to determine design slopes and elevations.

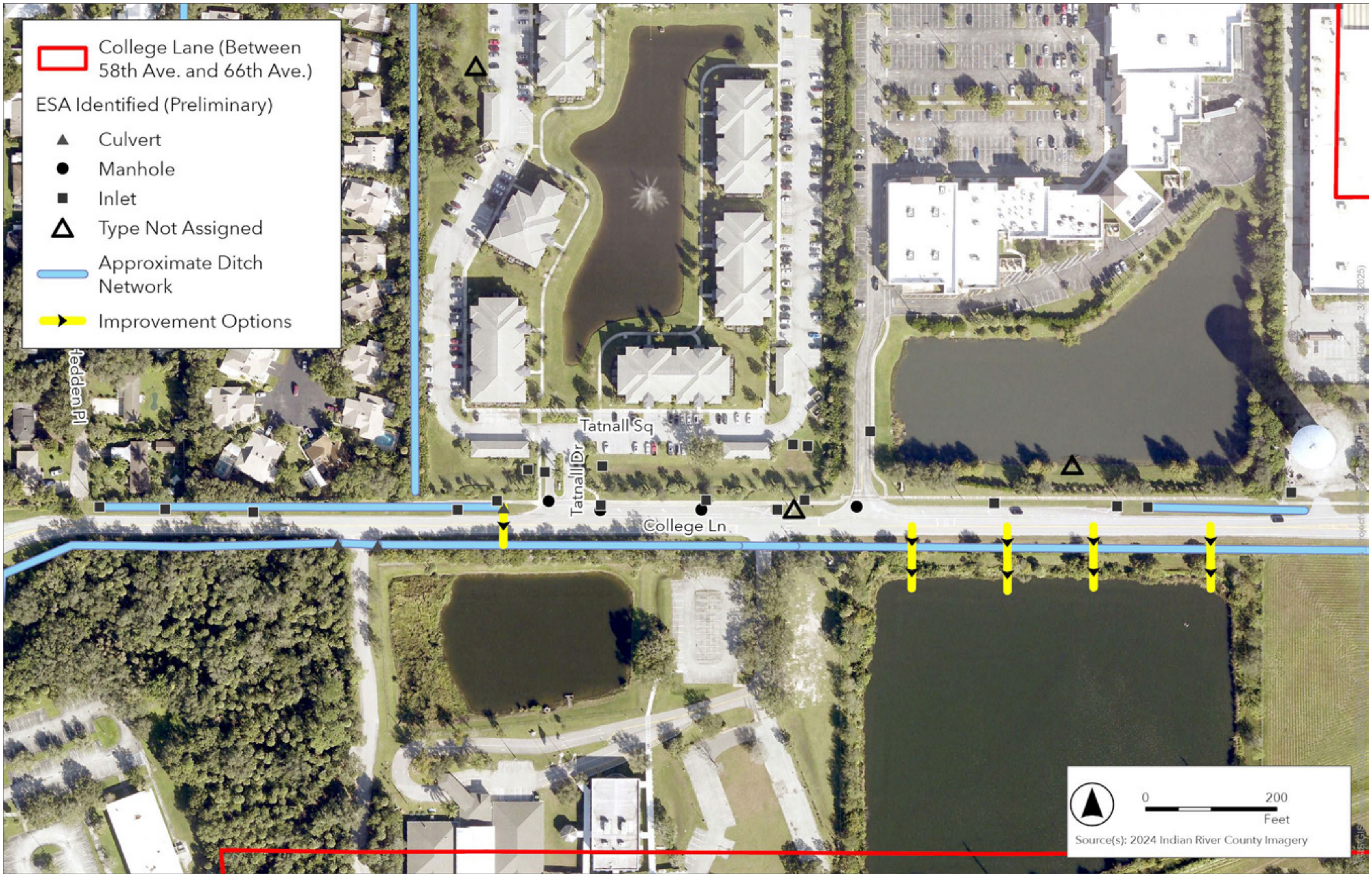

Figure 38

College Lane Proposed Conceptual Improvement Option #2

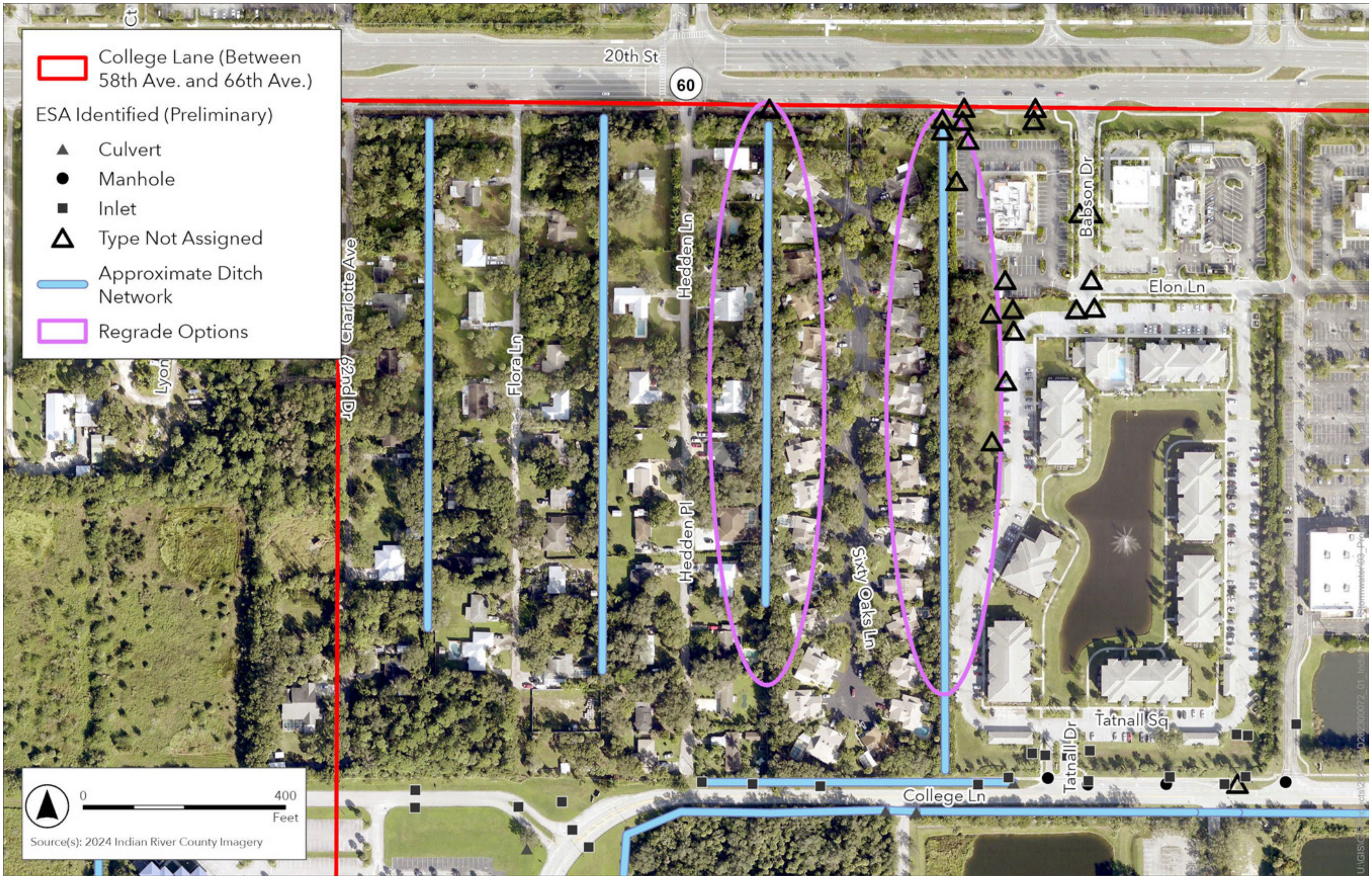

Figure 39

College Lane Proposed Conceptual Improvement Option #3

6.1.4 Priority Area 4 – 37th Street

6.1.4.1 Background

37th Street Priority Area is located between US Highway 1 to the west and Indian River Boulevard to the east and is mostly surrounded by medical offices, seen in **Figure 40**. The boundaries of the City of Vero Beach border 37th Street on both the east and west ends of the road. There are several undeveloped parcels at the southeastern corner of the road and east across IRB. IRL is just east of these parcels, approximately 2,200 feet away from the intersection of 37th Street and IRB.

Most of the undeveloped parcels across IRB are privately owned by Indian River Land Trust, according to the IRC Property Appraiser website. There are two parcels about 1,500 feet southeast of 37th Street owned by Indian River County, which appear to be used for mosquito control based on a desktop review of ERPs in the vicinity of 37th Street.

Vero Beach Regional Airport occupies the area immediately west of 37th Street, just across US Highway 1. The COVB VA identified the airport as Focus Area 1, an area containing a vulnerable asset and prone to flooding. Like the Rockridge Priority Area, IRC should consult with COVB and consider any plans they may have for that Focus Area prior to deciding on final corrective actions to address the flooding there.

The existing infrastructure in the 37th Street Priority Area consists of ditches and culverts running east and west along 37th Street, on both the north and south sides of the road. Stormwater is generally conveyed east towards IRL. An ERP #40739 – 5 was issued by SJRWMD to Indian River County in 2021 that permits the construction of a 0.45-acre dry retention pond located at the southwestern intersection of 37th Street and Indian River Boulevard to serve a 1.3-acre basin off of 37th Street. The ERP is associated with roadway improvements near the intersection of 37th Street and IRB which are not yet constructed. These improvements are referred to as Project IRC-1910 on the Infrastructure Improvements Projects webpage. As of April 2025, construction has not started for the project.

6.1.4.2 Site Visits

During site visits ESA staff verified the locations of some stormwater structures and ditches along 37th Street Priority Area. At the time of the site visits, in both August 2024 and January 2025 there was standing water in the ditches along the length of the street. This standing water could indicate that the system is tidally influenced as a result of its proximity to IRL. At the northeastern end of 37th Street, a concrete culvert structure was identified going east towards Indian River Boulevard (**Figure 41).** The same structure was identified on plans dated 2017 for the ERP #18729 – 5 which specified the dimensions as an 84” x 48” box culvert with inverts of -1.70 ft North American Vertical Datum 1988 (NAVD 88) and -1.74 ft NAVD 88 at the other end of the outfall on the eastern side of Indian River Boulevard.

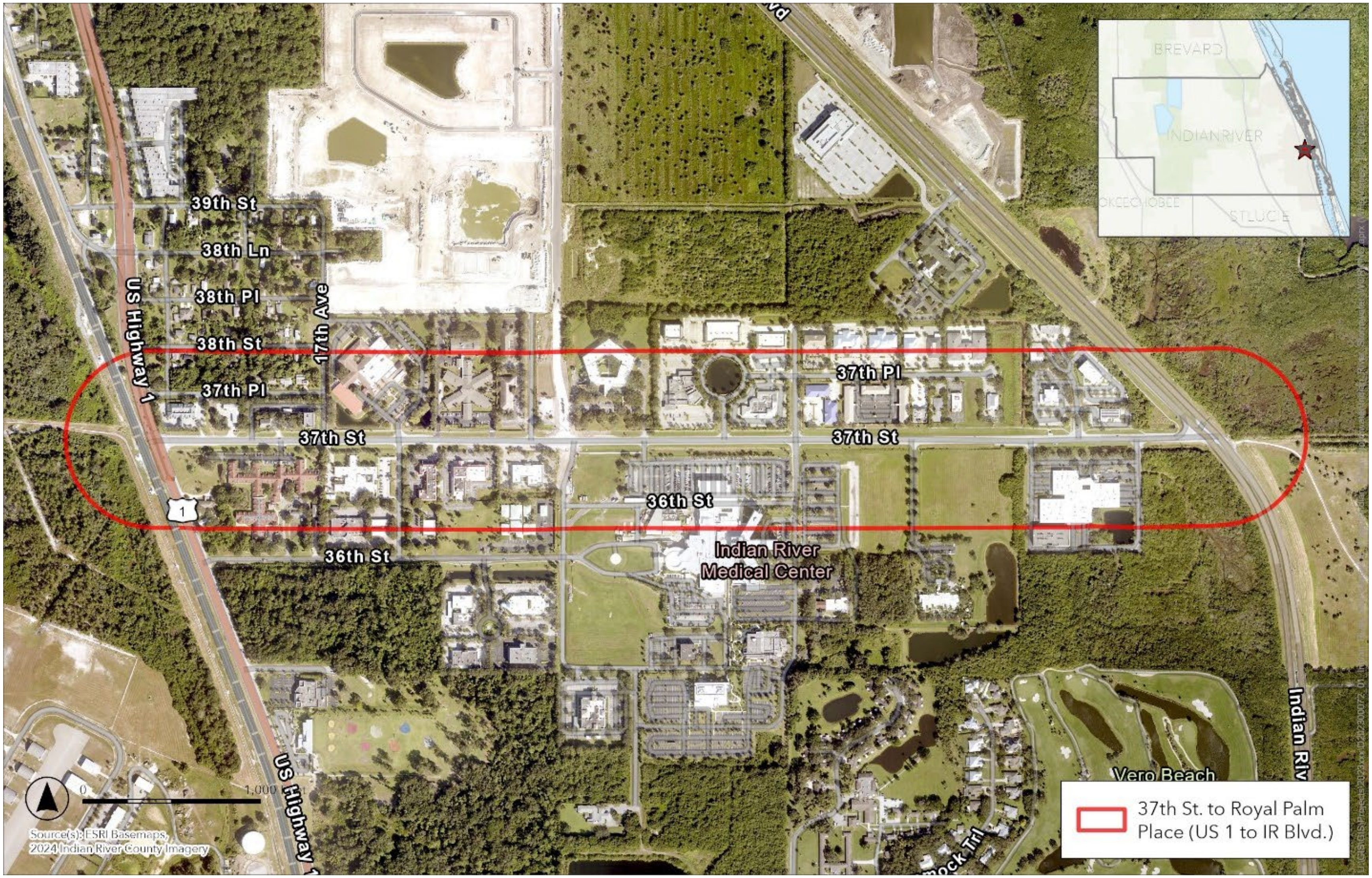

Figure 40
37th Street Priority Area

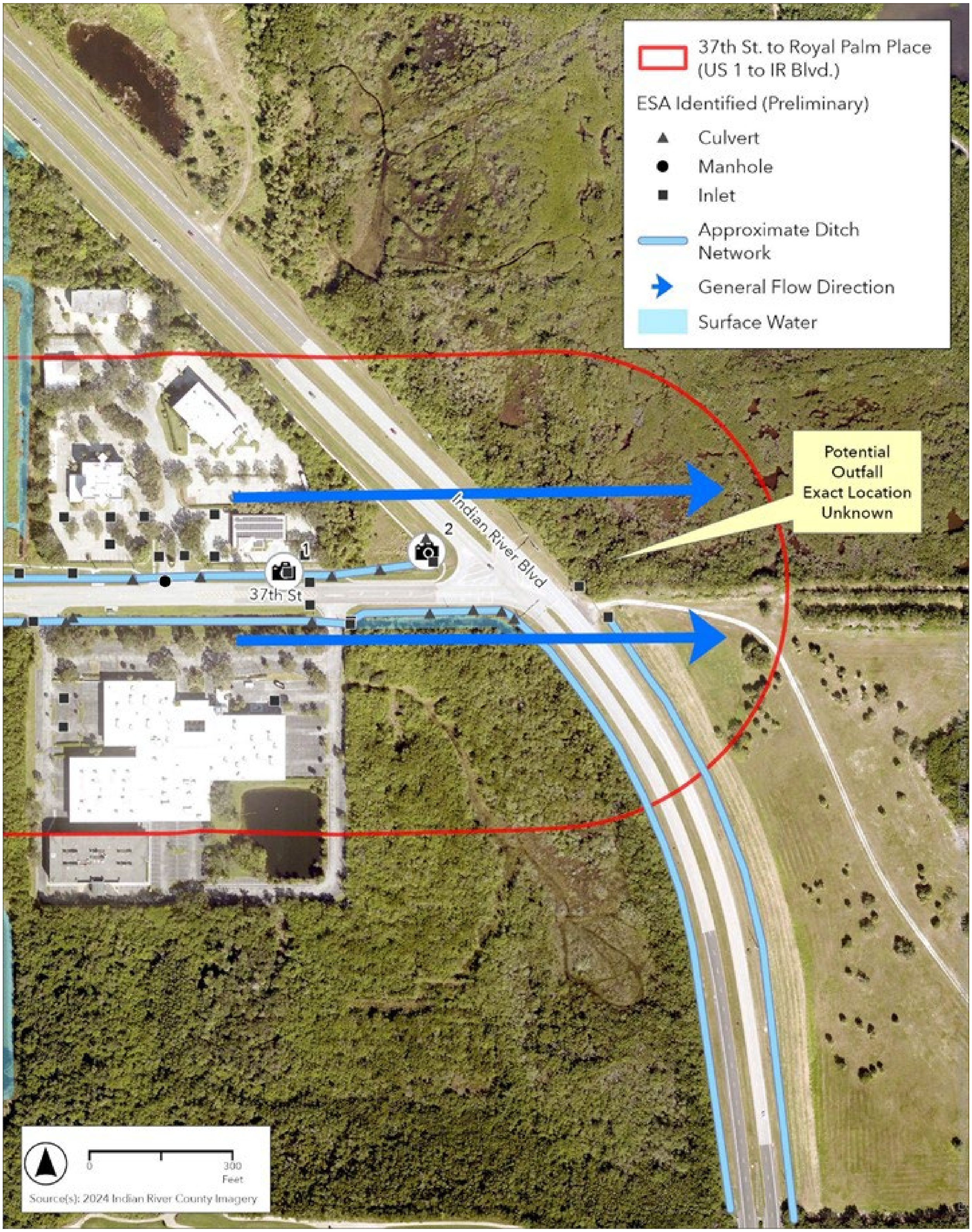

Figure 41
37th Street Site Visit Focus Area

The western limits of 37th Avenue Priority Area were also examined during the site visits. Several culverts were observed, and it was noted that the structures are generally well-connected, but some maintenance could be beneficial to control vegetation and to monitor the condition of the structures.

6.1.4.3 Proposed Conceptual Improvements

Several opportunities have been conceptualized as possible options to provide flood control and improve water quality in the vicinity of 37th Street Priority Area. It should be noted that the 0.45-acre dry retention pond has not yet been constructed, and the addition of that stormwater treatment area will have an impact on the hydraulic function of the corridor. Overall, maintenance including vegetation removal and repair of cracked culverts is recommended to ensure the existing drainage system is performing to the best of its ability. **Table 16** summarizes the proposed conceptual improvement options for 37th Street Priority Area.

TABLE 16
37TH STREET – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Increase storage and/or discharge volume at eastern end	Medium/High	Long	$465,300
Option 2	Hold back water on the western side using stepwise system	Low	Medium	$985,600
Option 3	Establishing a bioswale	Medium	Short	$777,700

Option 1 is to increase the storage capacity or discharge volume on the eastern limits of 37th Avenue. This could be accomplished by expanding the 0.45-acre pond expected to be constructed there, or by expanding the conveyance capacities of either the proposed or existing infrastructure to allow more excess runoff to be discharged east towards IRL. Water could be discharged towards the undeveloped parcels east of 37th Street, or southeast towards the IRC owned parcels. This would help to alleviate flooding by providing additional storage volume to hold excess runoff from 37th Street and could have some water quality benefit by treating a larger volume of runoff. There are limited options for conveying water outside of the Priority Area limits due to its proximity to the City of Vero Beach, so coordination with COVB as well as engagement with the private landowners would be needed to increase discharge outside of 37th Street. A modification of ERP #40739 – 5 would be required to expand the capacity of the 0.45-acre pond or to add an additional outfall structure and approval must be obtained from SJRWMD. This permitting effort could require modeling. **Figure 42** shows the location of the proposed stormwater pond which could be used for storage for Option 1.

Option 2 is to implement a stepwise drainage system to hold back more water on the western side of 37th Street that can be stored before release towards the east during heavy rainfall events. This could be accomplished through a combination of installing various structures and by altering invert elevations of existing structures. This could help to reduce flooding impacts on the eastern downstream end of 37th Avenue by slowing it down and preventing it from staging up there during heavy storm events. There is likely little water quality benefit to be gained by this option. The feasibility of this option depends on the capacity for additional storage on the western side of 37th Avenue. Existing invert elevations are currently unknown, so survey would need to be obtained to determine the configuration of a stepwise system. The ownership of drainage components are currently unknown, although it seems that IRC controls the road since they are facilitating the improvements on 37th Street with Project IRC-1910. To execute this option, coordination with landowners would be required along with easements to be obtained from the authorized entity holding jurisdiction over the swales. Permitting through SJRWMD may be needed, which could also require modeling.

Option 3 is to establish bioswales in the existing ditches along 37th Street. This could help to prevent flash flooding at the downstream (eastern) end of 37th Street by slowing down stormwater and would have some water quality benefits by increasing nutrient uptake. Like Option 2, this option would also require engagement with the respective owners of the roadside swales, which would be the first step. Full topographic survey may not be required for this option, but some assessment would be needed to catalog the existing vegetation in and around the ditches and to develop a planting plan. Out of the proposed options, this one is the least cumbersome but is also likely to have the least impact. **Figure 43** shows approximate placement of Options 2 and 3.

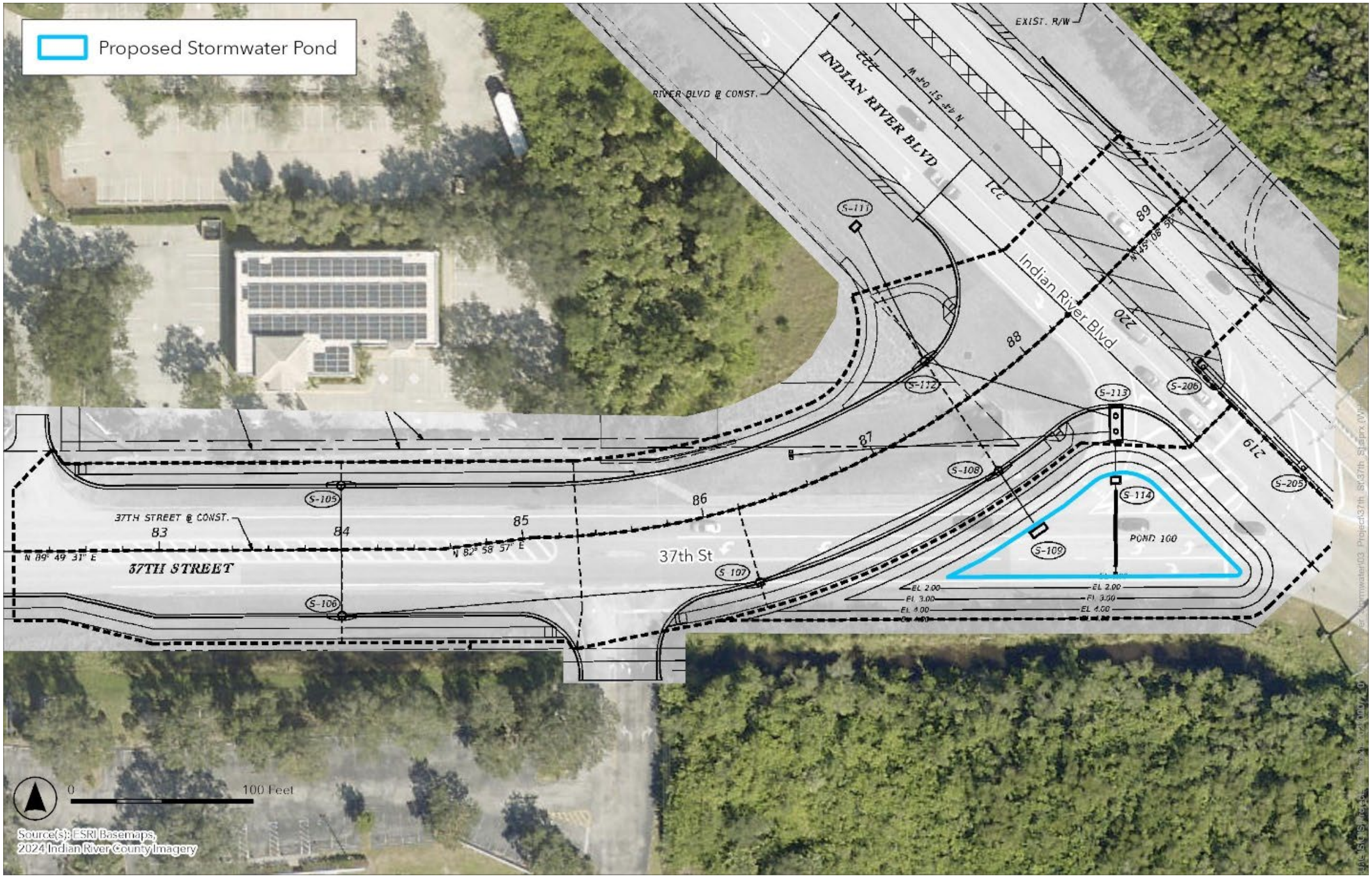

Figure 42
Proposed Conceptual Improvement Option #1 for 37th Street

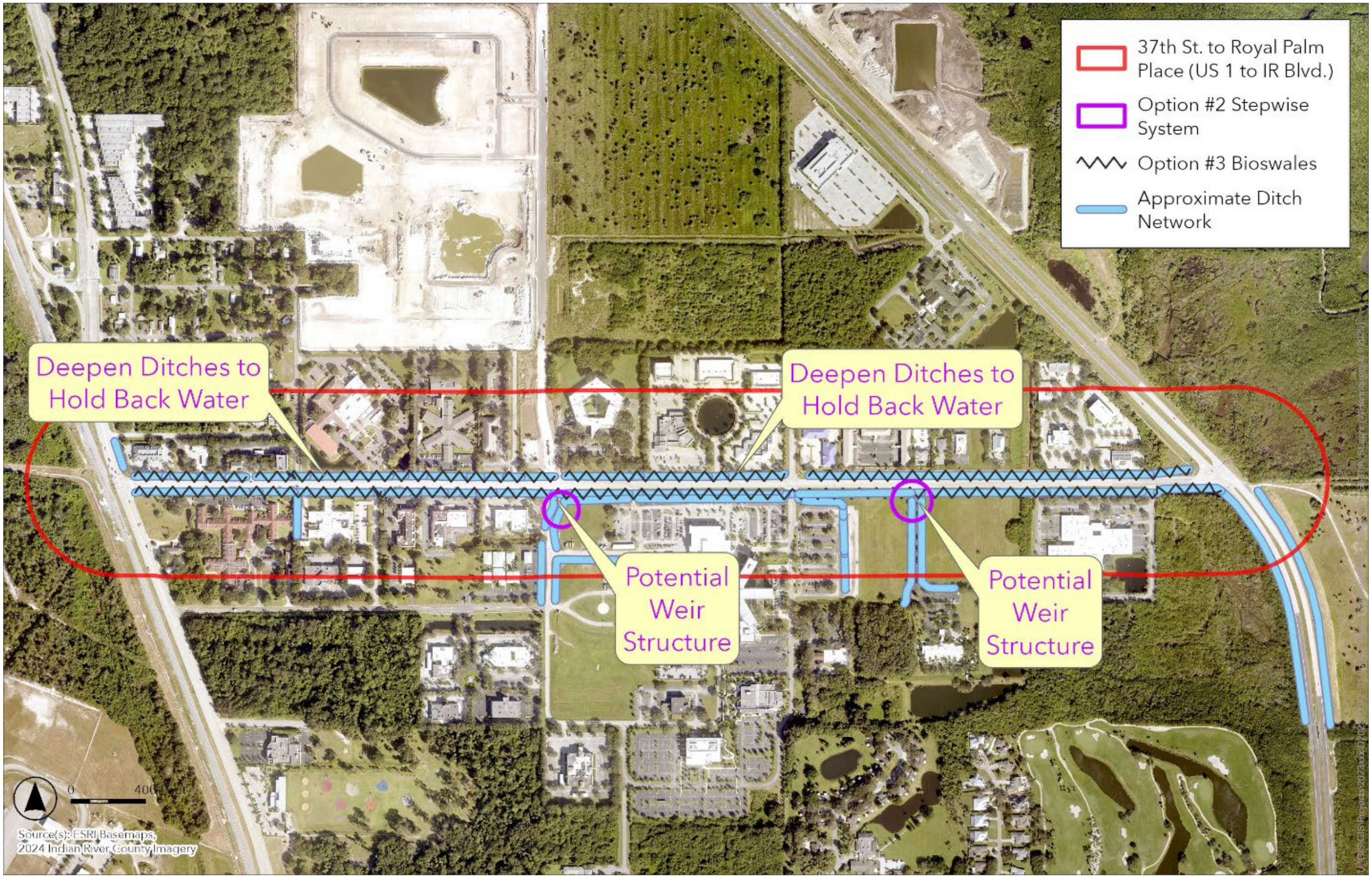

Figure 43

Proposed Conceptual Improvement Option #2 and Option #3 for 37th Street

6.1.5 Priority Area 5 – Fellsmere

6.1.5.1 Background

Fellsmere is a city approximately three (3) miles west of Interstate 95 and directly south of County Road 512, as seen in **Figure 44**. This Priority Area specifically includes the IRC areas immediately south and north of the City of Fellsmere limits. The area is residential, and homes are low-lying. The blocks of residences in the northeastern corner are approximately 300 feet by 500 feet and the remaining Priority Area has blocks that are about 1 mile by 0.25 miles in size. There has historically been flooding in Fellsmere which is why it was included as a Priority Area by IRC, and it is the largest Priority Area out of the nine (9) areas to be evaluated as part of this SMP.

The topography within Fellsmere, like many of the other Priority Areas, is primarily flat. A 1-meter resolution LiDAR dataset is available for some of the Priority Area, but it is missing in the southern portion of the Priority Area. There is a publicly available Digital Elevation Model (DEM) at a resolution of 1/3 arc second for the areas where LiDAR is missing.

The existing drainage infrastructure consists of shallow swales along property lines connected by small culverts and water is conveyed to larger ditches, mostly along the roads dissecting the Priority Area from west to east, such as 91st Street, 89th Street, 87th Street, 85th Street, 83rd Street, 81st Street, and 79th Street. Note that these are dirt roads. There are larger canals along the perimeter of the Priority Area, specifically along 77th Street at the south, running west to east, and another running north to south along 141st Avenue and continuing south past the end of the road. The canal along 141st Avenue is called Park Lateral in online maps from SJRWMD.

There are several ERP permits within the area of interest, consisting mostly of permits for the drainage swales for the roads, owned by IRC. The area east of Fellsmere Priority Area is permitted under ERP #92262 – 1 for a future 3,500-acre development of various land uses; this permit expires 12/13/2030. In addition, there is an ongoing ERP #18578 – 4 for 19,729 acres of an agricultural surface water management system consisting of pumped and gravity drained basins issued to the Fellsmere Water Control District in the areas south and west of this priority area. This permit appears to have additional modifications proposed that are still under review.

A neighborhood just east of Interstate 95 known as Vero Lake Estates has a similar drainage system for which a Master Drainage Plan was developed in the late 1990s. The plan consisted of expanding the existing ditches, re-grading of roadside and backlot ditches, installing control structures at the intersections of swales, and constructing four (4) new wet detention ponds. The project was eventually implemented as Vero Lake Estates Stormwater Improvements, consisting of a series of swales and canals leading to large stormwater detention ponds. As reported in IRC's Lagoon Management Plan, this project had an estimated capital cost of $1,572,829 while offering estimated load reductions of 7,655 pounds per year of TN and 1,993 pounds per year of TP. These improvements offered some of the highest reductions in Total Nitrogen out of all operational projects, second only to IRC's fertilizer and landscape management ordinance.

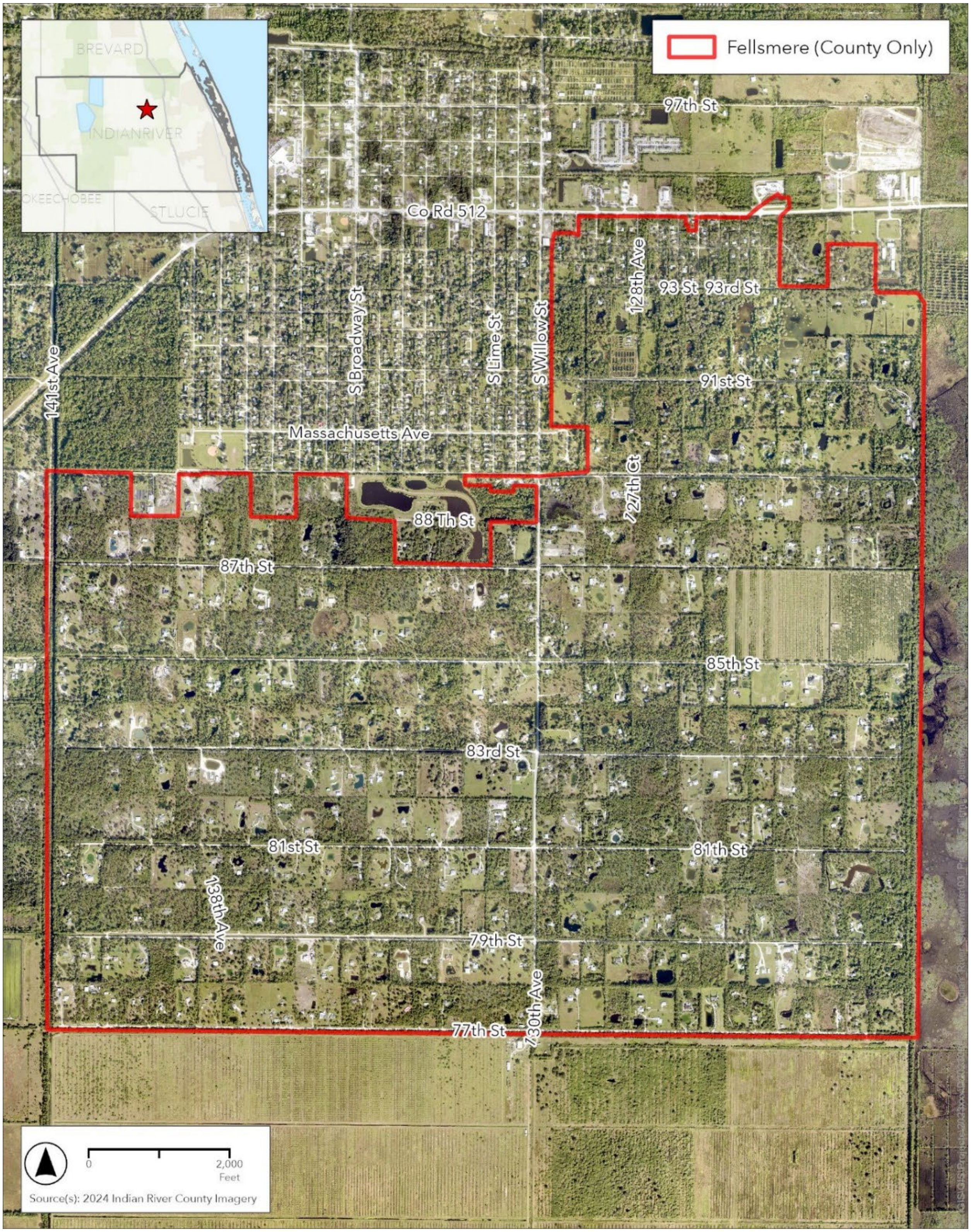

Figure 44
Fellsmere Priority Area

The City of Fellsmere constructed a 35.15-acre stormwater treatment and storage park just north of the Fellsmere Priority Area limits, permitted as ERP #155439 – 1 through SJRWMD. The site was historically a borrow pond that had become a public park. Based on a review of aerial imagery, the park's construction was completed in 2023. Consultation with the City of Fellsmere to determine the park's impact on flooding events post-construction would be informative for IRC to evaluate a similar option for flooding control in the Fellsmere Priority Area.

6.1.5.2 Site Visits

Two site visits were conducted in the Fellsmere area, but due to the size of this Priority Area the visit was mainly conducted by driving multiple streets throughout the area and observing the existing infrastructure. The ditches along the roads running west to east were all observed with standing water to some extent, although the ditches appeared to become deeper the further south they are within the area. Many of them are heavily vegetated. The City of Fellsmere Stormwater Park was examined during the site visit as well. A survey control point was located at the southern end of the Priority Area. **Figure 45** shows the major stormwater features in the Fellsmere Priority Area.

6.1.5.3 Proposed Conceptual Improvements

Fellsmere is the largest Priority Area of them all, and requires a significant, regional approach to managing excess runoff from stormwater. There are a couple of options to improve flooding outcomes and water quality in the Fellsmere Priority Area. The options are summarized in **Table 17**.

TABLE 17
FELLSMERE – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Establish stormwater treatment and storage area(s)	High	Long term	$10,655,300
Option 2	Deepen existing ditches maintained by IRC / connect to surrounding canals	Low/medium	Medium/long term	$4,705,900

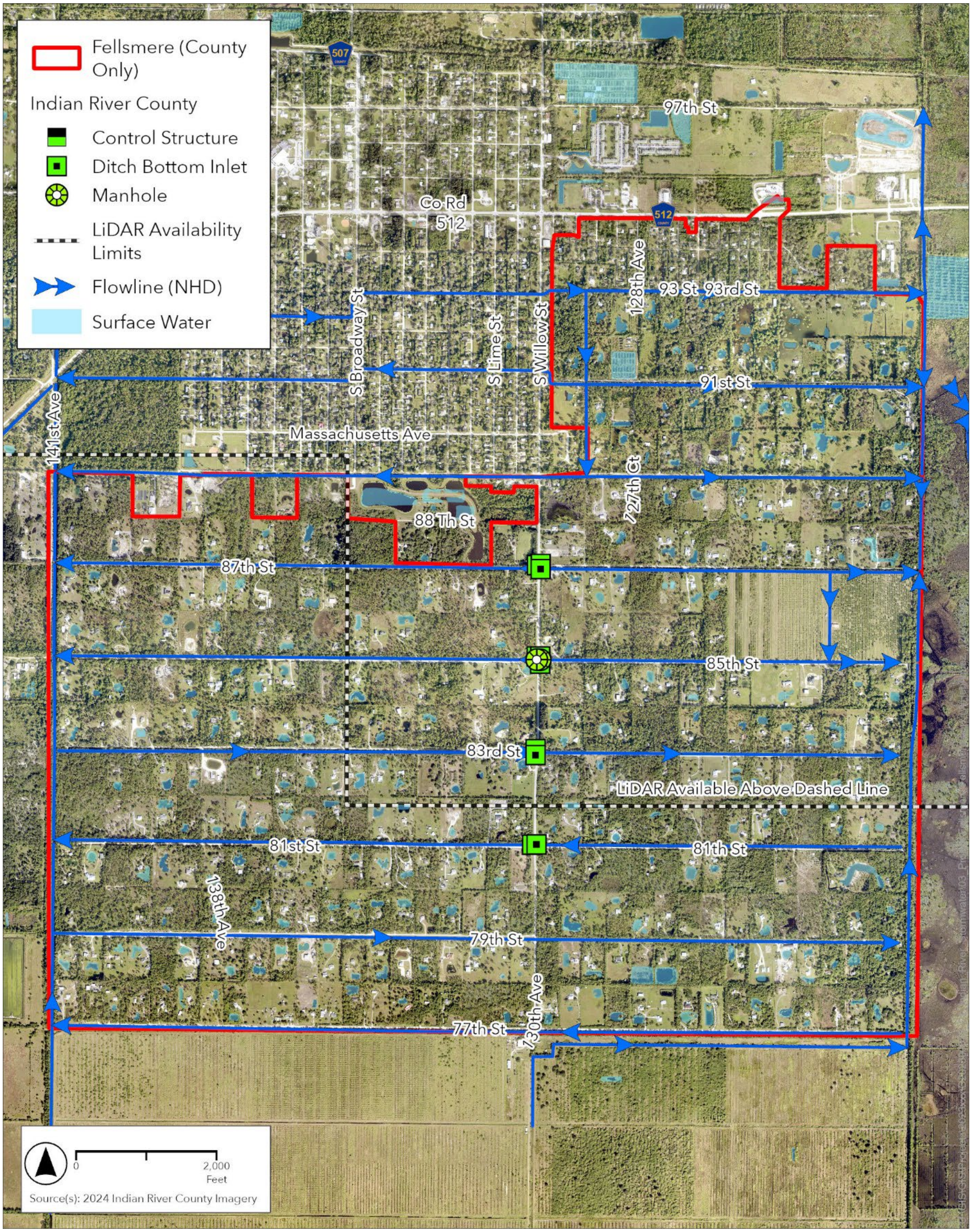

Figure 45

Stormwater Features within Fellsmere Priority Area

Option 1 is to establish a stormwater treatment and storage area (STA) within the Fellsmere Priority Area. A dedicated STA would reduce flooding by allowing excess stormwater runoff to accumulate there and would also provide a water quality benefit by offering residence time for nutrient uptake. There are multiple potential locations for the STA. These include multiple undeveloped parcels along the western side of the Priority Area limits and a few undeveloped parcels in the northeastern limits of the area. This option is costly and would constitute a significant investment by IRC, but it is seen an inevitable measure that will be necessary as the area develops and as flood zones continue to expand. Consequently, the first step to implement this option is for IRC to obtain funding. Modeling and design would be required to evaluate the hydraulics and hydrology of the area in detail and to determine an optimal location and configuration for the STA; once a location is selected, IRC would have to acquire land and obtain survey before any construction documents could be prepared. Coordination with the City of Fellsmere may be needed depending on the location, to determine if expansion of their existing stormwater park is an Option or if other portions of the City would benefit from the location being elsewhere in the Priority Area. This option would warrant engagement with the public and would entail permitting through SJRWMD and other entities.

Option 2 is to evaluate widening and/or deepening the existing ditches maintained by IRC within the County ROW, and connecting the ditches to surrounding canals to create a cohesive, well-connected drainage network in the Fellsmere area. These corrective actions would increase the storage capacity of the ditches, allowing them to hold more stormwater during heavy rainfall events. In addition, creating connections to other features would improve the overall conveyance throughout the drainage system, helping to reduce localized flooding. There would likely be little improvement to water quality since the ditches already exist and would simply be modified, although improved conveyance could offer some small benefit by reducing stagnant water. Survey would be required to evaluate the full extents and existing depths of the ditches and to determine how many and which ditches to modify, as well as the extent by which to deepen them. Additionally, the survey would be useful to determine where the ditches discharge to and identify potential connection points. This option would be less expensive than Option 1 but is expected to have a smaller impact on both flooding outcomes and water quality. Depending on the extent by which to modify the existing ditches, permitting may be required.

6.1.6 Priority Area 6 – Riviera Lakes (4th St. & 27th Ave.)

6.1.6.1 Background

This Priority Area is a residential area bound by 27th Avenue to the west, 24th Avenue to the east, 1st Street SW to the south, and 4th Street to the north (**Figure 46**). Within this Priority Area is a partially completed development of approximately 18 acres called Riviera Lakes. According to IRC staff, resident complaints have suggested that the early phases of construction for this development exacerbated flooding issues within these blocks of residences.

The existing infrastructure within 4th Street and 27th Avenue is limited. The drainage system currently consists of shallow ditches along the edges of properties within the area. Note that 24th Avenue is a dirt road. Sub-Lateral B-5 E canal, owned by IRFWCD, runs along 1st St SW at the southern boundary of this Priority Area.

The partially completed Riviera Lakes development had an ERP #148231 – 1 issued from SJRWMD in 2023. Documents from the ERP indicate that the development consists of 40 single-family lots and a clubhouse along with a stormwater management system comprised of three (3) dry retention ponds and one downstream wet detention pond. There was a berm constructed along the eastern edge of the development that has apparently contributed to the increase in flooding experienced by some residents within the Priority Area.

6.1.6.2 Site Visits

ESA visited 23rd Avenue and drove around to see the partially completed development at Riviera Lakes. See **Figure 47**. At the time of the site visit, the Riviera Lakes development no longer appeared to be in active construction but remains unfinished. ESA staff examined the berm that was constructed as part of the Riviera Lakes development. Standing water was observed in the dirt road on 24th Avenue.

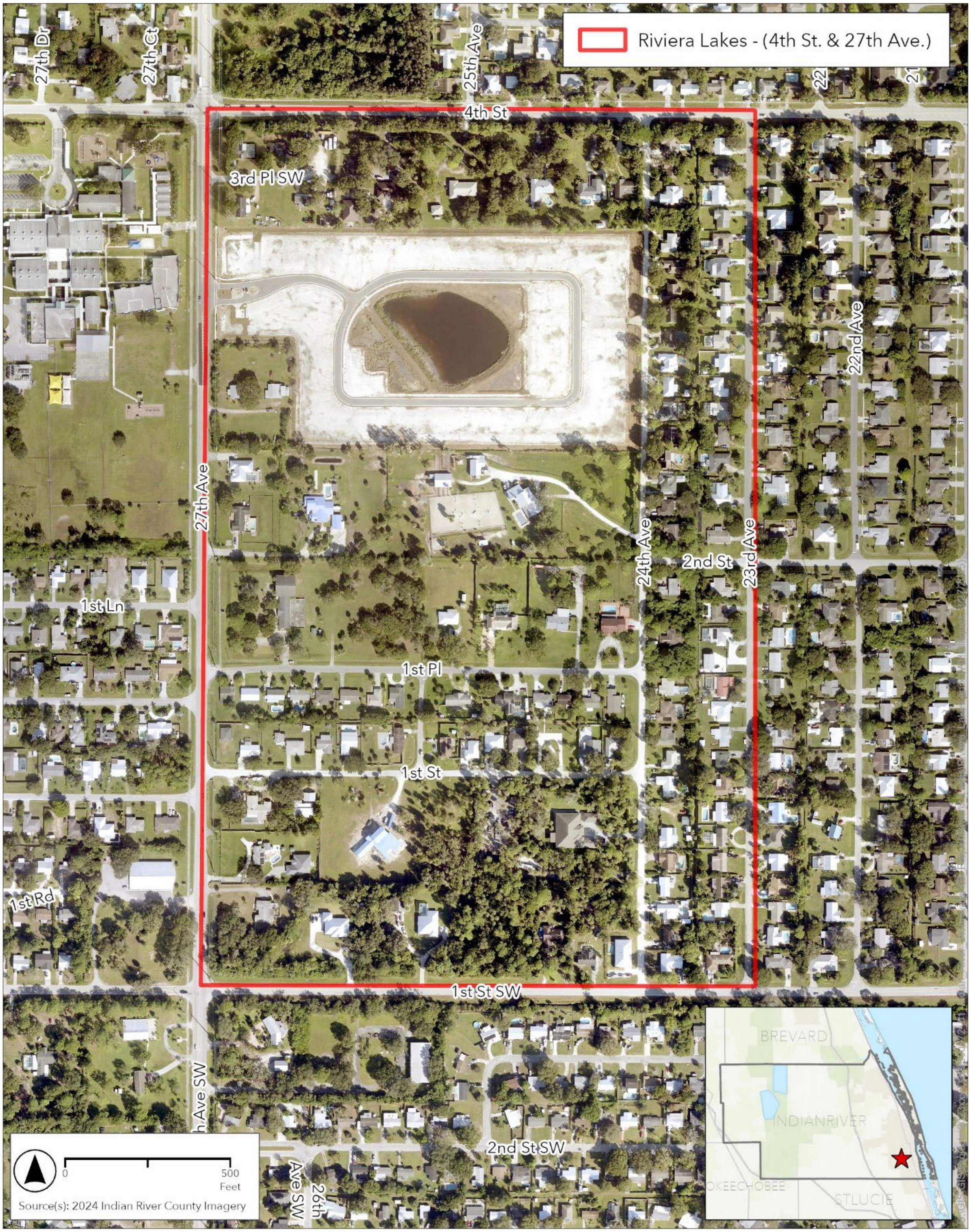

Figure 46
Riviera Lakes Priority Area

Figure 47
Riviera Lakes Site Visit Focus Area

6.1.6.3 Proposed Conceptual Improvements

There are a couple of options for Riviera Lakes that have potential to alleviate flooding experienced by residents, presented in **Table 18**.

TABLE 18
RIVIERA LAKES – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Re-construct east-west swales intended for Riviera Lakes development	Low	Medium	$741,500
Option 2	Pitch the roadway grading towards the newly obtained ROW at Riviera Lakes	Low	Medium	$596,300

Option 1 is to re-construct the east-west swales for the Riviera Lakes development to function as the stormwater system as originally intended. Creating the swales would provide some storage and would encourage excess water to be conveyed away from residences. Additionally, berm removal would help to allow stormwater from the surrounding residences to enter the new pond. This option could be accomplished upon consulting with the County Attorney to obtain the surety bonds. An ERP modification may be required for this option.

Option 2 is to re-grade the roadway swales towards the newly obtained ROW at Riviera Lakes and ensure those swales reach a point of legal positive outfall. See **Figure 48** for an approximate schematic of these options.

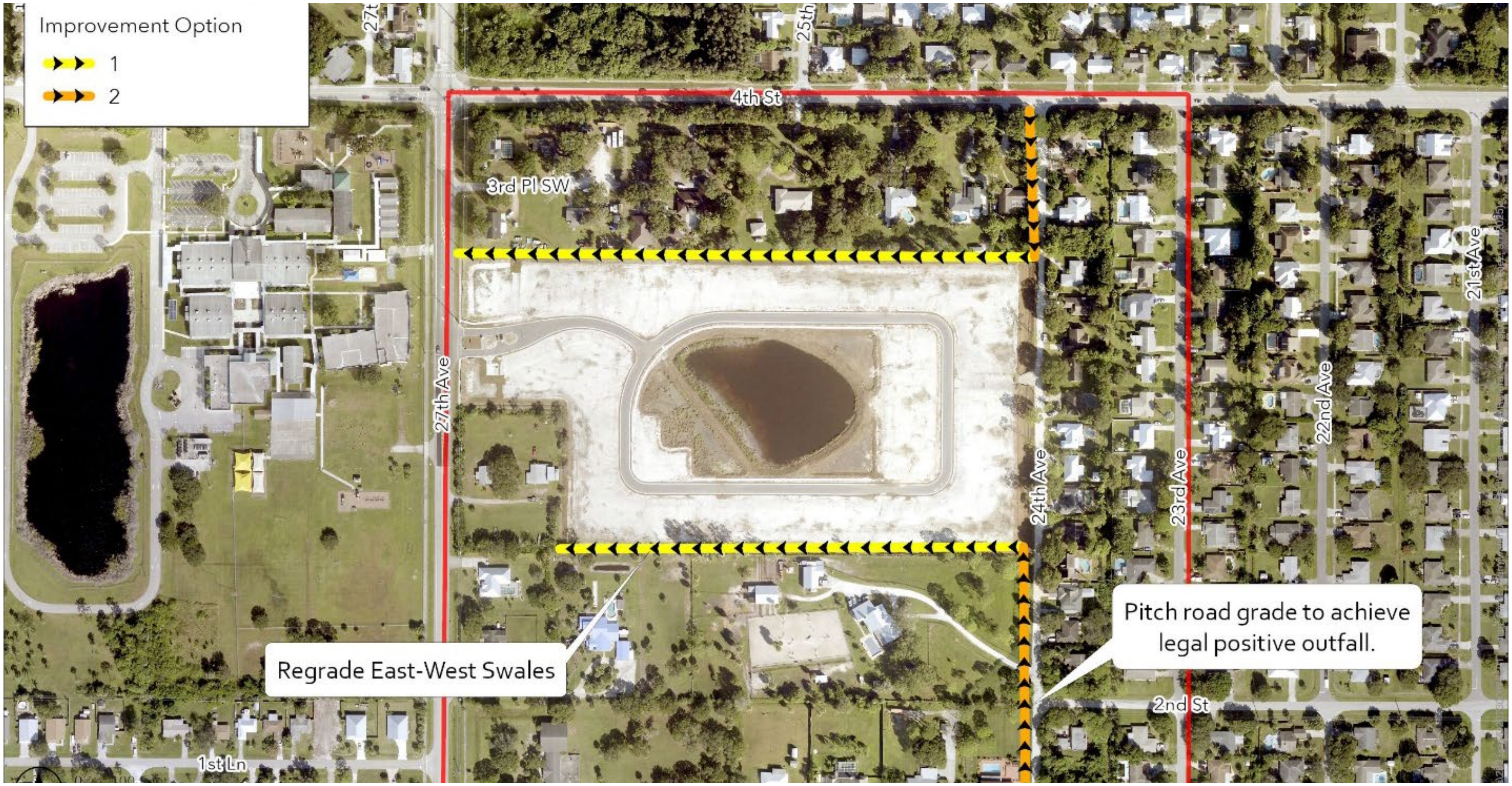

Figure 48

Riviera Lakes Proposed Conceptual Improvement Option

6.1.7 Priority Area 7 – 4th St. & 8th St. (58th to 66th Ave.)

6.1.7.1 Background

4th and 8th Street Priority Area, also known as Pinetree Park, is a residential area bound by 66th Avenue to the west, 58th Avenue to the east, 4th Street to the south and 8th Street to the north, as seen in **Figure 49.** The drainage is similar to Fellsmere and consists of shallow swales and ditches. There are multiple canals owned by IRFWCD around the perimeter of 4th Street and 8th Street Priority Area.

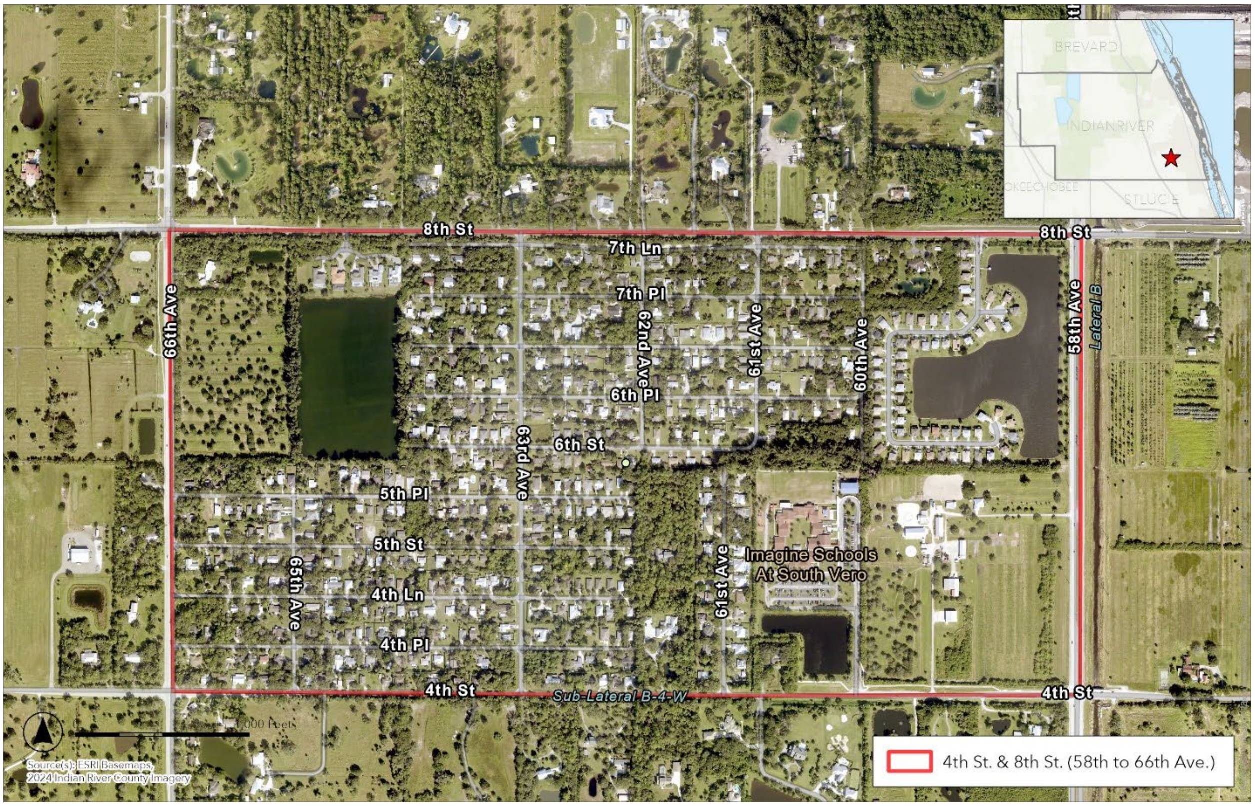

Figure 49
4th Street and 8th Street Priority Area

The existing drainage in this area consists of shallow roadside swales connected by shallow culverts, with some deeper ditches across the neighborhood. Based on available LiDAR, the deepest of these ditches is along 63rd Avenue, which runs north to south approximately in the middle of the Priority Area limits. It seems that stormwater is conveyed from the swales to the 63rd Avenue ditch and from there, stormwater flows north into the Sub-Lateral B-3 W canal along 8th Street and south into Sub-Lateral B-4 W, both owned by IRFWCD. Both of these canals lead east to a larger canal along 58th Avenue and ultimately discharge to the South Relief Canal, which outfalls to the IRL.

There are three (3) surface water management ponds within this area of interest. The stormwater pond at the northeastern corner is permitted under ERP #71222 – 1 for the Carriage Lake subdivision. The Technical Staff Report (TSR) from SJRWMD indicates that the surface water management system consists of a 13.9-acre wet detention pond with associated inlets and pipes. On the western side of the area enclosed by 4th and

8th Street is Laurel Springs Subdivision (ERP #26227 – 2). This permit indicates that there is an additional dry retention area west of the project area; however, that parcel is currently under construction. Currently there is a proposed development there called Raven's Landing, ERP #188049 – 1**.** This permit expires on April 3, 2028. According to the TSR, the proposed drainage system for Raven's Landing consists of two (2) interconnected wet detention ponds with associated inlets and pipes. The overflow will discharge north to the 8th Street drainage system, which outfalls to the South Relief Canal.

6.1.7.2 Site Visits

During the site visit, standing water was observed in the drainage ditches, and at some properties, the water was as high as the finished floor elevation of the homes. ESA staff observed residents at one (1) property placing sediment over one of the drainage swales, most likely intended as a driveway. Like other priority areas, the maintenance of the drainage structures within 4th and 8th Street appears to have been neglected based on visual observations made during the initial site visit including overgrown vegetation.

The preliminary phases of construction at Raven's Landing were spotted during the site visits. The pond at Laurel Springs was not seen due to its location in a gated community. The pond at the Carriage Lake subdivision was observed with high water levels and there appeared to be multiple pipes connecting the pond to Sub-Lateral B-3 W canal along 8th Street.

Figure 50 shows the stormwater features at 4th and 8th Street.

6.1.7.3 Proposed Conceptual Improvements

Overall, for the 4th Street and 8th Street Priority Area, it is recommended to perform maintenance on existing structures and increase connectivity between swales. Besides this, the options discussed below focus on adding additional storage or considering if additional discharge can be introduced to existing ponds bound by the Priority Area. The options are summarized in **Table 19**.

TABLE 19
4TH ST & 8TH ST – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Establish stormwater treatment area	High	Long term	$8,625,300
Option 2	Discharge into existing pond(s) at laurel springs OR new development	Low	Medium/long term	$706,100
Option 3	Convey water southeast to agricultural parcel or Indian River Farms Canals	Low	Medium/long term	$574,300

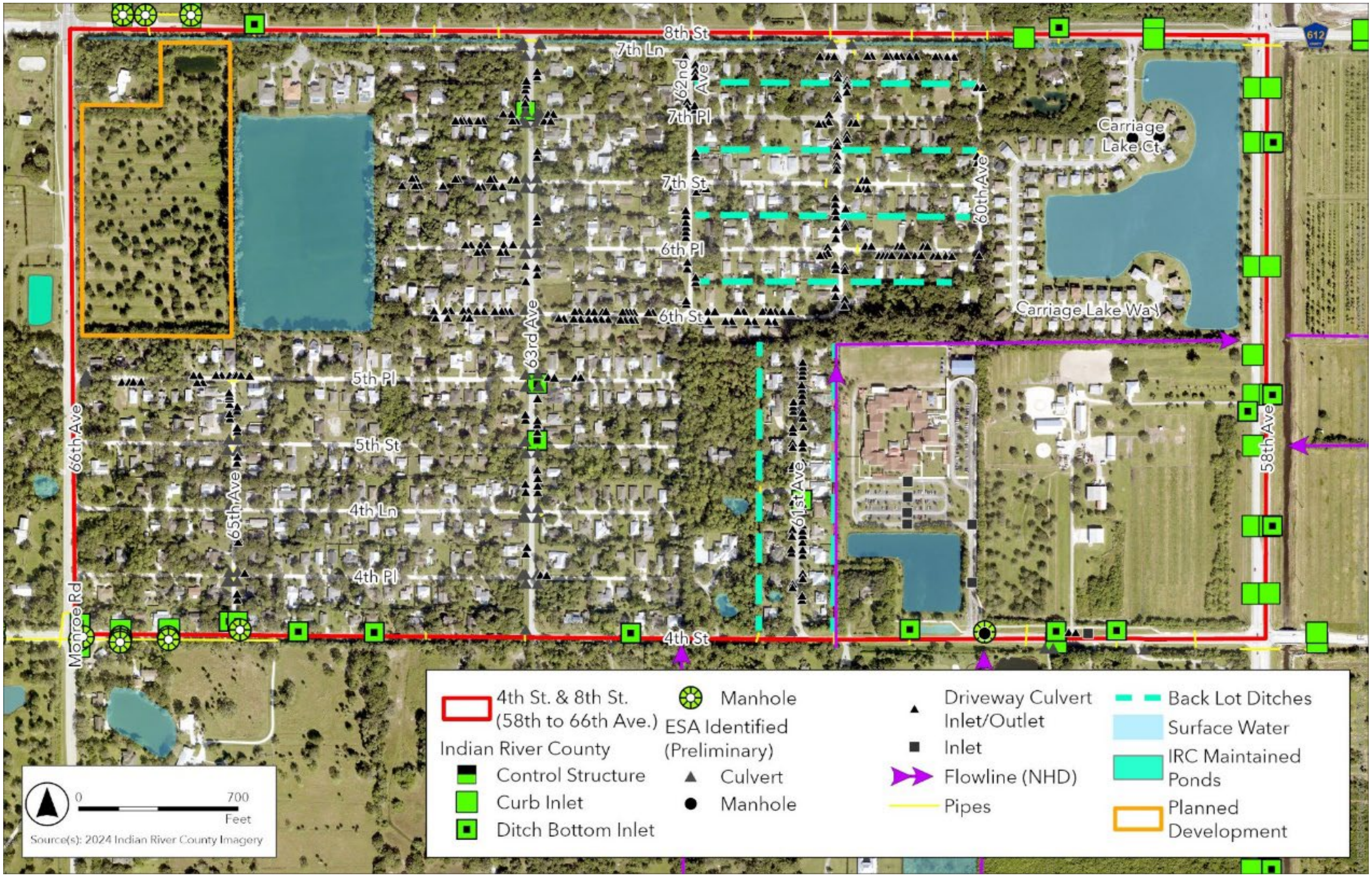

Figure 50

Stormwater Features within 4th and 8th Priority Area

Option 1 is to establish a stormwater treatment and storage area somewhere in the vicinity of the 4th Street and 8th Street Priority Area. This would entail the design, permitting, survey, and land acquisition discussed previously for other Priority Areas.

Option 2 is to create a new discharge location at an existing pond within the Priority Area and route stormwater there. This could be accomplished by discharging into the existing Laurel Springs pond, or into the new stormwater pond slated for construction at the Raven's Landing development. Note that the pond at Carriage Lake is not being considered as a discharge location due to its high water levels seen during the site visit. Agreement from the landowners would be required to proceed with this option. In addition to determining the pond's available capacity for additional discharge, topographic survey and inventory of existing structures would be required to determine the conveyance route for this option. An ERP would be required to establish the new outfall location.

Option 3 is similar to Option 2 in that it entails creating a new discharge location to convey stormwater towards; in this case, towards the southeast agricultural parcel and out into the IRFWCD canals. This would require an easement to be obtained from the landowner(s) to establish a conveyance network and outfall location southeast of the 4th Street and 8th Street Priority Area. The capacities of the canals would need to be determined which would entail coordination with IRFWCD. Like the others, survey may need to be obtained to accomplish this option. **Figure 51** approximately shows these options.

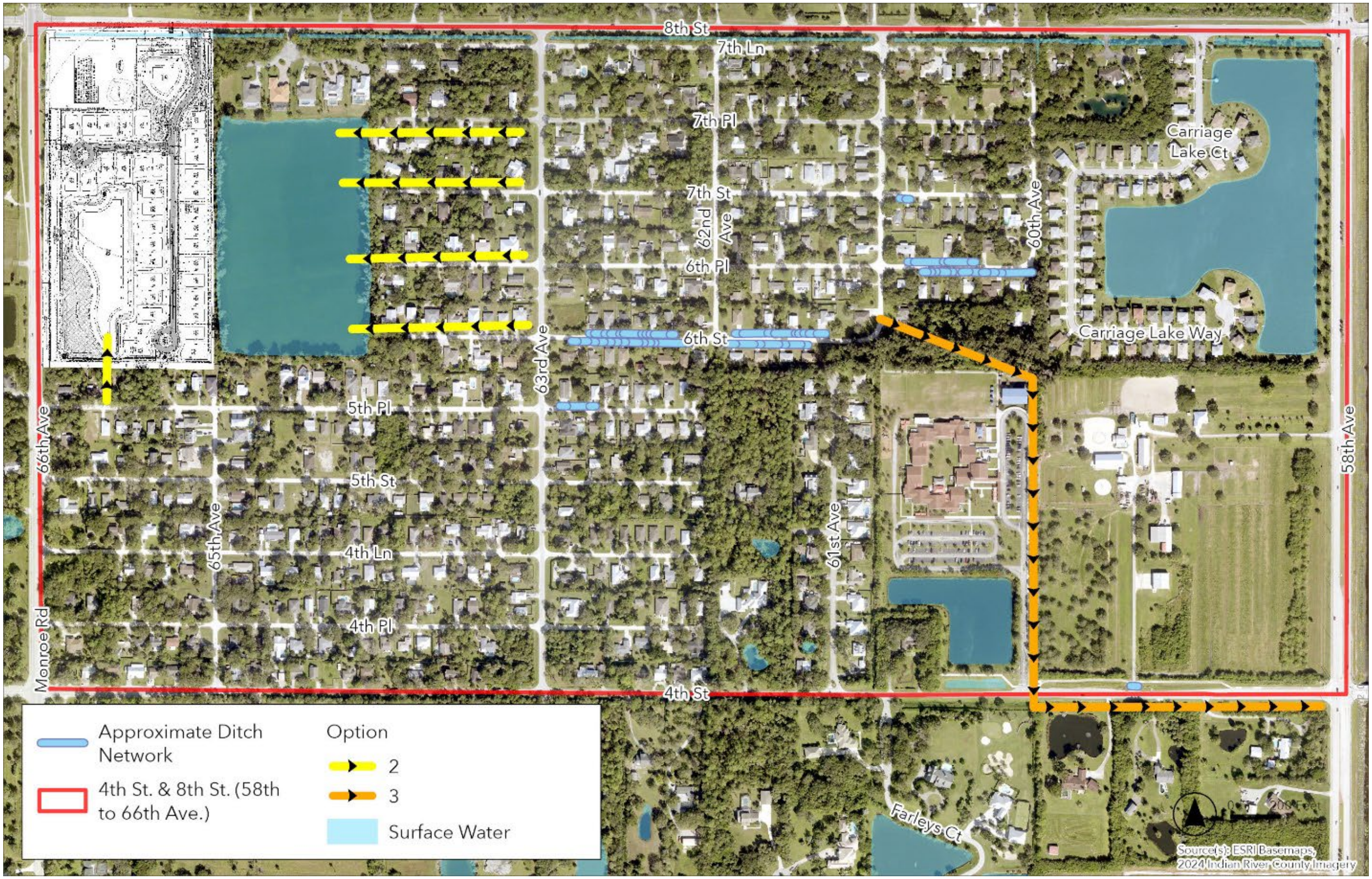

Figure 51

Proposed Conceptual Improvement Options for 4th and 8th Priority Area

6.1.8 Priority Area 8 – Indian River Drive — County Maintained ROWs

6.1.8.1 Background

Indian River Drive Priority Area lies just east of US Highway 1 in the northern extent of IRC, along the shores of IRL (**Figure 52**). Indian River Drive is bisected by the City of Sebastian, so the Priority Area is limited to County-maintained right-of-ways. The City of Vero Beach borders the southern extent of this Priority Area. Gifford and Wabasso are unincorporated communities included in this Priority Area, nestled between the city limits, and the unincorporated community of Roseland lies at the northern end of the Priority Area. Along Indian River Drive is a mix of residences and businesses, with a handful of undeveloped parcels scattered throughout. It was conveyed to ESA by IRC staff that these coastal areas experience poor drainage and some properties experience flooding.

The existing infrastructure consists of shallow swales, some deeper ditches and canals, culverts, inlets, and outfalls to the IRL. The full extent of the existence, ownership, and inner connectivity of the drainage easements is unknown. There are numerous ERPs along and in proximity to Indian River Drive. Around 2004, a project known as East Roseland Stormwater Improvements was designed and at least partially permitted in the area of Roseland, which is in the northwestern limits of this Priority Area. The project entailed stormwater collection, conveyance and detention systems in the form of two (2) wet ponds in the East Roseland area. While the project was only partially realized, the single stormwater detention pond constructed as part of East Roseland Stormwater Improvements is estimated to offer 216 pounds per year of Total Nitrogen reduction and 58 pounds per year of Total Phosphorous reduction and had an estimated capital cost of $433,134 at the time of construction, according to IRC's Lagoon Management Plan.

6.1.8.2 Site Visits

Residential areas along Indian River Drive along with an area west of Indian River Drive across US Highway 1 were examined during the site visit. ESA staff identified several drainage structures, some of which were blocked with sedimentation. In the northwestern extent of the Priority Area, a cracked outfall structure and riprap was observed on 143rd Street. A canal was examined at the southern end of Indian River Boulevard, at approximately 404 S. Indian River Drive that ultimately discharges to IRL. **Figure 53, Figure 54,** and **Figure 55** show the areas examined during the site visits.

Figure 52
Indian River Drive Priority Area

Figure 53

Areas Examined near Indian River Drive, Northern Extent

Figure 54

Areas Examined near Indian River Drive, Middle

Figure 55

Areas Examined near Indian River Drive, Southern Extent

6.1.8.3 Proposed Conceptual Improvements

Multiple options exist to improve the drainage and water quality along Indian River Drive. Note that for all options, effort should be made to focus on areas most susceptible to inundation from sea level rise and storm surge within this Priority Area. Vulnerability Assessments completed by the Florida Department of Environmental Protection, by the City of Sebastian, by the City of Vero Beach, and by IRC shall be referenced to identify these areas. Proposed conceptual improvement options are summarized in **Table 20**.

TABLE 20
INDIAN RIVER DRIVE – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Establish stormwater treatment and storage area	High	Long term	$9,436,800
Option 2	Establish rain gardens or vegetated swales	Low/Medium	Medium	$1,660,200
Option 3	Acquire easements to connect and improve conveyance throughout system + maintenance	Low	Medium	$632,000

Option 1 is to establish a stormwater treatment and storage area somewhere along Indian River Boulevard. This would be accomplished by acquiring a sizable land area to convey water to and store for treatment and flood prevention. This option would require extensive survey, modeling, design, coordination with landowners and with the public, and permitting. However, as discussed for other Priority Areas, the construction of a STA is likely to be inevitable as sea levels rise, development continues, and weather events become more severe. This option is the most impactful on flooding outcomes and water quality. Specific areas where sea level rise is expected to have the greatest impact along Indian River Drive should be prioritized for the location of the STA. Additionally, discussions with the City of Sebastian and the City of Vero Beach should be held to assess their interest in collaborating on a regional-scale STA somewhere along Indian River Drive.

Option 2 is to install rain gardens or vegetated swales throughout Indian River Drive. This option is less impactful than Option 1 on both inundation outcomes and water quality, but it is easier to implement at a smaller scale and is less costly. Note that this option would still require additional annual budgeting for operation and maintenance. As discussed for other Priority Areas, rain gardens can help to slow down water and increase nutrient uptake, which both improves flooding outcomes to some extent and has a positive impact on water quality.

Option 3 is to connect existing infrastructure and improve conveyance throughout the entire drainage system within the Indian River Drive corridor. This option would not likely have any water quality benefit; however, it would most likely result in some improvement in flooding outcomes. Connecting the drainage system would increase the surface area to disperse excess runoff to and therefore greater storage volume would be available for water to accumulate in during heavy rainfall events.

6.1.9 Priority Area 9 – Indian River Lagoon Outfall Replacement/Upgrades

6.1.9.1 Background

Numerous outfall locations exist along IRL. This Priority Area focuses on exploring potential water quality improvement measures and retrofits or replacements of existing outfalls. ESA reviewed IRC Property Appraiser data and available ERPs within IRC limits to compile an inventory of structures that discharge into IRL. **Figure 56** displays outfalls recorded as National Pollutant Discharge Elimination System (NPDES) discharge locations as well as structures from FDOT's Stormwater Asset Management System (SAMS) public viewer.

South of the City of Vero Beach, there are outfalls at Oslo Boat Ramp, the Lagoon Greenway, and the South Relief Canal owned by IRFWCD. The land to the south of Oslo Road is largely owned by IRC for mosquito impoundments. Most of the land north of Oslo Road is owned by SJRWMD, with a couple of parcels interspersed owned by the University of Florida. There are ERPs in this area related to road improvements and mosquito control. Most of the land surrounding the Lagoon Greenway is owned by the Florida Inland Navigation District (FIND), and there are two (2) parcels jointly owned by IRC (50%), SJRWMD (25%) and FIND (25%). There is an ERP (#125194 – 2) adjacent to the Lagoon Greenway to construct a boardwalk and viewing platforms. No stormwater management was proposed. South of that is an ERP (#26182 – 2) for a multifamily subdivision that ultimately discharges to IRL.

The South Relief Canal is just south of McKee Botanical Garden. Nearby ERPs include #51779 – 1, which consists of two (2) dry retention ponds for the widening of 4th St, owned by IRC, and ERP #103252 – 1 which was issued to IRC Public Works in 2006, entailing the installation of a "pollution control system at the three outfall locations of the Indian River Farms Water Control District". Also, within the City of Vero Beach is the Main Relief Canal also owned by IRFWCD which outfalls directly to IRL. Between the South and Main Relief Canals is the Rockridge Priority Area discussed in Section 6.1.2.

North of the City of Vero Beach and Priority Area 4, 37th Street, there are natural areas with some outfalls to the lagoon. A channel around 404 S. Indian River Drive appears to discharge directly to IRL. In addition, south of 11398 S. Indian River Drive there is another large ditch. Similarly, at approximately 11180 US Hwy 1 there is a channel connecting to IRL. In the northern extents of Indian River Drive there are several outfall locations in the residential areas between properties adjacent to the lagoon. Just north of 13610 N. Indian River Drive, there appears to be a culvert going out into IRL. At 13275 N. Indian River Drive is a swale that was observed with standing water, most likely a result of tidal influence indicating an outfall across the road in the lagoon.

6.1.9.2 Site Visits

Outfalls along Indian River Drive were observed briefly during the site visit for Priority Area 8. Due to the number and wide span of outfall locations across the County, the outfalls were not inspected in detail. It is recommended that structures and canals should be examined and documented during low tides to assess their condition and performance.

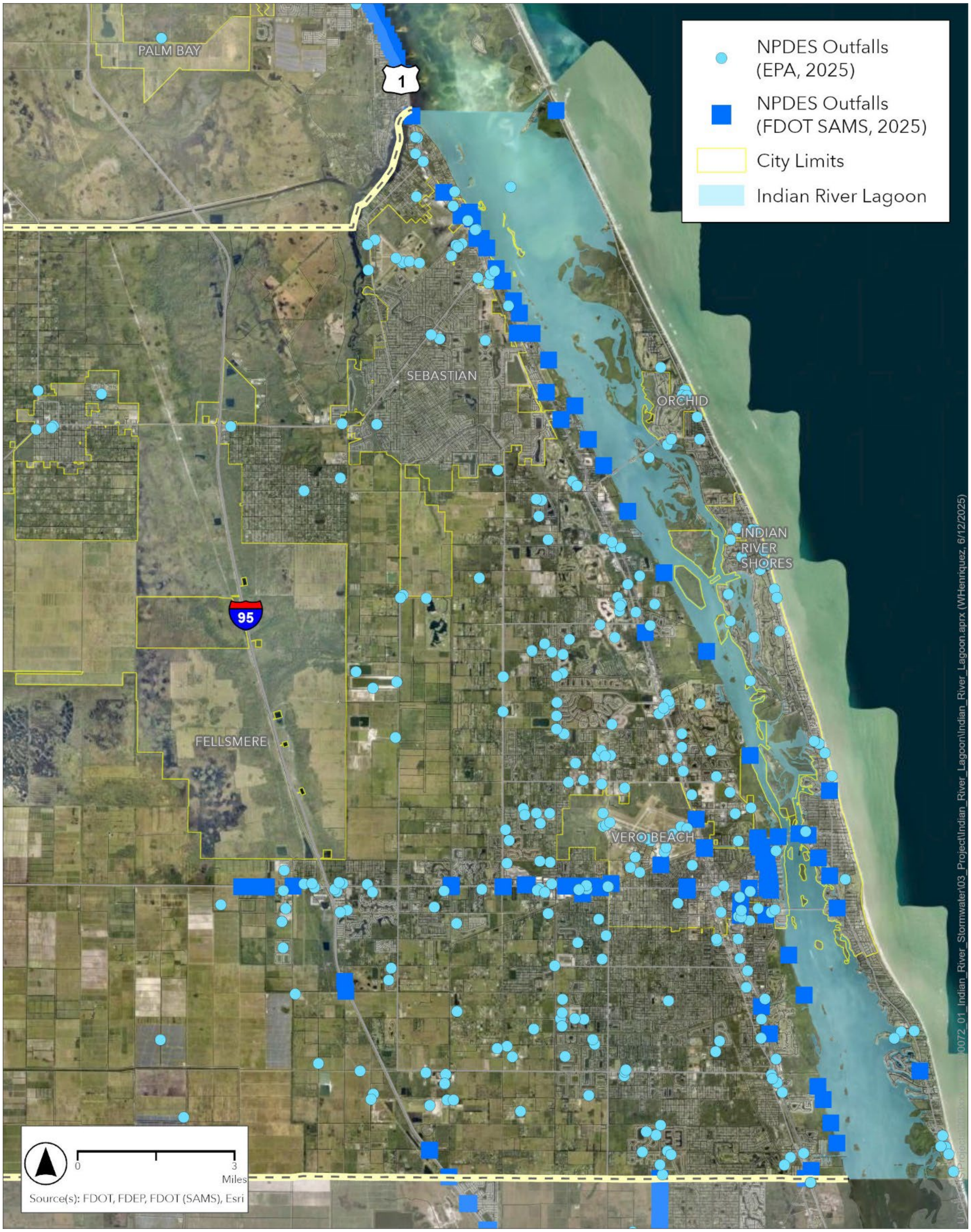

Figure 56
Indian River Lagoon and NPDES Outfall Locations

6.1.9.3 Proposed Conceptual Improvements

Proposed improvements for the outfalls along IRL focus on providing some level of water quality treatment and backflow prevention to mitigate tidal flooding. The options proposed for IRL outfalls entail applying end treatments to structures to provide some nutrient removal from the lagoon and replacing culverts when necessary. Initiatives like these are discussed in **Section 5.1.1**.

Alternatively, a more impactful solution requiring significant investment from the County would be to acquire land along IRL to provide additional treatment and buffer to treat runoff from urban and developed areas before excess stormwater enters the lagoon. This could be implemented in developed areas adjacent to existing natural and undeveloped parcels, some of which are owned by the County. A summary of the proposed conceptual improvement options is presented in **Table 21**.

TABLE 21
INDIAN RIVER LAGOON OUTFALL – CONCEPTUAL IMPROVEMENT OPTIONS

Option	Description	Water Quality	Timeline	Feasibility Difficulty / Costs
Option 1	Install vortex or screening structures	Low	Medium	$778,100
Option 2	Replacing culverts	Low	Medium	$892,100
Option 3	Acquire land for buffer zones	Medium	Long	$12,523,800

SECTION 7

Ranking of Conceptual Improvements

7.1 Ranking Purpose

Through the course of this work, conceptual capital improvement projects have been identified and proposed both within the nine priority areas as well as for consideration county-wide. To guide the County in its allocation of resources, ESA has developed the ranking methodology presented in this section. The aim of the ranking methodology was to optimize flood protection and water quality improvements, while balancing the challenges each conceptual improvement may encounter.

These projects are prioritized using a tailored matrix based upon the project's anticipated level of magnitude to provide flood reduction, estimated implementation cost, and likelihood to improve water quality. These projects must be further developed in design, in order to determine an estimated number of Basin Management Action Plan (BMAP) credits.

7.2 Ranking Criteria

The ranking criteria and scoring methodology are based on the benefits to the County for WQ improvement, CRS points, flood abatement, resiliency, time to complete and overall cost.

- Timeline for Implementation – 5 for the shortest timelines, 1 for longest, important for grant funding
- Alleviate stormwater flooding – 5 for alleviating nuisance flooding, 0 for no flood impact
- Provide resiliency - 5 for increased long-term resiliency of the project and its impact, 0 for no increase in resiliency
- Provide water quality improvement – 20 for best water quality improvement, 0 for no water quality improvement
- Project Zone Rank – total pounds of proposed removal of Nitrogen and Phosphorus, 20 for best nutrient removal potential, 0 for no nutrient removal potential
- WBID TMDL/Impairment List – 10 points if adjacent to Impaired Waters, 1 for increased distance from impaired waters. Not zero since all waters lead to the IRL.
- Activity 420 (Natural shoreline protection) criteria for the CRS – projects that increase the length of shoreline that can be counted as natural shore protection within IRC have the potential to earn points under activity 420 of the CRS program. Shoreline protection practices including regulations or ordinances that govern public and private development and construction to protect channels and shorelines in their natural state, also have the potential for additional CRS points.

- Activity 450 (Stormwater management) criteria for the CRS - projects that improve the stormwater management of new development within the watershed have potential to earn points under Activity 450 of the CRS program. The four approaches to improve management under this category include:
  - Stormwater Management Regulations
  - Watershed Master Planning
  - Erosion and Sediment Control
  - Water Quality
- Real estate acquisition – 10 if already County owned, 1 if significant cost is required to purchase lands
- Easement coordination - 10 if existing easements exist or no easement required, 1 if multiple easements are required.
- Magnitude of Cost – Base 20

Points	**Estimated Project Cost**	
	Low End	High End
20	Under $500,000	
19	$ 500,000.00	$ 600,000.00
18	$ 600,000.00	$ 700,000.00
17	$ 700,000.00	$ 800,000.00
16	$ 800,000.00	$ 900,000.00
15	$ 900,000.00	$ 1,000,000.00
14	$ 1,000,000.00	$ 1,100,000.00
13	$ 1,100,000.00	$ 1,200,000.00
12	$ 1,200,000.00	$ 1,300,000.00
11	$ 1,300,000.00	$ 1,400,000.00
10	$ 1,400,000.00	$ 1,650,000.00
9	$ 1,650,000.00	$ 1,900,000.00
8	$ 1,900,000.00	$ 2,150,000.00
7	$ 2,150,000.00	$ 3,000,000.00
6	$ 3,000,000.00	$ 4,000,000.00
5	$ 4,000,000.00	$ 6,000,000.00
4	$ 6,000,000.00	$ 8,000,000.00
3	$ 8,000,000.00	$ 10,000,000.00
2	$ 1,000,000.00	$ 20,000,000.00
1	Above $20M	

- Permit complexity – 10 if normal SWERP & USACE, 1 if Sovereign Submerged Lands, CSX, FDOT or multiple applicants are required.

- Design efficiency – 10 if typical design, model, bid, build process, 5 if extensive modeling, or alternate delivery (Construction-Manager-at-Risk or design build), 1 if design requires extensive structural, roadway, bridge design.
- Maintenance Complexity and Annual Expense – 10 if minimal maintenance with no structures (i.e., annual or major storm events), 5 if quarterly maintenance with multiple structures, 1 if monthly, intensive maintenance, such as for rain gardens. Points deducted for increasing complexity – i.e. many structures, larger area, expensive equipment required, etc.

7.3 Ranking Matrix

		Evaluation Criteria from Scope *Rank of the criteria*															
			Base 5	Base 10	Base 5	Base 20	Base 20	Base 10	Base 10	Base 10	Base 10	Base 10	Base 20	Base 10	Base 10	Base 10	
Priority Area	**Proposed Design Improvements**	**Rank**	**Timeline for Implementation**	**Alleviate Stormwater Flooding**	**Provide resiliency or Increased Level of Service**	**Provide Water Quality Improvement**	**Project Zone Rank**	**WBID TMDL/ Impairment List**	**CRS Activity 420 (Natural Shoreline Protection)**	**CRS Activity 450 (Stormwater Management)**	**Real Estate Acquisition**	**Easement Coordination**	**Magnitude of Cost**	**Permit Complexity**	**Design Efficiency**	**Maintenance Complexity & Cost**	**TOTAL**
4) 37th St. to Royal Palm Place (US 1 to IR Blvd.) - Option 1	Increase storage and/or discharge volume at eastern end	1	2	8	5	16	12	10	0	3	10	7	20	9	8	7	117
4) 37th St. to Royal Palm Place (US 1 to IR Blvd.) - Option 3	Establishing a bioswale	2	4	7	2	12	12	10	0	3	10	7	17	10	10	5	109
4) 37th St. to Royal Palm Place (US 1 to IR Blvd.) - Option 2	Hold back water on the western side using stepwise system	3	3	6	3	16	12	10	0	3	10	7	15	8	8	7	108
7) 4th St. & 8th St. (58th to 66th Ave.) - Option 2	Discharge into existing pond(s) at laurel springs OR new development	4	3	5	3	15	20	1	0	5	10	5	17	8	8	7	107
7) 4th St. & 8th St. (58th to 66th Ave.) - Option 3	Convey water southeast to agricultural parcel or Indian River Farms Canals	5	3	5	2	10	20	1	0	5	10	5	19	9	8	7	104
8) Indian River Drive — County maintained ROWs - Option 3	Acquire easements to connect and improve conveyance throughout system + maintenance	6	2	5	3	10	16	10	5	0	5	5	18	8	8	7	102
9) Indian River Lagoon Outfall Replacement/Upgrades - Option 1	Install vortex or screening structures	6	4	4	3	15	12	10	0	0	10	7	17	8	8	4	102
2) Rockridge Area (SR60 to 12th St) & 6th Ave. to IRL – within the County - Option 3	Install backflow prevention devices	8	4	2	1	2	16	10	0	0	10	10	17	10	10	8	100
9) Indian River Lagoon Outfall Replacement/Upgrades - Option 2	Replacing culverts	9	5	5	4	5	12	10	0	0	10	7	16	9	9	7	99
3) College Lane (between 58th Ave. & 66th Ave.) - Option 1	Connect and restore existing structures	10	4	5	3	10	4	1	0	5	10	8	19	10	10	7	96
3) College Lane (between 58th Ave. & 66th Ave.) - Option 3	Regrade ditches	11	4	5	3	10	4	1	0	5	10	7	17	10	10	9	95
8) Indian River Drive — County maintained ROWs - Option 2	Establish rain gardens or vegetated swales	11	4	3	3	12	16	10	5	0	10	5	9	8	9	1	95
6) Riviera Lakes (4th St. & 27th Ave.) - Option 2	Pitch roadway grading to achieve legal positive outfall	13	3	7	3	5	0	1	0	10	10	7	19	10	10	9	94
3) College Lane (between 58th Ave. & 66th Ave.) - Option 2	Route stormwater to ponds	14	2	5	5	15	4	1	0	5	10	5	18	8	8	7	93
5) Fellsmere (County Only) - Option 2	Expand existing County-maintained ditches / connect to canals	15	4	5	3	10	20	1	0	0	10	5	5	10	10	9	92
1) 90th Ave. Drainage - Option 1	install culvert and outfall SW of Fire Station 7	16	4	8	5	10	8	1	0	0	5	5	17	10	10	8	91
2) Rockridge Area (SR60 to 12th St) & 6th Ave. to IRL – within the County - Option 1	Raise pipe inverts along Indian River Boulevard	17	4	1	1	2	16	10	0	0	10	8	14	8	8	8	90
10) County Owned Ponds - Option 1	BeeMats/ Solar Bee or other aeration/nutrient uptake	18	5	5	3	15	12	1	0	0	10	10	4	10	10	4	89
9) Indian River Lagoon Outfall Replacement/Upgrades - Option 3	Acquire land for buffer zones	19	3	5	5	20	12	10	0	0	1	5	2	7	8	10	88
1) 90th Ave. Drainage - Option 3	Maintenance to convey water to canals south of Fire Station 7	20	4	8	4	10	8	1	0	0	5	3	17	10	10	7	87
10) County Owned Ponds - Option 2	Harvest and vegetation/ muck removal	20	5	5	3	12	12	1		0	10	10	6	9	10	4	87
2) Rockridge Area (SR60 to 12th St) & 6th Ave. to IRL – within the County - Option 5	Establish Rain Gardens	22	4	1	2	10	16	10	0	5	5	3	9	10	10	1	86
6) Riviera Lakes (4th St. & 27th Ave.) - Option 1	Re-construct east-west swales, pull surety bonds	22	2	7	4	5	0	1	0	10	10	5	17	10	10	5	86
2) Rockridge Area (SR60 to 12th St) & 6th Ave. to IRL – within the County - Option 2	Install additional pipes across Indian River Boulevard	24	4	3	3	2	16	10	0	0	10	3	13	7	7	7	85
1) 90th Ave. Drainage - Option 2	Regrading to convey water north towards canal along 20th St.	25	4	8	3	6	8	1	0	0	5	3	17	10	10	7	82
2) Rockridge Area (SR60 to 12th St) & 6th Ave. to IRL – within the County - Option 4	Purchase land and establish new SW treatment areas	25	1	7	5	20	16	10	0	10	1	1	1	2	5	3	82
8) Indian River Drive — County maintained ROWs - Option 1	Establish stormwater treatment and storage area	27	3	5	5	20	16	10	5	0	1	1	3	2	5	3	79
5) Fellsmere (County Only) - Option 1	Establish stormwater treatment and storage area(s)	28	2	10	5	20	20	1	0	0	3	1	2	2	5	3	74
7) 4th St. & 8th St. (58th to 66th Ave.) - Option 1	Establish stormwater treatment area	28	2	6	5	20	20	1	0	5	1	1	3	2	5	3	74

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SECTION 8

Summary of Recommendations

8.1 Summary of Recommendations

The following section details the summary of recommendations as discussed throughout this SMP. The single most impactful action IRC can take to alleviate their BMAP load reduction requirements is to consult with FDEP to ensure they are being evaluated accurately. Potential factors contributing to IRC's elevated loading requirements are the unconfirmed agricultural lands and the likelihood that some of the existing BMP's within the County have not been accounted for in the BMAP.

8.1.1 Prioritized List of Conceptual Projects

This SMP has identified numerous conceptual stormwater improvement projects and recommended various actions for IRC to take towards better stormwater management. The most critical factor to accomplish these projects is funding. Once funding is secured, the projects can be implemented according to their order of importance:

1. Lobby for BMAP revision
2. Establish land acquisition fund
3. Obtain survey and GIS database of structures
4. Develop maintenance schedule and asset management system and invest in additional equipment and staff
5. Priority project areas
6. Retrofit County stormwater ponds
7. Ensure stormwater ponds are accounted for and generating credit for the BMAP
8. Planning division check agricultural exemptions

8.1.2 Assessment of IRC's Geographic Information Systems (GIS)

The existing GIS data for IRC does not appear to be inclusive of all stormwater assets within IRC. The accuracy of the data is questionable in several areas, often lacking information on input format, GPS equipment, or the methods and timing of data collection. Overall, metadata is either lacking or incomplete for all features. Regarding specific features, backlot ditches only have ID and location information available. Additional fields such as status, flow direction, elevation, PID, ownership, and access are unknown.

While the schema for inlets and pipes is well-designed, the schema for backlot ditches, IRC maintained ponds, and non-pipe culverts is minimal, primarily indicating location with little to no additional data. Many inlets and pipes have incomplete data for additional schema fields. Additionally, the GIS data contains topographic inconsistencies that need to be addressed to create a reliable topographic network. The flow direction of lines is not consistently correct based on observations and available topographic data, although there is a field to indicate direction.

IRC maintained ponds include minimal data, primarily parcel and location information. Elevation, inlet details, and maintenance schedules would help to augment the dataset. While IRC maintained ponds are those provided by IRC, other water features must be generated to create a comprehensive hydrologic model.

Non-pipe culverts have type and location information but lack details on flow direction and other pertinent information. Pipes have mostly populated fields for diameter, type, material, and location, but other fields such as flow direction and elevations are incomplete. Inlets have a well-designed schema, but most fields, except for type, subtype, and access, are unpopulated.

ESA created an initial GIS database of existing stormwater features throughout IRC and provided it to the County. Three datasets were created, one each for inlets, waterbodies, and stormwater conveyance. These datasets were compiled by running analyses in ArcGIS Pro on data from various sources, such as imagery, a County-wide digital elevation model, the National Hydrography Dataset, and others. It is important to note that none of these have been fully field-verified and should be used for preliminary planning purposes only. Further information and precautions are included in the metadata attached to each dataset.

8.1.3 Stakeholder Coordination

ESA facilitated stakeholder coordination meetings in April 2025. The goals of these meetings were to identify common objectives shared by IRC and stakeholders in regard to stormwater management, discuss ongoing stormwater projects by stakeholders in proximity to IRC's priority areas, and evaluate the potential for collaboration towards future stormwater projects.

The first of these meetings was held virtually on April 21st, 2025 with the City of Vero Beach, including staff from both COVB and IRC. In particular, Priority Areas close to COVB limits were discussed in detail, including the Rockridge and 37th Street Priority Areas; additionally, the COVB VA was also discussed. As mentioned previously, the Rockridge Area is close to Focus Area 2 in the City's VA. During the meeting, COVB indicated that the wastewater treatment plant is scheduled to be relocated in the coming years. Following that, a planned development is expected to be designed to include the redevelopment of that area and surrounding areas. COVB expressed their awareness of flooding concerns from residents in the Rockridge Area. The 37th Street Priority Area is also near Focus Area 1, identified in the COVB VA, which includes the Vero Beach Regional Airport. COVB expressed that there is currently a stormwater plan being developed for the airport but that the drainage is self-contained. East and north of 37th Avenue, there are multiple undeveloped parcels for which COVB has received plans for development. In another area of IRC, within COVB limits and west of the airport, there is a defunct golf course that may be redeveloped in the future and has the potential to include stormwater treatment with a focus on nutrient reduction. Overall, the coordination meeting with COVB was productive with both entities expressing a willingness to work together where possible to improve stormwater management in shared or neighboring areas.

The second stakeholder coordination meeting was held also on April 21st, 2025, with the City of Sebastian (COS). Most of the discussion was centered around areas along Indian River Drive and IRL outfall locations. COS conveyed that they have executed several stormwater improvement projects near and along Indian River Drive in recent years, and that more are ongoing. Maintenance of outfall screening structures controlled by the City was also discussed, allowing IRC to gain insight on the labor requirement for such treatments. Again, COS expressed enthusiasm towards the potential of collaboration with IRC on future stormwater improvement projects, as well as towards increased coordination in general.

As of May 2025, efforts have been made to contact other stakeholders in IRC but no other meetings have been scheduled.

8.2 Conclusion

This SMP examined numerous components of the current drainage system in Indian River County, including existing challenges related to impaired water quality and flooding concerns. The SMP identified several opportunities for improvement as well as various avenues for IRC to obtain funding for improvement projects. Additional feasibility studies may be implemented to evaluate these conceptual improvement projects, dependent upon project readiness and funding availability. It is anticipated that the SMP will be updated on a five to ten-year interval to address changes to the County's stormwater infrastructure, climate change and sea level rise projections and the priority projects list will be updated as well to remove completed projects and add new projects.

- Develop an implementation plan for improvement projects within the priority areas
- Address GIS data gaps by obtaining survey and creating database of stormwater features
- Seek funding opportunities for improvement projects
- Seek opportunities for implementation of best management practices county-wide
- Continue coordination with neighboring municipalities
- BMAP revision

SECTION 9

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