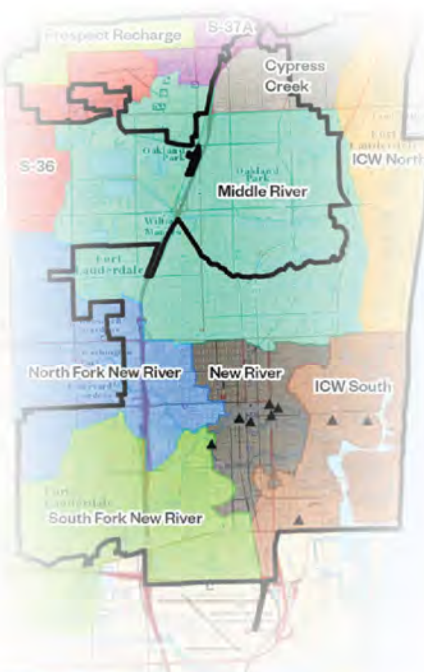
WATERSHED ASSET MANAGEMENT PLAN (WAMP)



PUBLIC WORKS DEPARTMENT
SUSTAINABILITY DIVISION
STORMWATER & ENVIRONMENTAL SERVICES

Prepared by:
Hazen and Sawyer, PC
and GHD
Project P12482, Task Order 14

ASSET MANAGEMENT

VALUE ALIGNMENT LEADERSHIP ASSURANCE

CONTROL VERSION TABLE	
Version 1.0	Date: Dec 2019

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List of Acronyms and Abbreviations

Abbreviation	Definition
AAA	Adaptation Action Areas
AMP	Asset Management Plans
AWWA	American Water Works Association
BMP	Best Management Practice
BRE	Business Risk Exposure
CAPEX	Capital Expenditures
CB	Catch Basin
CBM	Condition-Based Maintenance
CCTV	Closed Circuit Television
CIP	Capital Improvement Planning
CM	Corrective Maintenance
CoF	Consequence of Failure/Criticality
CoS	Cost of Service
CRS	Community Rating System
D&CM	Design & Construction Manual
EAM	Enterprise Asset Management
EUL	Expected Useful Life
FDEM	Florida Department of Emergency Management
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
HOA	Homeowners Association
I&T	Inspection and Testing
IAM	Institute of Asset Management
ICW	Intracoastal Waterway
IRR	Internal Rate of Return

Abbreviation	Definition
KPI	Key Performance Indicator
LID	Low Impact Development
LoE	Level of Effort
LoF	Likelihood of Failure
LoS	Level(s) of Service
LoS P	The City's current/present Level of Service
LoS A	The City's Level of Service Tier where watershed goals require the maximum feasible level of inspection and preventive and corrective maintenance.
LoS B	The City's Level of Service Tier where watershed goals require an improved level of inspection and preventive and corrective maintenance.
LoS C	The City's Level of Service Tier where watershed goals require focusing on the most critical stormwater infrastructure, high priority areas, and addressing environmental compliance.
MH	Manhole
MHPA	Multi-Habitat Planning Area
MS4	Municipal Separate Storm Sewer System
NAVD88	North American Vertical Datum of 1988
NFIP	National Flood Insurance Program
NFNR	North Fork New River
NPDES	National Pollutant Discharge Elimination System
NOAA	National Oceanic & Atmospheric Association
O&M	Operations & Maintenance
OPEX	Operational Expenditures
PdM	Predictive Maintenance
PM	Preventative Maintenance
PWD	Public Works Department
ROI	Return on Investment
RTF	Run to Failure
RUL	Remaining Useful Life
S36	Fort Lauderdale Executive Airport Watershed
SAP	Sustainability Action Plan

Abbreviation	Definition
SFHA	Special Flood Hazard Area
SFNR	South Fork New River
SFWMD	South Florida Water Management District
SLR	Sea Level Rise
SOPs	Standard Operating Procedures
STW OPS	Stormwater Operations
SWMP	Stormwater Master Plan
TAMP	Tactical Asset Management Plan
TBM	Time-Based Maintenance
TMDL	Total Maximum Daily Load
USACE	US Army Corp of Engineers
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGAO	United States Government Accountability Office
USFWC	US Fish and Wildlife Commission
WAMP	Watershed Asset Management Plan
WLA	Waste Load Allocation

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Glossary of Terms

1. **Asset** – Item, thing, or entity that has potential or actual value to an organization (International Standard, ISO 55000, 2014).

2. **Asset Management** – Coordinated activity of an organization to realize value from assets (International Standard, ISO 55000, 2014).

3. **Asset Management Plan** – Documented information that specifies the activities, resources, and timescales required for an individual asset, or a grouping of assets, to achieve the organization's asset management objectives (International Standard, ISO 55000, 2014).

4. **Asset Management Policy** – Intentions and direction of an organization as formally expressed by its top management (International Standard, ISO 55000, 2014).

5. **Asset Management Program -** A formalized, systematic set of practices to implement the Asset Management Plan within the organization, with a focus on developing Asset Management capabilities within the organization. The Program typically includes the cohesive development, implementation, and integration of people, processes and information systems (AWWA AM Definitions Guidebook, 2018).

6. **Asset Management System** – Management system for asset management whose function is to establish the asset management policy and asset management objectives (International Standard, ISO 55000, 2014).

7. **Asset Life** – Period from asset creation to asset end-of life (International Standard, ISO 55000, 2014).

8. **Asset Type** – Grouping of assets having common characteristics that distinguish those assets as a group or class (International Standard, ISO 55000, 2014).

9. **Critical Asset** – Asset having potential to significantly impact on the achievement of the organization's objectives (International Standard, ISO 55000, 2014).

10. **Criticality -** An asset prioritization measure often used to determine "what" assets to focus on. Criticality is normally based on potential Consequences of Failure, not Risk, and is used to determine higher priority assets for risk management activity (AWWA AM Definitions Guidebook, 2018).

11. **Community Rating System (CRS) -** A program developed by FEMA to provide incentives for those communities in the Regular Program that have gone beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding (FEMA, 2019).

12. **Condition Assessment -** A technical assessment of an asset followed by the interpretation of the resultant data to determine its current and/or future physical condition, performance, Likelihood of Failure, and/or Remaining Useful Life (IIMM, 2015) (SIMPLE)(modified). The assessment

can be based on a desktop analysis, physical observation/inspection, interviews, and/or through the use of instrumentation (AWWA AM Definitions Guidebook, 2018).

13. **Hard Asset -** An asset that is purchased and constructed, has a defined lifecycle and is replaced at the end of the useful life.

14. **Key Performance Indicator (KPI) -** A performance measure that is considered important to the organization (IIMM, 2015).

15. **Level of Service (LoS)** – Parameters, or combination of parameters, which reflect social, political, environmental and economic outcomes that the organization delivers ((International Standard, ISO 55000, 2014).

16. **Level of Service (LoS) A -** Level of Service Tier which would be required where watershed goals require the maximum feasible level of inspection and preventive and corrective maintenance.

17. **Level of Service (LoS) B -** Level of Service Tier which would be implemented in watersheds requiring an improved level of inspection and preventive and corrective maintenance in order to meet the established watershed goals.

18. **Level of Service (LoS) C -** Level of Service Tier which would allow the City to meet its watershed goals, focusing on the most critical stormwater infrastructure, high priority areas, and addressing environmental compliance.

19. **Management System –** Set of interrelated or interacting elements of an organization to establish policies and objectives and processes to achieve those objectives (International Standard, ISO 55000, 2014).

20. **Natural Asset** - An asset that is not human-made but must be managed by the City to comply with NPDES permit requirements, and to mitigate flood risk or water quality impacts, for example.

21. **National Flood Insurance Program (NFIP) -** The program of flood insurance coverage and floodplain management administered under the Act and applicable federal regulations promulgated in Title 44 of the Code of Federal Regulations, Subchapter B (FEMA, 2019).

22. **Soft Asset** - A human-determined asset managed by the division that is not constructed or purchased outright, does not have a defined lifespan but does have defined operation and maintenance costs. Soft assets can be tangible living documents such as policies, procedures and/or guidelines that influences intangible behavior(s) to produce measurable outcomes/results.

23. **Strategic Asset Management Plan** – Documented information that specifies how organizational objectives are to be converted into asset management objectives, the approach for developing asset management plans, and the role of the asset management system in supporting achievement of the asset management objectives (International Standard, ISO 55000, 2014).

Acknowledgements

The City of Fort Lauderdale Watershed inaugural Asset Management Plan (WAMP) was completed with the collaboration of many members of the City of Fort Lauderdale Public Works Department, Finance Department, Information Technology Department (IT), Geographical Information Systems (GIS), and the Hazen Team (Hazen and Sawyer, PC and GHD). Many members of the City contributed through their participation during the discovery interviews, workshops, meetings, and submittal reviews.

Table A.1: City of Fort Lauderdale Staff Members

Paul A. Berg	Director-Public Works	Veronica Wade	Revenue Collections Manager
Nancy Gassman	Assistant Public Works Director of Sustainability	Brandy Leighton	Senior Project Manager
Aneisha Daniel	Deputy Director- Public Works	Rares Petrica	Senior Project Manager
Glen Hadwen	Sustainability Manager	Kymberly Holcombe	Chief Financial Administrator
Elkin Diaz	City's Project Manager	Shannon Barrett	Senior Administrative Assistant
Sandra Marie Pierce	Stormwater Operations Manager	Reina Gonzalez	Administrative Supervisor
Todd Hiteshew	Environmental Compliance Manager	Kelly High	Administrative Supervisor
Richard Benton	Floodplain Manager	Elke Blanco	Senior Administrative Assistant
Larry Teich	Environmental Compliance Supervisor	Susan LeSage	Engineering Business Manager
Omar Castellon	Chief Engineer	Fernando Ayrosa	Senior Technical Analyst
Erin Saey	STW OPS Admin Assistant	Ian A Wint	GIS Manager
Jeron Coney	Chief of Maintenance	Lucia Hogan	GIS Analyst
Eric Rucker	Chief of Stormwater Repairs	Carlos Cruz	GIS Analyst
Todd Hiteshew	Environmental Compliance Manager	Dennis Girisgen	City Engineer/Urban Land Development Manager
Donna McMahon	Customer Service Supervisor	Craig Barret	CADD Coordinator
Nadine Blue	Senior Administrative Assistant	Claudelle Hazell	Administrative Assistant I
Ruby Cuellar-Summa	Administrative Assistant I	Richard Wentworth	Maintenance Supervisor
Jordan Wingate	Senior Administrative Assistant	Michael Donaldson	City Surveyor
Fred Harris	Cityworks Administrator		

Executive Summary

ES-1 Overview

The purpose of this Watershed Asset Management Plan (WAMP) is to document the current state of the City of Fort Lauderdale's stormwater assets and to project the short and long-range asset renewal and replacement needs aligned with ongoing and future operations and maintenance requirements. The WAMP is intended to be a planning document used to provide a rational framework for understanding the existing risk and stewardship requirements of the City's stormwater asset portfolio and planning for the appropriate standard of care necessary to provide an acceptable level of service to the City's stormwater stakeholders and customers. This WAMP consolidates the City's asset information into a structured framework and uses it to provide a justifiable basis to support long-term organization, operations, and asset management decisions.

The WAMP is the asset management plan for the City's stormwater assets and addresses the five (5) core questions of asset management in order to optimize the value of the assets based on the City's stormwater organizational objectives.

1. What is the current state of the stormwater assets?
2. What is the required level of service?
3. Which assets are critical to sustained performance?
4. What are the best operation and maintenance & capital improvement investment strategies?
5. What is the best long-term funding strategy?

The City's Flood Resilience and Environmental Groups commissioned Hazen and Sawyer, with support from GHD, to perform an assessment of its current related program activities against sound industry standard practice, as defined by the Institute of Asset Management (IAM), which incorporates six (6) major components, whose relationship is shown in **Figure ES.1.**

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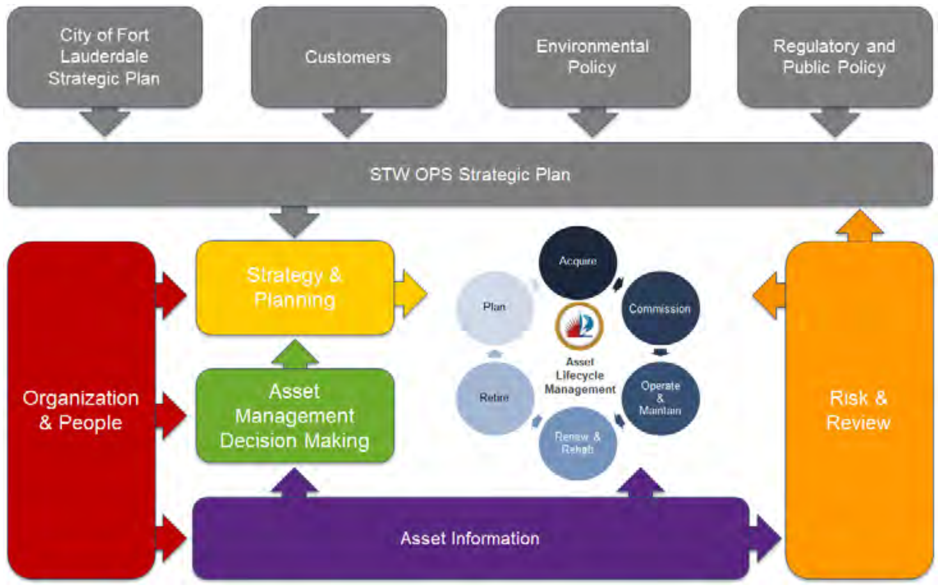
Figure ES.1: Institute of Asset Management's Conceptual Model



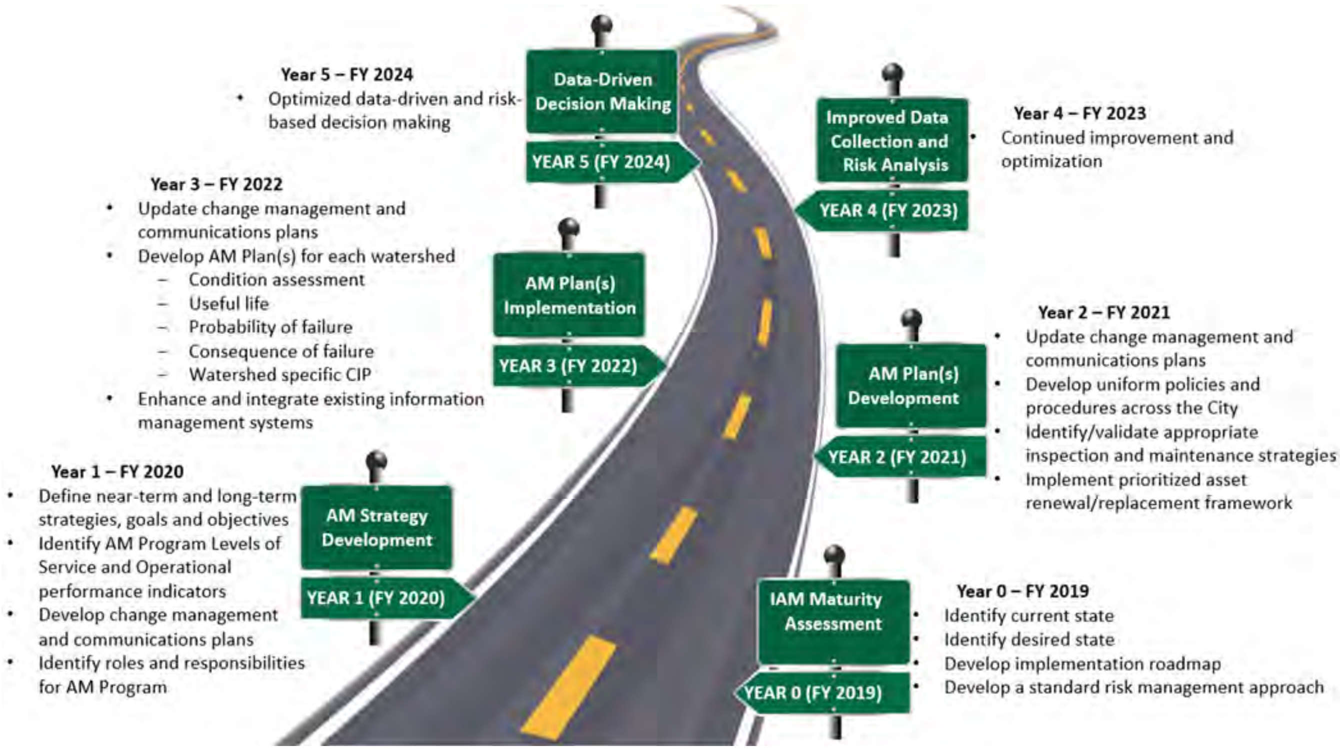
An effective asset management program will support data-driven and risk-based decision making. The desired end-result includes the following:

- **Asset Management Strategy:** A clear and concise plan is available that states the needs and approach to the Public Works Stormwater and Environmental Groups' Asset Management Program and is integrated into the culture.
- **Data Needs:** Data is collected, organized, easily available and useful to make decisions regarding the maintenance, rehabilitation and replacement of assets.
- **Risk Management:** A clear understanding of the Public Works Stormwater and Environmental Groups' risk tolerance is established and is integrated into the organizational culture. In addition, a guide to evaluate risks that incorporates consequences and likelihood of failure (LoF) is available.
- **Prioritize and Plan Investment:** Public Works Stormwater and Environmental Groups' asset systems have asset management plans detailing the appropriate maintenance and monitoring strategies for each asset class and watershed, and scheduled capital renewal/replacement of assets based on risk. Collectively, these asset management plans inform the Public Works Stormwater and Environmental Groups' overall asset investments.

The implementation roadmap describes each of the recommended initiatives, along with specific actions, the assigned Flood Resilience and Environmental Groups' lead, the Flood Resilience and Environmental Groups' teams responsible for supporting the initiative implementation, the anticipated timeframe for completion, the priority of the action, and the estimated cost for support from external resources.

The implementation roadmap action items and corresponding schedule are presented at a high level in **Figure ES.2**, with initiative detail provided in **Appendix A.**

Figure ES.2: Public Works Stormwater and Environmental Groups Asset Management Implementation Roadmap



Implementation requires a broad section of departments, divisions, and sections working together to achieve the overarching asset management goals. This includes participation from Public Works executive management, Cityworks administration, Sustainability Division, Engineering Division, and Strategic Support. In addition, the WAMP will support the City's Flood Resilience and Environmental Vision, Mission, and Goals (Figure 1.2); Community Rating System; and NPDES and Water Quality efforts.

ES-2 City Overview, Watersheds and the Overall Stormwater System

The City of Fort Lauderdale is situated in the east-central portion of Broward County, Florida and it encompasses approximately 36 square miles with an estimated population of 176,747. Fort Lauderdale is the largest of Broward County's 31 municipalities with more than 13 million visitors per year (as per 2013 data). The City is composed of ten (10) primary watersheds ranging in size from approximately 2,100 to 10,500 acres characterized by urban development, low-lying topography and intersected by numerous canals and rivers. **Figure ES.3** presents the 10 primary watersheds within the City. **Table ES.1** lists the 10 watersheds and the number of total assets within each watershed in accordance with the City's 2019 stormwater geodatabase.

Figure ES.3: City Watersheds

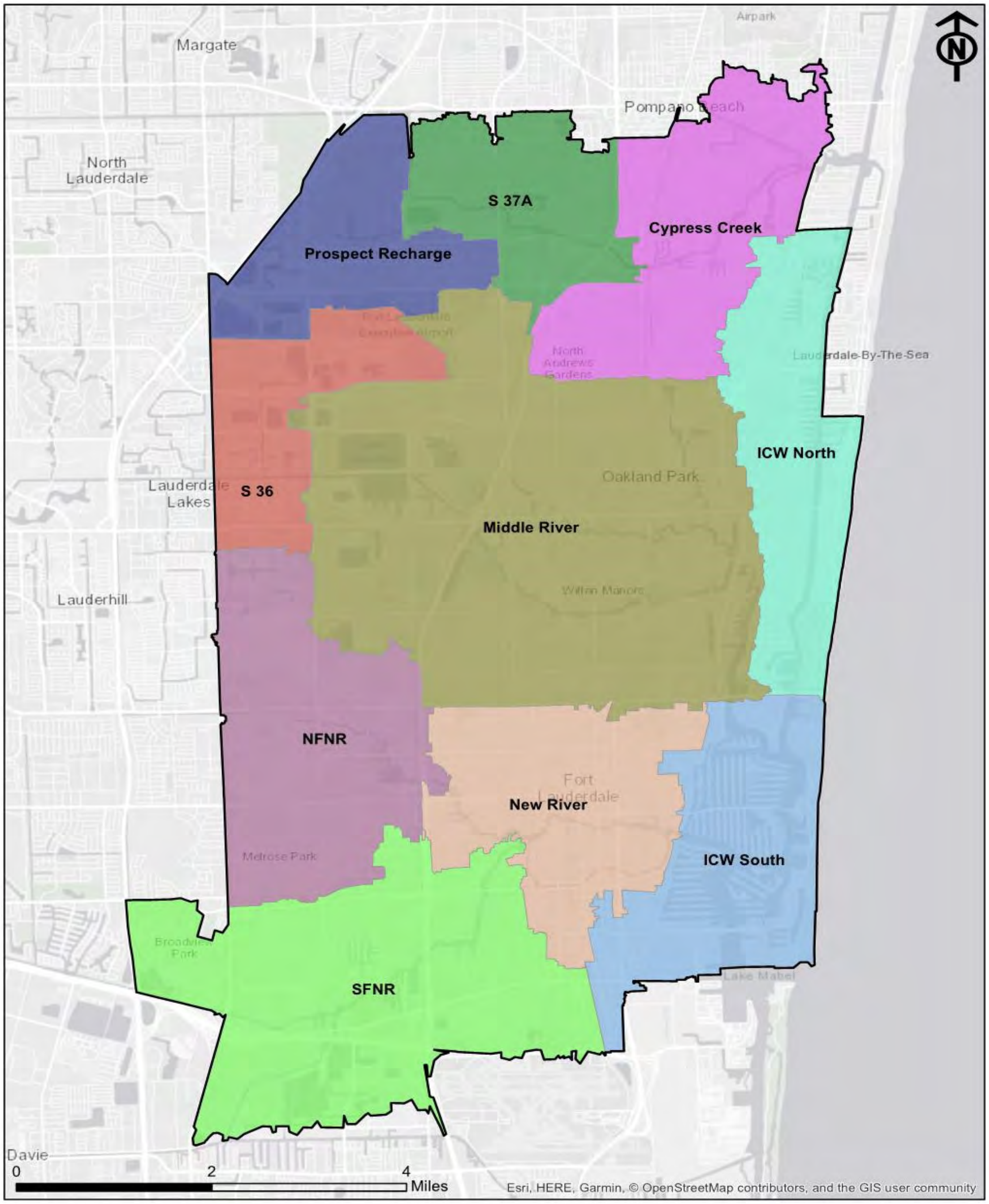


Table ES.1: Watershed Hard Asset Identification

Watersheds	Number of Hard Assets (Stormwater Geodatabase)	Total Watershed Size (Square Miles)	Watershed Area within City Boundary (Square Miles)
Cypress Creek	1,115	5.65	1.25
Intracoastal Waterway (ICW) North	5,337	4.88	4.78
Intracoastal Waterway (ICW) South	7,254	5.30	5.26
Middle River	8,363	16.34	7.30
New River	11,364	5.29	5.29
North Fork New River (NFNR)	2,949	6.40	2.56
South Fork New River (SFNR)	4,088	9.65	5.86
Prospect Recharge	1,755	3.71	1.97
Fort Lauderdale Executive Airport (S 36)	491	3.24	1.10
Uptown S37A	437	3.54	0.63

The City categorizes the assets that are managed by the STW OPS or that are related to the stormwater system in three different categories as follows:

- **Hard assets -** assets that are human-made, purchased and constructed, have a defined lifecycle and are replaced at the end of their useful life.
- **Soft assets -** human-determined assets managed by the division that are not constructed or purchased outright with an undefined lifespan. Soft assets can be tangible living documents such as policies, procedures and/or guidelines that influences intangible behavior(s) to produce measurable outcomes/results.
- **Natural assets -** not human made assets managed by the Division. These include rivers, creeks, trees, mangroves, beach, runoff and discharges.

Figure ES.4 presents the stormwater assets as provided in the 2019 stormwater geodatabase.

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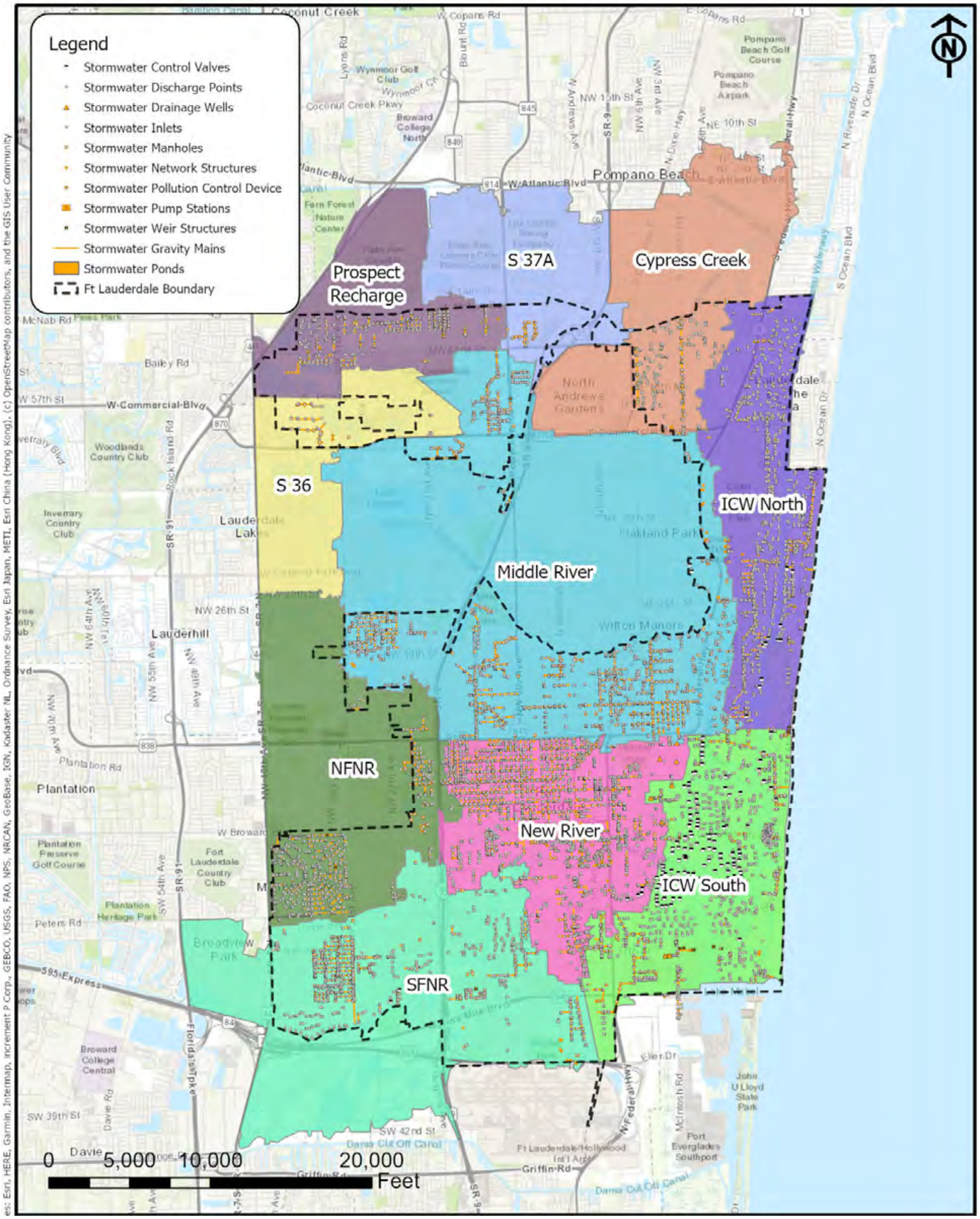
Figure ES.4: Stormwater Hard Assets (2019 Stormwater Geodatabase)



ES-3 Risk Management

Management of risk is critical in order to optimize level of service provided to the City's stormwater customers, minimize the lifecycle cost associated with asset ownership, operations and maintenance, and minimize the likelihood of catastrophic stormwater infrastructure failure with the City's service area. As such, the City intends to move to a more risk-based asset management decision making approach. This will help the City to prioritize its asset management investment in higher risk assets or projects. Knowing an asset's risk allows asset managers to make informed decisions about the best actions to take to optimize asset performance and achieve the City's asset management objectives.

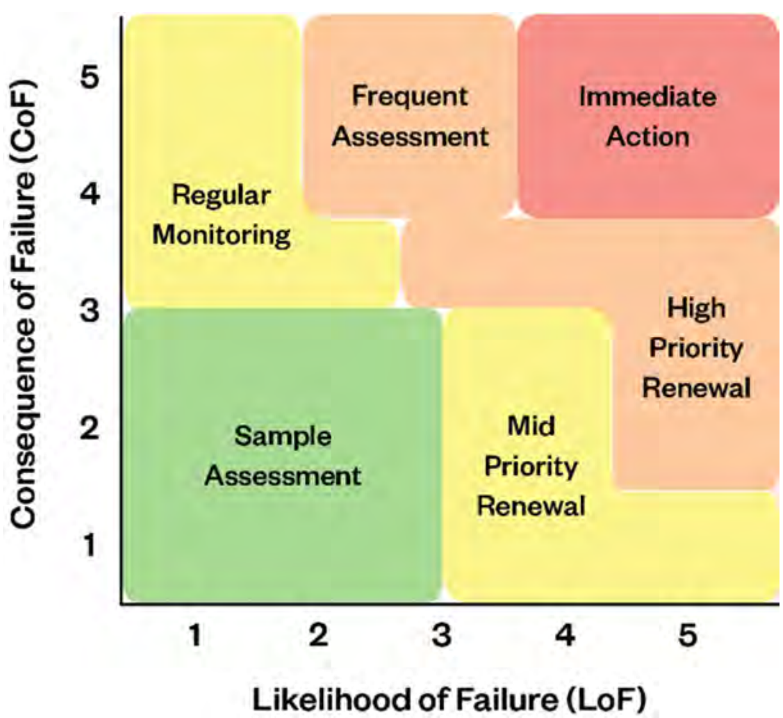
Overall asset risk is determined by quantifying an asset's likelihood (or probability) of failure (LoF) and consequence of failure (CoF). Knowing the LoF and CoF allows the City to calculate the business risk exposure (BRE), or risk using the following calculation:

BRE = LoF X CoF

Determining asset BRE allows asset managers to predict how their actions can impact the future performance of the stormwater assets and support City stormwater service level goals.

BRE scores can be used as visual representations of the asset risks, which allow for prioritization of the recommended actions (inspection, assessment, renewal, replacement, etc.) that is recommended for the asset portfolio. **Figure ES.5** presents the recommended action for assets based on their LoF and CoF scores.

Figure ES.5: **Typical Risk Matrix and Associated Management Approaches**



Additional details on how to determine overall risk, including details on LoF and CoF determination, can be found in **Section 2.2** of this document.

ES-4 Operations Maintenance and Replacement Strategies

Asset lifecycle management strategies are planned actions that enable assets to provide the defined levels of service in a sustainable manner, while managing risk, at the lowest lifecycle cost. Asset lifecycle management strategies are typically organized into the following categories:

- **Operations & Maintenance activities –** including regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal activities –** significant rehabilitation designed to extend the life of the asset and replacement activities that are expected to occur once an asset has reached the end of its useful life and rehabilitation is no longer an option.
- **Expansion activities –** planned activities required to extend services to previously unserviced/underserviced areas or expand services to meet growth demands. Also includes redevelopment activities.
- **Disposal activities –** the activities associated with the disposal of an asset once it has reached the end of its useful life or is otherwise no longer needed by the municipality.
- **Non-asset solutions –** actions or policies that can lower costs, lower demands, or extend asset life (e.g. better integrated infrastructure planning and land use planning, demand management, insurance, process optimization, education of public).

The City assesses the costs of potential lifecycle activities to determine the lowest lifecycle cost strategy to manage each asset type. The sum of all asset lifecycle management strategies informs the minimum cost to sustain each asset type. Failing to take care of assets can impact the total cost of ownership for that asset and can also have other impacts such as causing damage to other infrastructure or causing interruption to service delivery. Maintenance and renewal activities are timed to reduce the risk of service failure from deterioration in asset condition, and to minimize the total cost of ownership. Sufficient investment, of the right type, at the right time, is crucial.

Additional details regarding Operations, Maintenance and Replacement Strategies can be found in **Section 2.4.2**.

ES-5 City Flood Protection and Community Investment Plan

In recent decades, several of the City's coastal watersheds have experienced more routine flooding associated with both Spring and King Tides. The events are often referred to as "Sunny Day/Nuisance Flooding" resulting from higher than normal tides in association with Sea Level Rise (SLR). There are three (3) watersheds identified with flooding as a result of changes to the historic tidal patterns. As shown in Figure 3.1, these watersheds include the Intracoastal Waterway (ICW) North, Intracoastal Waterways (ICW) South and the New River basin areas. Most of the flooding has been associated with roadways, residential properties and common areas.

The Stormwater Master Plan Modeling and Design Implementation Program is a holistic and future-focused effort that involves several interconnected phases as described below.

- **Phase I:** included implementation of 37 small-scale stormwater Capital Improvement Planning (CIP) projects managed and completed by the City.
- **Phase II:** included development of a city-wide stormwater model and also addressed storm and tidally-driven flooding issues in seven priority neighborhoods. Those seven neighborhoods and the watersheds in which they are located are listed in **Table ES.2.** Projects will be constructed in a phased approach from 2020 to 2025.

Table ES.2: Priority Neighborhoods and Corresponding Watersheds

Neighborhood	Watershed(s)
Edgewood	South Fork New River
Victoria Park	New River, ICW South
Progresso Village	New River
Southeast Isles	ICW South, New River
Durrs	North Fork New River
Dorsey Riverbend	North Fork New River, New River
River Oaks	South Fork New River

- Phase III Stormwater Improvements: The City has selected the following neighborhoods for Phase III stormwater improvements: Melrose, Sailboat Bend, Riverland, Harbor Isles, Flagler Village, and Downtown. The design improvements for these neighborhoods shall be coordinated with the WAMP objectives, recommendations, and initiatives.

ES-6 Standard of Care, Level of Service (LoS) and Key Performance Indicators (KPIs)

The City's present watershed LoS delivered to its customers (LoS P) defines how the City currently responds to citizen requests to inspect, maintain, repair and/or replace assets in each of its ten watersheds. **Table ES.3**provides the LoS P associated with the City's stormwater management, engineering, and environmental programs.

Table ES.3: City of Fort Lauderdale Baseline LoS P

Exiting Hard Assets	Reactive Inspection (non-emergency)	Proactive / Routine Inspection	Proactive Routine / Preventive Maintenance	Reactive / Corrective Maintenance
Control Valve	As needed	Quarterly	NPDES Permit: Clean XX Annually	Respond to Reactive Maintenance Efforts
Pond	Undefined	Undefined	Undefined	Undefined
Discharge Point	As needed	Critical Only - Monthly	Respond to Critical Outfall	Respond to Reactive Maintenance Efforts
Drainage Well	As needed	Semi-Annual (Feb/Aug)	Respond to Maintenance Efforts	Respond to Maintenance Efforts

Exiting Hard Assets	Reactive Inspection (non-emergency)	Proactive / Routine Inspection	Proactive Routine / Preventive Maintenance	Reactive / Corrective Maintenance
			on a First Come First Serve Internal Referral Basis	on a First Come First Serve Internal Referral Basis from Reactive Inspections
Exfiltration Trench	Undefined	Undefined	Undefined	Undefined
Inlet	As needed	Semi-Annual	Clean XX Annually	Perform XX Reactive / Corrective Maintenance Annually
Manhole	Respond to Maintenance Efforts on a First Come First Serve Basis	Respond to Maintenance Efforts on a First Come First Serve Basis	Clean XX Annually	Perform XX Reactive / Corrective Maintenance Annually
Gravity Main	Respond to Maintenance Efforts on a First Come First Serve Basis	Respond to Maintenance Efforts on a First Come First Serve Basis	Clean XX Annually	Perform XX Reactive / Corrective Maintenance Annually
Network Structure	Undefined	Undefined	Undefined	Undefined
Pollution Control Structure	As needed	Quarterly (Feb/May/Aug/Nov)	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Perform XX Reactive / Corrective Maintenance Annually
Pollution Control Device	As needed	Quarterly (Jan/Apr/Jul/Oct)	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Perform XX Reactive / Corrective Maintenance Annually
Pump Station	As needed	PS No. 1&2 – Semi-Weekly PS No. 4&5 - Quarterly	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Perform XX Reactive / Corrective Maintenance Annually
Weir Structure	As needed	Semi-Annual (Apr-Oct)	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis from Reactive Inspections
Swales[(1)]	Undefined	Undefined	Undefined	Undefined
Culvert	Undefined	Weekly (Jan-Dec)	Undefined	Undefined
Ditch	Undefined	Melrose Ditch – Monthly (Jan-Dec)	Undefined	Undefined
Pressure Pipe	Undefined	Undefined	Undefined	Undefined
Right of Way	Undefined	Undefined	Undefined	Undefined

Exiting Hard Assets	Reactive Inspection (non-emergency)	Proactive / Routine Inspection	Proactive Routine / Preventive Maintenance	Reactive / Corrective Maintenance
Seawall	Undefined	Undefined	Undefined	Undefined
Rock and Grade(2)	Undefined	Undefined	Undefined	Undefined
KT Delineators	Undefined	Deployed Annually (Sept)	Undefined	Undefined
KT No Wake Signs	Undefined	Deployed Annually (Sept)	Undefined	Undefined
Riverland Delineators(3)	Undefined	Undefined	Undefined	Undefined
High Water Signs(3)	Undefined	Undefined	Undefined	Undefined

(1) *New asset to be mapped during the WAMP implementation.*
(2) *New asset. Ownership to be determined.*
(3) *On hold.*
(4) *SWML (a soft asset) has a 5-year renewal cycle.*

The three proposed alternatives to LoS are as follows:

- **LoS C** would allow the City to meet its watershed goals with a baseline level of service over and above LoS P, focusing on the most critical stormwater infrastructure, high priority areas, and addressing environmental compliance.
- **LoS B** would be implemented in watersheds requiring an improved level of inspection and preventive and corrective maintenance in order to meet the established watershed goals.
- **LoS A** would be required where watershed goals cannot be met without a much greater level of inspection and preventive and corrective maintenance.

Each LoS will outline the frequency (for proactive LoS) or efficiency and timeliness (for reactive LoS) at which work is to be completed, with values more stringent as the LoS increases. For example, the Discharge Point/Outfall asset class may have the following LoS:

Table ES.4: Discharge Point/Outfall LoS - Example

Levels	Levels of Service			
	Reactive Inspection (non-emergency)	Proactive/ Routine Inspection	Proactive/Routine Preventive Maintenance	Reactive/ Corrective Maintenance
LoS P	As needed	Critical Only	Respond to Critical Outfall	Respond to Reactive Maintenance Efforts
LoS C	Respond within 3 days	33% of assets inspected each fiscal year	33% of all assets restored to performance standards each fiscal year	100% of all asset repairs completed within 60 calendar days of notification
LoS B	Respond within 2 days	66% of assets inspected each fiscal year	66% of all assets restored to performance standards each fiscal year	100% of all asset repairs completed within 45 calendar days of notification

Levels	Levels of Service			
	Reactive Inspection (non-emergency)	**Proactive/ Routine Inspection**	**Proactive/Routine Preventive Maintenance**	**Reactive/ Corrective Maintenance**
LoS A	Respond within 1 day	100% of assets inspected each fiscal year	100% of all assets restored to performance standards each fiscal year	100% of all asset repairs completed within 30 calendar days of notification

ES-7 How Much Will the WAMP Cost?

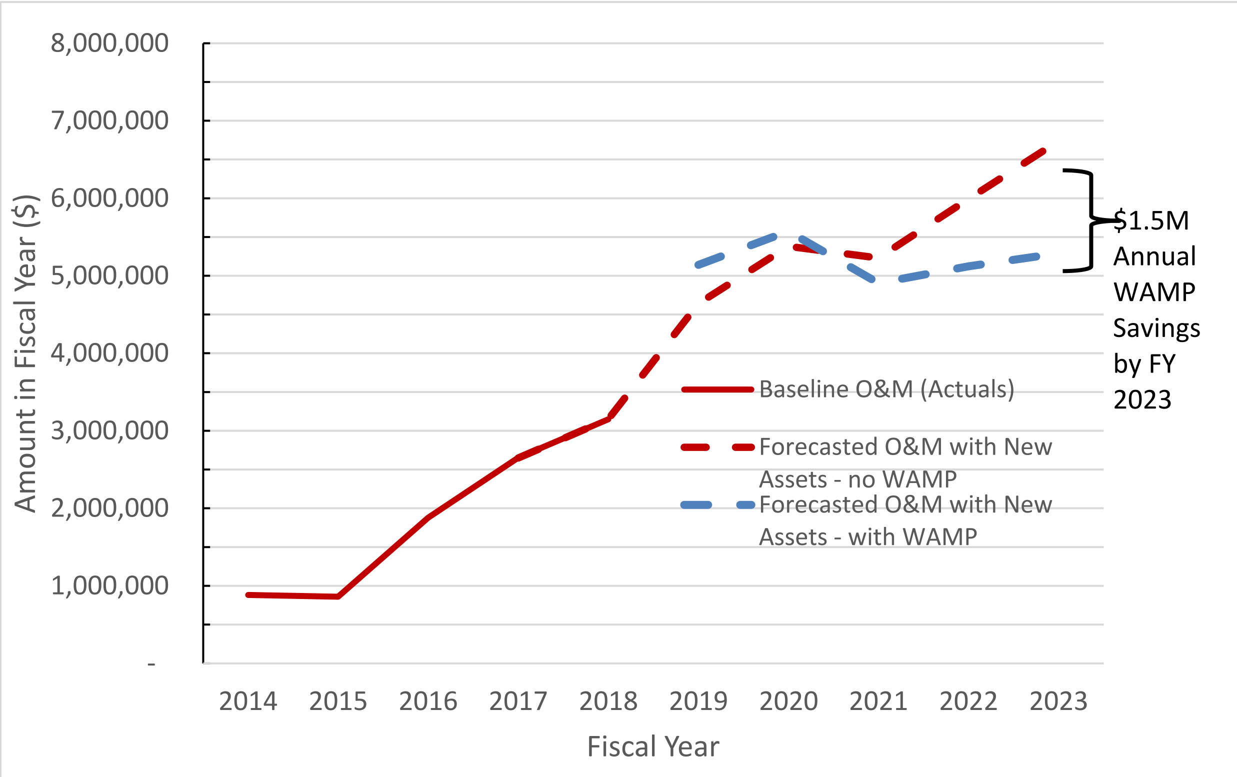
In order to determine the level of effort (LOE) and associated budget requirements for the City to develop and implement a multi-phase, multi-year WAMP that supports the City's sustainability and environmental programs for Fiscal Years 2019 through 2023, the City needs to assess the following four components for each of the 10 watersheds:

- Forecasted operations and maintenance expenses, which includes both in-house and contracted work.
- Forecasted capital renewal and replacement costs
- Estimated impact of SWMP assets on forecasted operations and maintenance expenses.
- Forecasted WAMP investment costs, both for external (i.e., consultant) support and within STW OPS.
- Forecasted WAMP savings achieved through improved efficiencies.

Each of these components is described in further detail in **Sections 6.2** through **6.5**. **Section 6.6** then presents graphical and tabular summaries of how all four of these components comprise the WAMP's forecasted LOE and associated Stormwater Operating Fund budget for Fiscal Years 2019 through 2023.

Based upon the current situation, the most realistic basis for forecasting future stormwater fund operations and maintenance expenditures for Fiscal Years 2019 through 2023 is a linear projection of historical budget data for Fiscal Years 2014 through 2017, for which complete annual budgetary data currently exist. **Figure ES.6** presents the O&M cost projections through FY 2023.

Figure ES.6: LOE for WAMP, Forecasted WAMP Savings and Stormwater Operations Fund Budget Estimate Fiscal Years 2019 through 2023



Capital Investment for the City of Fort Lauderdale for fiscal years 2020 through 2024 is identified through the Community Investment Plan (CIP), which provides a total investment required including stormwater infrastructure.

The Stormwater Management Program faces several infrastructure challenges in order to successfully achieve the City's stated goal: 'to be a sustainable and resilient community'. The key objective of this goal is to reduce flooding and adapt to sea level rise. The City has already developed a stormwater master plan and plans to invest $196 million into making hard assets more resilient to flooding and sea-level rise.

Stormwater capital investment planned for FY 2020 is $11.6 million, or 1.6% of the total budget. The City intends to issue a $200 million bond in FY 2021 in order to fund the critical infrastructure needed to reduce flooding in at least five of the ten watersheds and their respective seven neighborhoods, which make up half of the City's stormwater system of ten watersheds, recognizing that each watershed has its own unique requirements.

ES-8 How Can the City Pay for the WAMP?

Stormwater funding, as stated in the City's Revenue Manual (Page 104), is derived from stormwater fees assessed and approved by the City Council for services provided to the City to the community ratepayers. This rate is projected to increase by 5% annually through 2023.

The WAMP funding strategy outlines the suggested financial approach to adequately funding the required standard of care, LoS and KPIs needed to achieve the City's stormwater objectives outlined in Section 4. The financing strategy forecast was prepared in alignment with the City's 2018 Stormwater Management Financing Study, so that it can be used to measure ratepayer impacts relative to what was identified in that study, and includes:

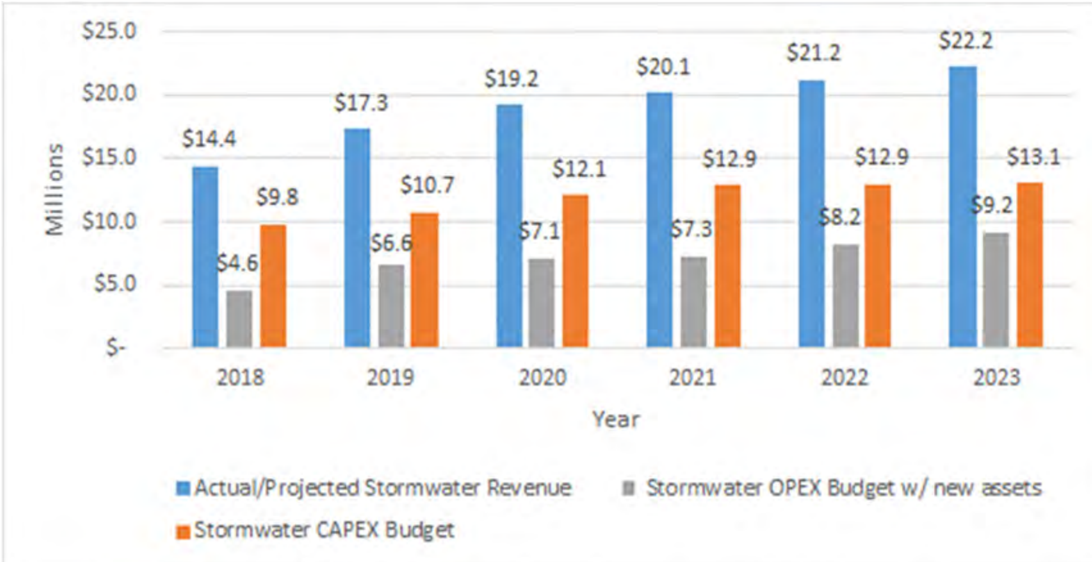
- Annual expenditure forecasts broken down by:
  - Capital renewal rehabilitation, and replacement activities
  - Significant operating costs
- A breakdown of annual funding/revenue by source
- Identification of any funding shortfalls, if applicable
- Documentation of all key assumptions

Funding strategies consider both Operational (OPEX) and Capital (CAPEX) expenditures and are based upon the Levels of Service STW OPS is striving to achieve today and how STW OPS expects demand for these services to change over the next five years and beyond. It also considers how reliable the City's stormwater infrastructure (and ancillary equipment such as fleet vehicles) is today with respect to meeting existing demand, and whether the infrastructure has the capacity to meet expected future demand. These considerations inform a financial plan that supports meeting service levels by providing:

- Recurrent Operational Expenditure Profile – What STW OPS needs for day-to-day management of the assets
- Investment Profile – Capital expenditures needed for both replacement of existing assets and for growth in the system
- Revenue Profile – What STW OPS is being paid for the services it provides
- The Revenue-Cost Gap (or surplus) – Including associated implications and recommendations

Figure ES.7 presents a projection of stormwater funding needs through fiscal year 2023. These funding needs include stormwater OPEX budget, including the addition of operations and maintenance for anticipated new stormwater assets, a projection of stormwater CAPEX needs, and the overall potential revenue requirements that will need to be funded through stormwater revenues.

Figure ES.7: Stormwater Funding Projections



ES-9 Recommendations for Continuous WAMP Improvements

The WAMP is the guiding strategic document providing the overarching strategic goals and objectives and the framework and methodologies governing the content of the asset management plans (AMPs) that will be created for each watershed. These individual AMPs will provide the LoF and CoF (and subsequent BRE) evaluation and update, along with the forecasted O&M and capital costs for the subsequent five fiscal years.

It is recommended that the WAMP's strategic goals and objectives be reviewed as frequently as is feasible given the City's current and future asset management staffing levels. Ideally, once asset management roles and responsibilities are defined and staffing levels are deemed adequate to fulfill these roles and responsibilities, it is recommended that the WAMP's strategic goals and objectives be reviewed annually to ensure alignment throughout all watershed AMPs. In addition, as each watershed's LoF, CoF, and BRE are defined based on updated condition assessment information, the watershed five-year forecasted O&M and capital expenditures projections should also be reviewed and updated annually.

A recommended guideline for reviewing and updating the WAMP, subsequent watershed AMPs, and the management and communications plan is shown in **Table ES-5**. Details of the recommended implementation timelines by IAM Section and Element is provided in **Appendix A**.

Table ES.5: Suggested WAMP and AMP Review Periods

Item	Suggested Minimum Review Time Period	Suggested Maximum Review Time Period	Comments
WAMP	Annually	Every Five Years	Perhaps more frequent at beginning to ensure actions are remaining on track and meeting the City's goals and objectives.
AMP (per watershed).	Semi-Annually	Annually	Once established, review each watershed's asset management progress and information to ensure changes to LoF/CoF are documented, resulting maintenance and capital plans are updated, and LoS are being met.
Change Management Plan	Semi-Annually	Annually	Ensure that requirements are in place to get employees trained on asset management principles, practices, and methodologies and the changes to individual jobs and responsibilities are identified and managed to effectively implement asset management.
Communications Plan	Semi-Annually	Annually	Once finalized, ensure Communications Plan is meeting stakeholder needs and familiarity with asset management principles and practices is increasing.

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SECTION 1 – INTRODUCTION

1.1 Purpose and Intent

The purpose of this Watershed Asset Management Plan (WAMP) is to document the current state of the City of Fort Lauderdale's stormwater assets and to project the short and long-range asset renewal and replacement needs aligned with ongoing and future operations and maintenance requirements. The WAMP is intended to be a planning document used to provide a rational framework for understanding the existing risk and stewardship requirements of the City's stormwater asset portfolio and planning for the appropriate standard of care necessary to provide an acceptable level of service to the City's stormwater stakeholders and customers. This WAMP consolidates the City's asset information into a structured framework and uses it to provide a justifiable basis to support long-term organization, operations, and asset management decisions.

The WAMP is the asset management plan for the City's stormwater assets and addresses five (5) key core questions of asset management in order to optimize the value of the assets based on the City's stormwater organizational objectives.

1. What is the current state of the stormwater assets?
2. What is the required level of service?
3. Which assets are critical to sustained performance?
4. What are the best operation and maintenance & capital improvement investment strategies?
5. What is the best long-term funding strategy?

1.2 Plan Development Approach

Having an effective asset management program that will inform the City Flood Resilience and Environmental Group's physical infrastructure investment planning throughout the asset lifecycle is the ultimate objective of the asset management implementation roadmap.

An effective asset management program will support data-driven and risk-based decision making. The desired end-result includes the following:

- **Asset Management Strategy:** A clear and concise plan is available that states the needs and approach to the Public Works Stormwater and Environmental Groups' Asset Management Program and is integrated into the culture.
- **Data Needs:** Data is collected, organized, easily available and useful to make decisions regarding the maintenance, rehabilitation and replacement of assets.
- **Risk Management:** A clear understanding of the Public Works Stormwater and Environmental Groups' risk tolerance is established and is integrated into the organizational

culture. In addition, a guide to evaluate risks that incorporates consequences and likelihood of failure (LoF) is available.

- **Prioritize and Plan Investment:** Public Works Stormwater and Environmental Groups' asset systems have asset management plans detailing the appropriate maintenance and monitoring strategies for each asset class and watershed, and scheduled capital renewal/replacement of assets based on risk. Collectively, these asset management plans inform the Public Works Stormwater and Environmental Groups' overall asset investments.

1.3 Asset Management Plan Implementation Process

The Public Works Stormwater and Environmental Groups' initial Asset Management Implementation Roadmap consists of initiatives spread across, and aligned with, each of the six (6) major Institute of Asset Management (IAM) Anatomy groups:

- Strategy and Planning
- Asset Management Decision Making
- Asset Lifecycle Management
- Asset Information
- Organization and People
- Risk & Review

The implementation roadmap describes each of the recommended initiatives, along with specific actions, the assigned staff responsible for supporting the initiative implementation, the anticipated timeframe for completion, the priority of the action, and the estimated cost for support from external resources.

The implementation roadmap action items and corresponding schedule are presented at a high level in **Figure 1.1**, with initiative detail provided in **Appendix A**.

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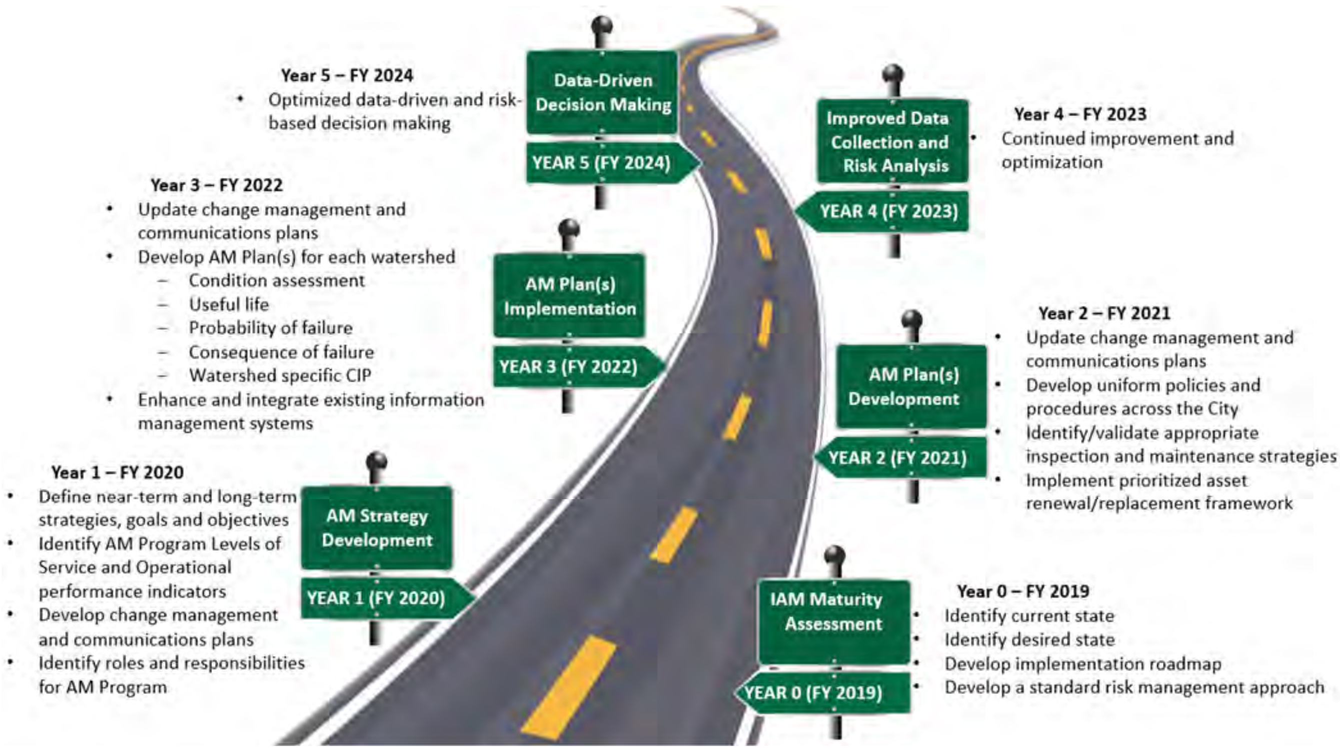
Figure 1.1: Public Works Stormwater and Environmental Groups Asset Management Implementation Roadmap



1.4 Plan Relation with other City Strategic Master Plans

The City of Fort Lauderdale has several City Strategic Planning initiatives that require consideration and for which the WAMP initiatives should be aligned. These planning documents include: Press Play Fort Lauderdale (2024); Fast Forward Fort Lauderdale (2035); City of Fort Lauderdale Sustainability Action Plan (Update 2011); Adopted Community Investment Plan Fiscal Years 2020-2024; the Commission Annual Action Plan FY 2020; Comprehensive Utility Strategic Master Plan (2017); and Comprehensive Plan (2016). In addition, the City performs an annual Neighbor Survey to measure neighbor satisfaction and set community priorities. In April 2013, the City Commission released the community's Vision Plan entitled *Fast Forward Fort Lauderdale 2035*, an inspirational view of the future and what the community of Fort Lauderdale wants to become. To carry out this Vision, *Press Play Fort Lauderdale* was developed. *Press Play Fort Lauderdale (2024)* is the community's strategic plan which focuses on the first five-year journey to the Vision Plan.

The Press Play Fort Lauderdale (2024) outlines 8 aspirational goals and 35 objectives and moved the strategic initiatives to be developed by the City departments. Each Department will prepare an annual Business Plan that will be tied and support the Citywide goals, objectives, and performance measures. The new approach allows the staff to be actively involved and emphasizes cross-departmental collaboration. It allows to measure the progress and outcomes of the strategic plan key performance indicators were identified to guide decision-making and resource allocation. The WAMP is designed to align with and provide support for this citywide strategic plan.

On March 13th, 2019, the Hazen Team facilitated a 2.5-hour asset management strategic planning workshop with key Public Works Stormwater and Environmental Group's, management and staff responsible for asset management program development and implementation elements. As part of this workshop, the *Press Play Fort Lauderdale (2018)* strategic plan was reviewed to determine WAMP and IAM Group alignment opportunities. After the workshop, the City rolled out the new strategic plan, Press Play Fort Lauderdale 2014. The top-rated City initiatives and priorities identified during the asset management strategic planning workshop were adjusted to align with the new Press Play 2024. In addition, on July 23rd the City provided to the Hazen Team the City's Flood Resilient and Environmental Mission, Vision, and Goals.

The following top-rated City priorities were identified, along with the IAM Group to which they best align. Furthermore, the City priorities were aligned with the City Flood Resilience and Environmental accepted goals. The City's Flood Resilience and Environmental Mission, Vision, and Goals are further described in Section 1.7.1.

- *Press Play Fort Lauderdale* (2024): Goal 1 – Build a sustainable and resilient community, Objective– Reduce flooding and adapt to sea level rise. IAM Group 1 – Strategy and Planning and Flood Resilience and Environmental Goal 1 – Reduce flooding and adapt to sea level rise.
- *Press Play Fort Lauderdale* (2024): Goal 8 – Build a leading government organization that manages all resources wisely and sustainably, Objective– Maintain financial integrity through sound budgeting practices, prudent fiscal management, cost effective operations, and long-term financial planning. IAM Group 2 – Asset Management Decision-Making.
- *Press Play Fort Lauderdale* (2024): Goal 1 - – Build a sustainable and resilient community, Objective – Proactively maintain our water, wastewater, stormwater, road, and bridge infrastructure. IAM Group 1 – Strategy and Planning and Flood Resilience and Environmental Goal 3 – Proactively maintain the City stormwater infrastructure.
- *Press Play Fort Lauderdale* (2024): Goal 1 - Build a sustainable and resilient community, Objective – Ensure climate change resiliency and implement local and regional strategies to reduce our carbon footprint. IAM Group 1 – Strategy and Planning and Flood Resilience and Environmental Goal 5 – Collaborate with stakeholders to mutually understand and address our community's flooding risks.
- *Press Play Fort Lauderdale* (2024): Goal 3 – Build a healthy and engaging community, Objective – Improve water quality and our natural environment. IAM Group 1 – Strategy and Planning and Flood Resilience and Environmental Goal 2 – Improve water quality and our natural resources.

In addition, the following new strategic objectives were proposed:

- Implement Stormwater Master Plan: IAM Group 1 – Strategy and Planning and Flood Resilience and Environmental Goal 1 – Reduce flooding and adapt to sea level rise and Goal 3 – Proactively maintain the City stormwater infrastructure.

- Implement Enterprise Asset Management (EAM) philosophy across the organization: IAM Group 2 – Asset Management Decision-Making and Flood Resilience and Environmental Goal 3 – Proactively maintain the City stormwater infrastructure.

The Hazen Team took into account these high priority strategies as this initial WAMP document was developed.

1.5 Suggested use of this Plan

The WAMP is intended to serve as a road map for the City to ensure that its stormwater and environmental related actions and activities are planned and prioritized to address flood risk management and water quality at an acceptable level of service and cost to its customers and stakeholders. This WAMP provides a vehicle to identify and prioritize potential stormwater management challenges and to ensure the appropriate standard of care is employed for each asset/asset type based on the application of a defined risk assessment framework.

1.6 Asset Management Plan Updates

The WAMP is the guiding strategic document providing the overarching strategic goals and objectives and the framework and methodology governing the content of the asset management plans (AMPs) created for each watershed. These individual AMPs will provide the LoF and CoF (and subsequent business risk exposure) evaluation and update, along with the forecasted O&M and capital costs for the subsequent five fiscal years.

It is recommended that the WAMP's strategic goals and objectives be reviewed as frequently as is feasible given the City's current and future asset management staffing levels. Ideally, once asset management roles and responsibilities are defined and staffing levels are deemed adequate to fulfill these roles and responsibilities, it is recommended that the WAMP's strategic goals and objectives be reviewed annually to ensure alignment throughout all watershed AMPs. In addition, as each watershed's LoF, CoF, and business risk exposure are defined based on updated condition assessment information, the watershed five-year forecasted O&M and capital expenditures projections should also be reviewed and updated annually.

1.7 City of Fort Lauderdale Organizational Capabilities and Responsibilities

The City's departments, divisions, and sections responsible for flood resilience and environmental resources management are described in the sections that follow. The main functional capabilities, roles and responsibilities to support the strategic planning, design, and operation and maintenance of stormwater asset management are presented in **Table 1.1**. **Appendix B** presents the PWD Org Chart as of January 1, 2019.

Table 1.1: Flood Resilience and Environmental Groups Functional Capabilities

<table>
<tr><th>Divisions / Sections</th><th>Positions</th></tr>
<tr><td colspan="2" align="center">Public Works Department</td></tr>
<tr><td>Executive Leadership</td><td>PW Director
Deputy Director – Public Works
Assistant PW Director – Sustainability
Assistant PW Director – Utilities
Assistant PW Director – Engineering</td></tr>
<tr><td colspan="2" align="center">WAMP-Related Proposed Responsibilities</td></tr>
<tr><td colspan="2">
Make final decisions pertaining to the WAMP
Lead development and establish organization-wide Asset Management Policy statement
Approve Level of Service and risk-based resource plans
Assess any workforce gaps related to revised PM workload and anticipated corrective and reactive work resulting from risk-based maintenance optimization
Develop strategy to fill resource gaps
Create Asset Management Steering Committee and institute procedures and practices
Establish change management procedures for Asset Management Program implementation
Solicit stakeholder feedback on performance relative to Level of Service
</td></tr>
<tr><td>Asset Management</td><td>Cityworks Administrator
AM Steering Committee (TBD)</td></tr>
<tr><td colspan="2" align="center">WAMP-Related Proposed Responsibilities</td></tr>
<tr><td colspan="2">
Develop organization-wide Asset Management Policy statement
Implement problem, cause, remedy codes into Cityworks
Develop and implement an asset onboarding workflow
Determine and implement schedule for attribute updates, including using Cityworks/GIS to edit attributes
Modify Work Order development procedure
Review potential for GIS editing in the field in conjunction with QA/QC workflow
Implement service request for vertical assets
Consolidate to a single instance of Cityworks
Develop roadmap to include integration of materials management and financial platform
Leverage Cityworks in field (tablet mode) for data collection
Align and assign asset management roles and responsibilities (AM Steering Committee)
Implement Levels of Service, aligned KPIs, strategies, and training (AM Steering Committee)
Formalize LoS and KPI tracking process and reporting mechanism (AM Steering Committee)
Measure effectiveness and adherence to policies (AM Steering Committee)
organizational alignment and readiness) (AM Steering Committee)
Formalize LoS and KPI tracking process and reporting mechanism (AM Steering Committee)
Keep asset/system risk profiles current (AM Steering Committee)
Track life cycle costs (up-front capital and all O&M) for each asset/class (AM Steering Committee)
Keep replacement cost information current (AM Steering Committee)
</td></tr>
<tr><td>Sustainability Division</td><td>Sustainability Manager</td></tr>
<tr><td>1. Sustainability & Climate Resilience</td><td>Sustainability Administrator
Administrative Assistant I
Senior Project Manager
Sustainability Coordinator
Sustainability Analyst
Urban Forestry Supervisor</td></tr>
</table>

Divisions / Sections	Positions
WAMP-Related Proposed Responsibilities	
• Coordinate implementation of asset management goals with Citywide Sustainability Action Plan • Coordinate climate resiliency into stormwater operations • Promote sustainable initiatives throughout the community, providing education on sustainable activities to improve economic, social and environmental viability of the WAMP	
2. Environmental and Regulatory Affairs	Environmental Compliance Manager Environmental Compliance Supervisor Environmental Program Coordinator Environmental Inspector II Environmental Inspector Senior Administrative Assistant
WAMP-Related Proposed Responsibilities	
• Set waterbody prioritization to meet target water quality LoS • NPDES coordination to meet established LoS • Coordinate with Floodplain Manager group to meet targeted CRS level and preparation of flooding reports	
3. Fleet Services	
WAMP-Related Proposed Responsibilities	
• Track operational costs for vehicles maintenance, repair and replacement by work order	
4. Stormwater Operations	Stormwater Operations Manager Senior Administrative Assistant
WAMP-Related Proposed Responsibilities	
• Implement IPSECA Process for O&M • Optimize PM scheduling based on risk • Implement problem, cause, remedy codes into Cityworks • Formalize PMs and CMs • Formalize procedures for engineering principles throughout life cycle to ensure asset performance • Formalize and implement operational changes per new asset management strategy Ensure existing emergency response plans are updated to include prioritization of activities based on asset criticality	
4a. Inspections Inspection Customer Service Stormwater Cleaning Street Cleaning TV Inspection	Stormwater Chief Utility Crew Leader Senior USW Utility SW
WAMP-Related Proposed Responsibilities	
• Formalize processes for seasonal process cleaning and emergency O&M • Track equipment use and associated costs by Work Order • Track materials costs by Work Order, and interface with purchasing system • Standardize inspection forms • Inspect stormwater assets and identify maintenance and repair requirements • Clean stormwater infrastructure as per AM strategy. Refer to SOP PW-SUST-STW-CLE-1 (to be updated during WAMP implementation phase)	
4b. Maintenance Stormwater Repairs Swales	Stormwater Chief Utility Crew Leader Senior USW Utility SW

Divisions / Sections	Positions
WAMP-Related Proposed Responsibilities	
• Track equipment use and associated costs by Work Order • Track materials costs by Work Order, and interface with purchasing system • Formalize PMs and CMs • Formalize and implement operational changes per new asset management strategy • Establish and implement Problem/Cause/Remedy for deeper suite of AM reports and visualizations • Perform stormwater infrastructure repairs based on established asset priority. Refer to PW-SUST-STW-MA-1 to 12 and PW-UTL-STW-MA-3 (Existing SOPs to be updated during WAMP implementation phase). • Install and maintains swales. Refer to Swale Program SOPs for daily operations and construction of swales (PW-SUST-STW-SWA-1 to 3)(1) (Existing SOPs to be updated during WAMP Implementation phase). • Compare CM and PM activities against staff skills and capacity and assess and fill gaps	
Engineering Division	**Chief Engineer**
1. Stormwater Adaptation and Design Division	Senior Project Manager Project Manager II Engineering Inspector II
WAMP-Related Proposed Responsibilities	
• Formalize standards for prioritization of equipment, pipe network, and pump station standards • Formalize process and workflow for requirements analysis, design and evaluation of asset systems and components • Formalize procedures for engineering principles throughout life cycle to ensure asset performance • Develop and implement an asset onboarding workflow • Develop and implement technical review systematically to decide on assets to be decommissioned and disposed • Standardize risk assessment framework across all asset classes • Formalize LoS and KPI tracking process and reporting mechanism • Implement formalized BRE tool • Ensure business continuity plans (or Emergency Operations Plans) are updated and regularly exercised.	
2. CADD	Survey/CADD Coordinator Engineering Technician Engineering Technician II
WAMP-Related Proposed Responsibilities	
• Oversee the as-built and survey drawing document control requirements • Oversee development and management of templates for as-built drawings and design CADD drawings to facilitate asset data integration into stormwater geodatabase	
3. Survey	Surveyor Surveying Operations Supervisor Senior Technical Strategist Engineering Aide Surveying Supervisor GIS Analyst
WAMP-Related Proposed Responsibilities	
• Provide sign and sealed stormwater topographic surveys to GIS Division for stormwater geodatabase asset updates	

Divisions / Sections	Positions
Strategic Support	Business Operations Management
1. Administrative Support	Administrative Supervisor Senior Management Champion
Data Control	Administrative Assistant Administrative Aide
Utilities Finance	Senior Account Clerk Senior Accountant Clerk
WAMP-Related Proposed Responsibilities	
• Develop roadmap to include integration of materials management and financial platform	
Call Center	Senior Administrative Assistant Administrative Aide
WAMP-Related Proposed Responsibilities	
• Provide customer support and track customer requests via Q-Alert System	
2. Financial Services	Senior Financial Administrator
Engineering Finance and Grants	Senior Administrative Assistant Senior Account Clerk Administrative Aide
WAMP-Related Proposed Responsibilities	
• Perform cost estimating, prepare budget analyses • Oversee grant acquisition • Capital decision-making and O&M decision-making project evaluation and adoption of process	
3. Budget and Procurement	Senior Administrative Assistant
WAMP-Related Proposed Responsibilities	
• Pre-align materials and service orders with Work Orders or storeroom (3-way match)	
4. Human Resources and Payroll	Administrative Assistant Administrative Assistant II
WAMP-Related Proposed Responsibilities	
• Develop Level of Service and risk-based resource plans • Multiple staff / domains supporting specific STW OPS departments	
5. Inventory Pipeyard and Management Support	Administrative Supervisor Sr. Procurement Inventory Specialist Procurement Inventory Specialist Senior Administrative Assistant Administrative Aide
Department of Sustainable Development	
(1) Building Services Division	Floodplain Manager/CRS Coordinator Urban Land Development Manager
WAMP-Related Proposed Responsibilities	
• Implement CRS recommendations • Report construction of public stormwater systems by new development, including stormwater as-builts and drainage easements	
Information Technology Services Department	
1. ITS/GIS Division	Senior Technology Strategist GIS Manager GIS Analyst

Divisions / Sections	Positions
WAMP-Related Proposed Responsibilities	
• Manage, analyze, and map asset geographical data • Determine and implement schedule for attribute updates, including using Cityworks/GIS to edit attributes • Review potential for GIS editing in the field in conjunction with QA/QC workflow • Multiple staff / domains supporting specific STW OPS departments • Institute QA/QC procedures as part of field data collection	

Note:

(5) Existing SOPs will be revised during the implementation phase.

1.7.1 City Flood Resilience and Environmental Vision, Mission and Goals

The City of Fort Lauderdale has shown that it recognizes the value of mitigating flood risk and maintaining the community's environmental resources by including in the City's 2024 Strategic Plan the objective to be a sustainable and resilient community. The PWD's vision is to provide flood protection and waterway pollution control through efficient and sustainable management of the City's stormwater and related assets.

Actions taken to meet the 5 main goals presented in **Figure 1.2** will help the City accomplish its resilience and environmental mission of proactively managing their stormwater and environmental resources through best asset management practices.

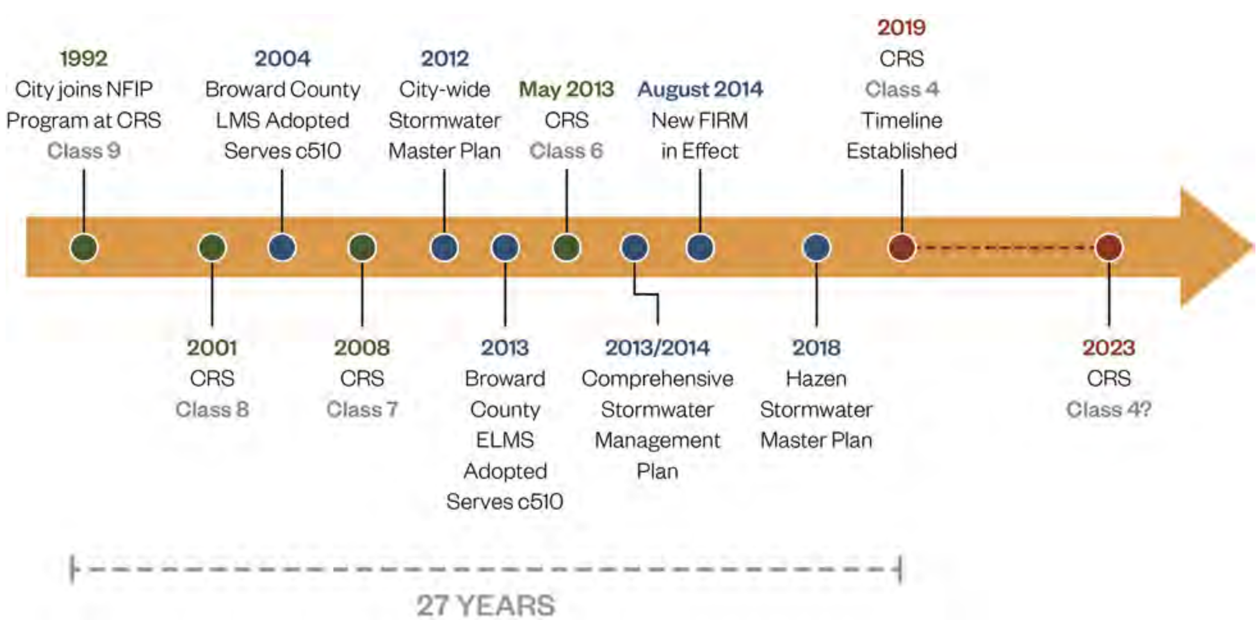
Figure 1.2: Mission, Vision, and Goals

The following sub-sections will identify how the City has made improvements to reduce flooding and maintain the stormwater infrastructure through the CRS program. They will also provide the anticipated schedule of projects designed to improve water quality in response to the City's NPDES MS4 Permit.

1.7.1.1 Community Rating System (CRS)

The National Flood Insurance Program's (NFIP) CRS is a voluntary program that rewards communities with up to a 45% insurance rate reduction based on the level of floodplain management activities that exceed the NFIP's minimum standard. The City joined the CRS program in 1992 at Class 9, progressed to Class 6 over a 21-year period, and has maintained its Class 6 Level since 2013. **Figure 1.3** shows a detailed timeline of the City's advancement through the ten CRS Levels.

Figure 1.3: CRS Progress to Date



The CRS Level is determined by a Score Card which outlines the goals and activities to be met and the maximum points that can be achieved by completing each activity. The City seeks to obtain a Class 4 Level within the next five years which requires that at least 50% of the watershed area is covered in watershed management plans, in addition to maintaining the Class 6 activities. It also means the City will need to earn approximately 1,000 additional points for CRS activities. By developing this Watershed Asset Management Plan the City will be able to meet this CRS requirement under Activity 452 (b) of the CRS Coordinator's Manual earning an additional 315 points.

By participating in the program, the City of Fort Lauderdale had estimated cumulative premium savings of $20M since its Class 6 designation in 2013. Moving to a Cass 4 will give the City a premium reduction of 30% in the Special Flood Hazard Area (SFHA), an additional 10% savings from the current premium reduction of 20% for Class 6, however premium reductions outside the SFHA will not change as the current 10% reduction is the highest reduction possible in the CRS classes. Based on 2018 premiums, this would save the City nearly $2M each year.

During the implementation phase of the WAMP, the Hazen Team will work with the City to determine the cost-benefit of moving from a CRS Class 6 to a CRS Class 4 by assisting the City in answering the following questions:

- Are the CRS activities needed to achieve a Class 4 feasible under the City's current staffing levels?
- What will the City need to invest in infrastructure and services to achieve a Class 4 rating?
- What City resources will be required to complete remaining CRS activities and what will it cost to commit those resources (i.e. staff time, collateral, etc.)?
- What additional effort is required to manage and report on activities?
- Is a five-year timeline reasonable for obtaining a Class 4 rating?
- Is achieving a CRS Class 4 rating consistent with the City's existing goals and plans?

To help answer these questions and align the WAMP CRS process with the City's Budget/CIP procedures, the Hazen Team suggests adopting a project scoring protocol similar to that used by the City Manager's Office. With a change in criteria to address the above listed questions, this Project Scoring Worksheet can act as a tool for prioritizing CRS activities based on the activity's impact on strategic goals, as well as the level of effort, cost of infrastructure/services, and management/reporting costs. An example worksheet is illustrated in **Figure 1.4** below and the full Benefit Matrix for Remaining CRS Point Opportunities. The matrix was developed from information on CRS Activity documentation furnished in the City of Fort Lauderdale 2019 CRS Cycle Visit Needs Assessment.

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Figure 1.4: City of Fort Lauderdale Remaining CRS Point Opportunities Benefit Matrix (Abbreviated)

Benefit Matrix			Level of Effort (staff hours) required to attain	Cost of infrastructure/services	Level of Effort (staff hours) required to maintain/report	Project Feasibility & Timeline	Project Consistency with existing approved plans	
			CRS Task Attributes					
Weighted Score (Rate each project category for impact using Scoring Criteria 0,1,2 – Scoring Criteria to be determined during WAMP Implementation Phase):			0	0	0	0	0	Total Points
Activity/ Element	Max Points	Documentation						
300 Public Information Activities								
310 Elevation Certificates (116 points)								
312(b) Maintaining ECs for Post-Firm Buildings	48	1. Copies of certificates (ECs and any attachments).						
312(c) Maintaining ECs for Pre-FIRM Buildings	30	1. Copies of certificates (ECs and any attachments).						
330 Outreach Projects (350 points)								
332(b) Flood Response Preparations	50	1. Copies of the projects 2. Written procedures for dissemination of the projects 3. Documentation that the materials were reviewed to determine whether they are still current and appropriate.						

1.7.1.2 NPDES and Water Quality

In accordance with the City's existing Municipal Separate Storm Sewer System Permit (MS4) (Cycle 4 National Pollutant Discharge Elimination System - Permit Number FLS000017-004, dated January 5, 2017), the City has established goals related to overall improvement of subject surface waters that have been identified as impaired. Based on collection of surface water quality samples at various designated locations within the City limits, the primary pollutant of concern is listed as fecal coliform.

Table 1.2 provides the seven top ranked impaired water bodies within the City limits and identifies the required waste load allocation (WLA) reduction for each water body. The source of this information was the City of Fort Lauderdale NPDES MS4 Permit FLS000017-004, and the Total Maximum Daily Load (TMDL) Prioritization Report, dated June 2017 (provided in **Appendix C**). Conclusions and prioritization approach were based on the Florida Department of Environmental Protection (FDEP) TMDL report dated 2012, using fecal coliform water quality data collected from 2003 to 2010, nearly 10 to 17 years ago. The ranking was based on magnitude and frequency of TMDL exceedances over the monitored period.

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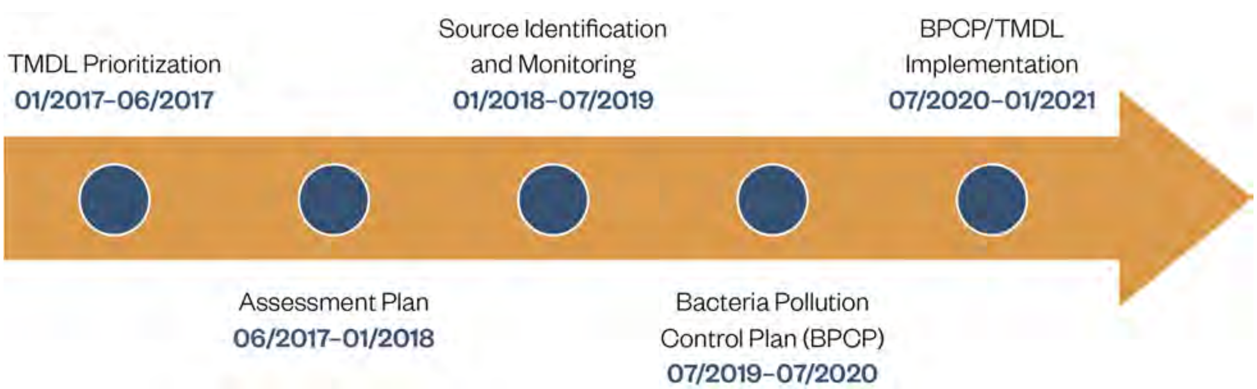
Table 1.2: Total Maximum Daily Loads (TMDL) – DEP Adopted (EPA Approved) and EPA Established

WBID	Waterbody Name	WLA* for NPDES Stormwater (% reduction)	TMDL Status	Pollutant of Concern
3276A	New River (North Fork)	94%	DEP adopted-EPA approved	Bacteria
3277A	New River Canal (South)	69%	DEP adopted-EPA approved	Bacteria
3274	C-13 East (Middle River) Canal	67%	DEP adopted-EPA approved	Bacteria
3226G4	Las Olas Isles	58%	DEP adopted-EPA approved	Bacteria
3276	C-12 Canal	52%	DEP adopted-EPA approved	Bacteria
3270	C-14 (Cypress Creek) Canal	22%	DEP adopted-EPA approved	Bacteria
3273	C-13 West (Middle River) Canal	22%	DEP adopted-EPA approved	Bacteria

The City established as their top priority for improved water quality the North Fork New River followed by the South New River Canal, then the C-13 East (Middle River Canal). The June 2017 TMDL Prioritization Report identified future stormwater improvement projects and set an Implementation Schedule for further assessment of the North Fork over the last two years followed by development and implementation of a Bacteria Pollution Control Plan for the water body. The Implementation Schedule is shown in **Figure 1.5**.

Figure 1.5: New River TMDL Implementation Schedule



Based on this implementation schedule, the North Fork New River waterbody is anticipated to see a significant reduction in bacteria loading through the current permit cycle (January 5, 2017 through January 5, 2021).

The proposed prioritization and implementation schedule is expected to meet the Stormwater Discharge Compliance and Water Quality Standards requirements in Part VIII of the NPDES MS4 Permit. TMDL implementation schedules for the remaining water bodies will be developed and implemented in future permit cycles.

The City's process to establish goals for improved water quality is sound; however, a review of more recent water quality data needs to be completed in order to determine if the prioritization process previously employed still yields the same list of ranked priorities. In addition, depending upon the salinity of the water bodies, the United States Environmental Protection Agency (USEPA) recommends evaluation of not only fecal coliform, but also enterococcus and e-coli bacteria. The City should confirm with the USEPA and FDEP the viability of using fecal coliform as the target waste load reduction parameter as compared to enterococcus and e-coli. The following steps are required to establish a more real time list of impaired water bodies and confirm (or modify) the priority listing established in the City's 2017 report:

- For the listed water bodies in Table 1-1 of the 2017 TMDL City report, gather and summarize current bacterial water quality data (in addition to the nutrient and dissolved oxygen records) and compare these results to data previously collected, during and since the 2003 to 2010 time period;
- Using the prioritized approach listed in the 2017 TMDL City report, develop a re-prioritized (as needed) list of impaired water bodies;
- Using this re-prioritized listing of impaired water bodies, develop an action plan of detailed measures required to improve water quality; and
- Include in the action plan a list of measures required to achieve stated WLAs, costs for their implementation, and a five-year plan for completion and monitoring of effectiveness of measures implemented.

1.7.2 Public Works Department

The City of Fort Lauderdale Public Works Department is made up of three Divisions (related to the WAMP): (1) Engineering, (2) Sustainability, and (3) Utilities. The WAMP supports the goals and objectives of the Sustainability Division.

1.7.2.1 Engineering Division

The Engineering Division is responsible for managing the implementation of City infrastructure upgrade projects. Projects range from improving sidewalks, seawalls, bridges, fire stations, water management facilities, sewer management facilities, stormwater drainage, parks, and beaches.

1.7.2.2 Sustainability Division

The Sustainability Division is organized into five sections to meet its mission to implement the Citywide Sustainability Action Plan, along with optimizing conservation and efficiency with City operations and providing essential environmental services. The Stormwater Operations Group, the Environmental Services and Regulatory Affairs Groups (Environmental Group), and the Sustainable and Climate Resilience Section comprise three of the five sections within the Sustainability Division.

1.7.2.2.1 Stormwater Section

The Stormwater Operations Group (STW OPS) is dedicated to maintaining and improving the City's stormwater infrastructure. The stormwater workgroups perform the following duties:

- Proactively inspect stormwater infrastructure,
- Respond to stormwater and street cleaning resident's service requests,
- Prepare City areas for hide tides and flood events,
- Inspect after high tide events and flooding events,
- Maintain the stormwater system,
- Proactively maintains the City's streets clean,
- Repair and replace aging infrastructure,
- Construct swales to reduce street flooding and stormwater runoff, and
- Improve the overall water quality in the City's waterways.

1.7.2.2.2 Environmental and Regulatory Affairs

The Environmental and Regulatory Affairs Section is charged with protecting the natural environment and the City's water, wastewater, and stormwater infrastructure. This WAMP document will highlight the Flood Resilience and Environmental Group's contributions to the stormwater infrastructure and natural environment. The key operations of the Environmental Group with respect to stormwater are:

- Flooding,
- Water quality, and
- Protecting and preserving the City's natural resources like the beaches and waterways.

The Environmental Group performs these duties in consultation with other City departments. This group is also engaged in educational and outreach opportunities to promote the importance and the sustainable use of our natural resources.

1.7.2.3 Strategic Support

The Strategic Support Section provides administrative support and financial services to the Public Works Engineering Department. The key services are:

- Engineering finance and grants,
- Budget and Procurement,
- Human resources and payroll,

- Data Control,
- Utilities finance, and
- Call center to address residents service requests and questions.

1.7.3 Department of Sustainable Development

1.7.3.1 Building Services Division - Floodplain Management and Community Rating System (CRS)

The Department of Sustainable Development is primarily responsible for assessing and reporting the CRS activities which were discussed in more detail in **Section 1.7.1.1** of this document.

1.8 City Watersheds and Stormwater System

1.8.1 City's Stormwater System

The City's existing stormwater geodatabase comprises of 14 feature classes, of which 12 are populated and 2 are in the process of being populated. In addition, there are 7 asset classes that are not in the stormwater geodatabase and are identified in **Table 1.3** as "undefined". **Table 1.3** summarizes the asset classes and the number of assets per feature class, as identified in the City's stormwater geodatabase and the STW OPS reports.

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Table 1.3: Summary of Existing Feature Classes and Number of Features per Feature Class (2019 Stormwater Geodatabase)

Asset Classes	Number of Hard Assets (Stormwater Geodatabase)
Control Valve	152
Pond(1)	18
Discharge Point	1,379
Drainage Well	50
Exfiltration Trench(1)	
Inlet	14,982* (an additional 12 are “Removed”)
Manhole	2,930
Gravity Main	18,787* (an additional 13 are “Removed, and an additional 55 are NULL in activity status)
Network Structure	1,406
Pollution Control Structure(1)	
Pollution Control Device	213
Pump Station	9
Unknown Point	3,029
Weir Structure	200
Culvert (2)	undefined
Ditch (Open Drain) (2)	undefined
Trench Drain (2)	undefined
Pressure Pipe (2)	undefined
Right of Way (2)	undefined
Seawall (2)	undefined
Swale (2)	undefined

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) There is no feature class for this asset in the stormwater geodatabase at this point.

1.8.2 City’s Primary Watersheds

The City is composed of ten individual watersheds ranging in size from approximately 3.24 to 16.34 square miles (2,100 to 10,500 acres) characterized by urban development, low-lying topography and intersected by numerous canals and rivers. **Figure 1.6** presents the 10 primary watersheds within the City. **Table 1.4** lists the 10 City watersheds and the number of total assets within each watershed in accordance with the City’s stormwater geodatabase.

Figure 1.6: City Watersheds

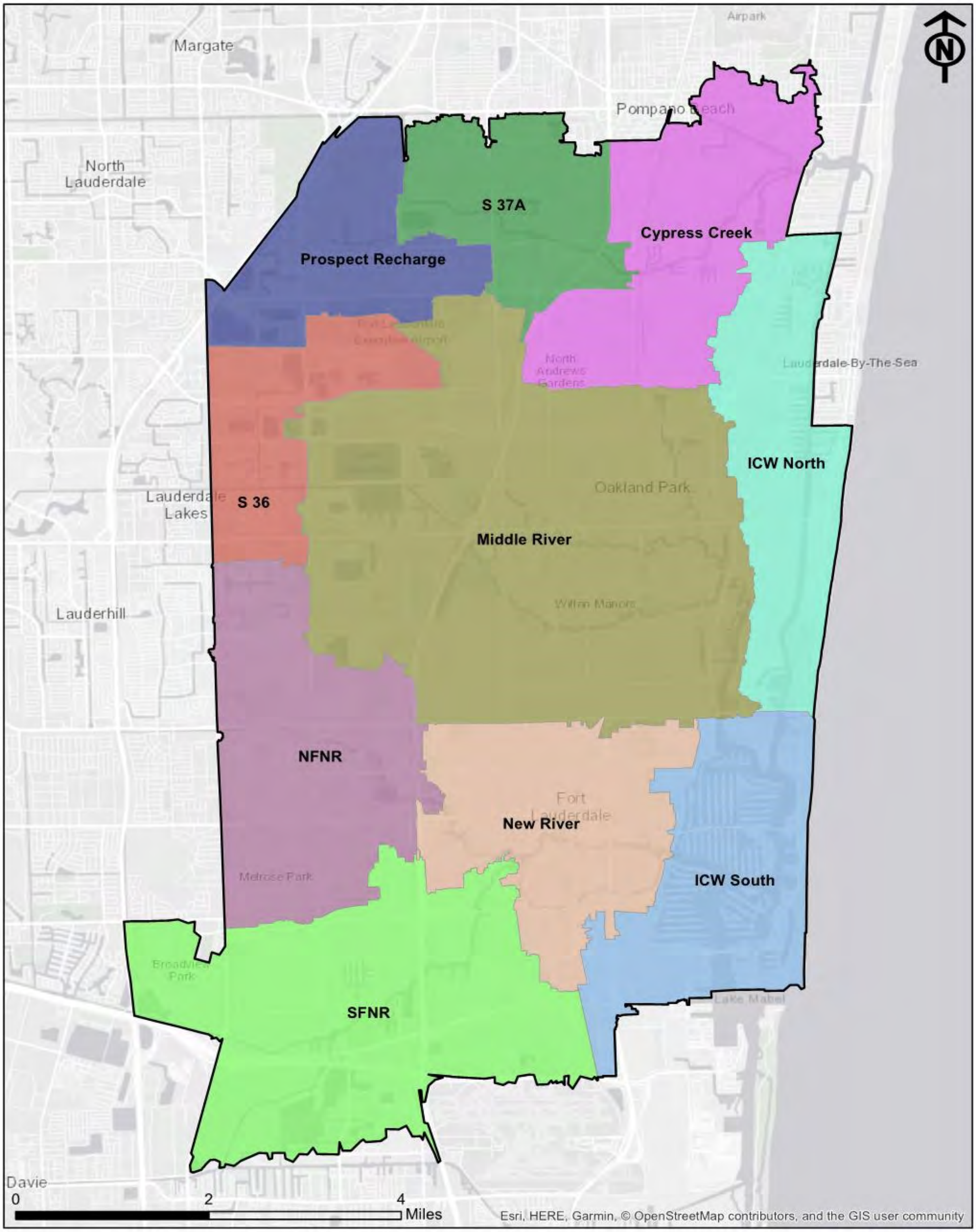


Table 1.4: Watershed Hard Asset Identification

Watersheds	Number of Hard Assets (Stormwater Geodatabase)	Total Watershed Area (Square Miles)	Watershed Area within City Boundary (Square Miles)
Cypress Creek	1,115	5.65	1.25
Intracoastal Waterway (ICW) North	5,337	4.88	4.78
Intracoastal Waterway (ICW) South	7,254	5.30	5.26
Middle River	8,363	16.34	7.30
New River	11,364	5.29	5.29
North Fork New River (NFNR)	2,949	6.40	2.56
South Fork New River (SFNR)	4,088	9.65	5.86
Prospect Recharge	1,755	3.71	1.97
Fort Lauderdale Executive Airport (S 36)	491	3.24	1.10
Uptown S37A	437	3.54	0.63

Table 1.5 presents the number of associations and the adjacent cities for each watershed.

Table 1.5: Number of Associations and Adjacent Cities for Each Watershed

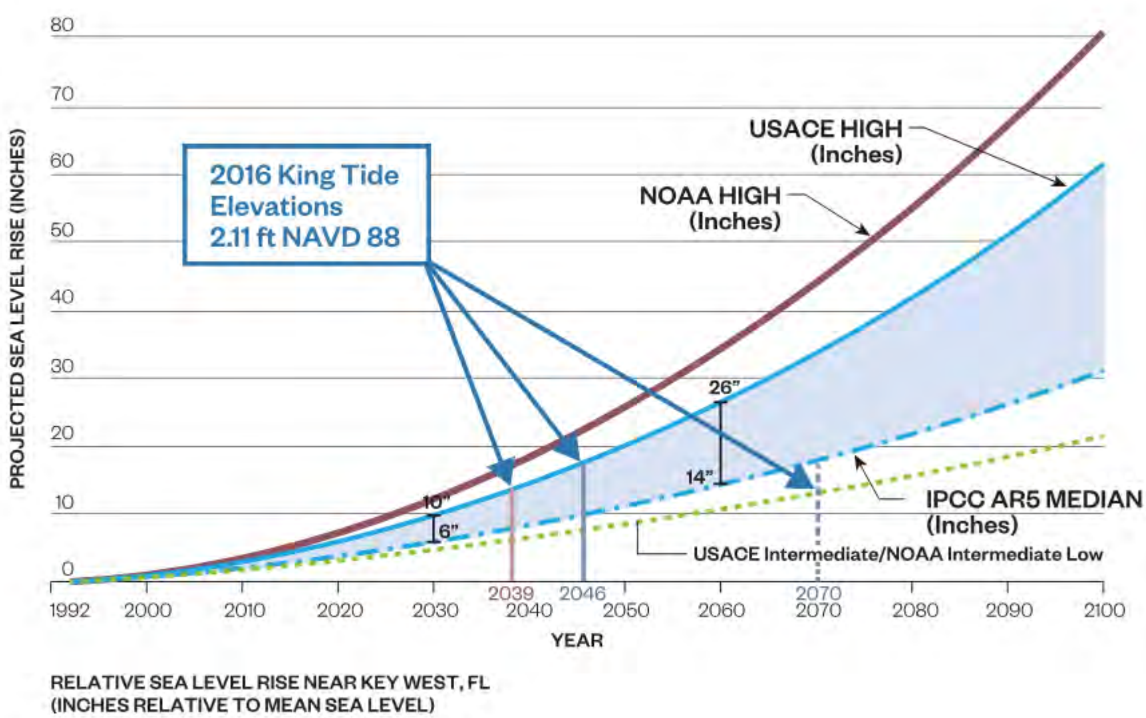
Watersheds	Number of Associations	Adjacent Cities
Cypress Creek	10	Pompano Beach, Oakland Park
Intracoastal Waterway (ICW) North	32	Pompano Beach, Lauderdale By The Sea, Sea Ranch Lakes
Intracoastal Waterway (ICW) South	48	Dania Beach, Hollywood, FLL Airport
Middle River	20	Oakland Park, Tamarac, Lauderdale Lakes, Lauderhill, Un-incorporated Broward Co.
New River	50	None
North Fork New River (NFNR)	11	Lauderhill, Plantation, Lauderdale Lakes, Unincorporated Broward Co.
South Fork New River (SFNR)	24	Davie, Plantation, Un-incorporated Broward Co., Dania Beach, Hollywood, FLL Airport
Prospect Recharge	3	North Lauderdale, Pompano Beach, Coconut Creek, Margate, Un-incorporated Broward Co.
Fort Lauderdale Executive Airport (S 36)	0	Tamarac, Lauderdale Lakes, North Lauderdale, Oakland Park
Uptown S37A	1	Pompano Beach, Oakland Park

1.8.3 Watershed Impacts

1.8.3.1 Climate Change Impacts: Sea Level Rise and Extreme Rainfalls

Sea level rise (SLR) impact shall be incorporated into stormwater design with the risk tolerance of the given infrastructure. The SWMP project proposed improvements were based on the latest global projections and climate science presented in the Unified Sea Level Rise Projection by The Southeast Florida Regional Climate Change Compact. The Unified Sea Level Rise Projection for the Southeast presents the projected SLR for the region from 1992 to 2100 as shown in **Figure 1.7**. It provides the SLR projection curves as established by USACE, NOAA and the IPCC. These projections have been subjected to rigorous review and represent the best available climate science for South Florida. The projections provide a range of outcomes to be incorporated into the design. For the SWMP projects, the modeling team modeled SLR scenarios using the USACE high SLR projections for 2035 and 2060 as part of the design analysis.

Figure 1.7: Unified Sea Level Rise Projection
(Southeast Florida Regional Climate Change Compact, 2015)



The 2016 king tide elevations shown on the figure above, along with team member site visits during king tide events, were utilized to inform planning and design of the proposed SWMP improvements.

Stormwater improvements are strategically phased and coordinated to account for both the timing of modifications on public and private property and future SLR projections in order to maximize the long-term value of the infrastructure improvements. The best example of strategically phased improvements in areas directly influenced by SLR and high tides is the proposed stormwater improvements in Southeast Isles Neighborhood. Initial improvements, like installation of tidal valves and raising of seawalls, were purposely prioritized in order to protect the lowest areas which are most severely impacted by tidal flooding. Securing the outer perimeter of the communities and providing backflow prevention were the initial steps required toward creating a climate-proof community and maximizing investments. Future modifications (timing dependent upon rate of SLR) include improvements such as expanding pump station capacities to accommodate newly vulnerable areas and increased runoff due to a shrinking unsaturated (soil) zone.

1.8.3.2 High Tides Impacts

Higher than normal tides normally occur during a new or full moon. The highest high tides of the year, are typically called king tides and occur during the months of August to November. These king tides may cause flooding in coastal and canal coastlines. The main tasks the STW OPS perform before, during, and after king tide events are:

- Before king tide events: Place MOT devices, delineators, and no wake signs
- During and after king tide events: Check leaking tidal valves, identify and record streets that flooded and take pictures, identify which inlets (catch basins) overtopped, and document seawalls that breached (also code enforcement inspects the seawalls that overtopped and documents the incidents to cite the residents).

The City provides information to the residents on king tides on the City's website. Detailed information on the following topics is provided:

- the predicted peak, date, and time of the king tides during the king tide months,
- how the City is going to prepare,
- City steps to address sea level rise,
- how neighbors can prepare,
- how neighbors can stay safe,
- general information on how tide predictions are made,
- flood risk information,
- drainage system maintenance, and
- and links to useful resources.

1.8.3.3 Development Projections and Impacts

Broward County Land Use GIS data was used to illustrate the composition of land use in each watershed (refer to Section 8 for watershed land use plans). Under Florida Statutes, Chapter 163, local governments are required to prepare a land use plan for certification by Broward County. As stated in the Housing

Element – Data Analysis of the City's Comprehensive Plan (2005), there were a total of 80,239 year-round housing units in Fort Lauderdale out of which multi-family units comprised 60 percent of the total units, while single-family units accounted for less than 40 percent. According to the population model used by Broward County, the total number of dwelling units expected for the City by 2025 are 105,856 and 108,806 by 2030. As vacant land becomes scarce, additional new dwellings will occur through redevelopment of parcels with existing structures or development of infill parcels. It is recommended that the unified sea level rise projection for Southeast Florida be applied when considering land use and long-term planning and functionality of stormwater infrastructure. Furthermore, adopting land use regulations to limit development and redevelopment in areas particularly vulnerable to tidal and storm flooding is recommended to limit the impact to natural systems and protect the City's waterways and shorelines.

In addition, all new dwellings shall integrate stormwater management components as part of the site design and permitting process. New construction shall be designed and permitted to meet stormwater management requirements, building codes, and environmental regulations. The Department of Sustainable Development, Engineering Division is responsible for development site plan reviews and stormwater collection system permitting.

1.8.4 Stormwater Master Plan Watershed Modeling

A hydrologic/hydraulic 1D/2D stormwater model of the City was developed under the Stormwater Master Plan and Design Implementation Program. The modeling effort consisted of a comprehensive basin by basin analysis of the existing and proposed stormwater systems and how they react to different conditions, including future projected climatological and land use conditions. The City was subdivided into 10 primary watersheds as shown in **Figure 1.2** (**Section 1.8.2**). Model results were used to help develop conceptual plans to address seven priority neighborhoods' stormwater issues, specifically in the areas found to be most susceptible to chronic flooding. Additional neighborhood details are provided in **Section 3**.

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SECTION 2 – OVERALL STORMWATER SYSTEM

2.1 What Assets does the City Own/Manage?

2.1.1 Asset Summary

The City categorizes the assets that are managed by the STW OPS or that are related to the stormwater system in three different categories as follows:

- Hard assets
- Soft assets
- Natural assets

The following sections describe each of these asset types in more detail.

2.1.1.1 Hard Assets

The City defines hard assets as human-made assets that are purchased and constructed, have a defined lifecycle and are replaced at the end of their useful life. **Table 2.1** summarizes the major components of the City's hard stormwater assets. The table includes asset inventory as identified in the City's stormwater geodatabase and as identified by STW OPS. The City is currently updating the stormwater geodatabase to include asset classes operated and maintained by STW OPS, which were not previously reflected in the stormwater geodatabase. The quantities shown in the table below are based on the best information available at the time this WAMP Document was prepared.

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Table 2.1: Number of Hard Assets per Asset Class (2019)

Hard Asset Class	Type of Asset	Number of Assets as per 2019 Stormwater Geodatabase	Number of City-Owned Assets as per 2019 Stormwater Geodatabase	Number of Assets as per STW OPS Reports
Control Valve	Tidal	150	150	161
	Unknown	1	0	
	Null	1	1	
				5 (End of Pipe Backflow Devices)
	Total (1)	152	151	
Pond	Null	18	18	
Discharge Point	Outfall	289	236	
	Other	43	38	
	Unknown	19	5	
	Null	1,028	770	
	Total (1)	1,379	1,049	1,038
Drainage Well	-	50	10	6
Exfiltration Trench (2)	-	-		
Inlet	Catch basin	326	185	
	Combination	466	125	
	Curb	975	375	
	Dry Well	89	41	
	Grate	5,877	4,025	
	Valley	30	17	
	Other	10	8	
	Unknown	6,935	4,157	
	Null	274	17	
	Total (1)	14,982	8,950	8,848
Manhole	Conflict	92	55	
	Standard	23	20	
	Terminal	539	243	
	Other	6	6	
	Unknown	1,780	856	
	Null	490	12	
	Total (1)	2,930	1,192	1,151
Gravity Main	Perforated	1367	643	
	Solid	16,702 (183.8 miles)	9,520 (162.4 miles)	183.5 miles
	Unknown	591	142	
	Null	127	4	
	Total (1)	18,787	10,309	
Network Structure	Pipe End (Endpoint)	933	262	
	Junction Chamber	472	329	
	Other	1	1	
	Total (1)	1,406	592	11

Hard Asset Class	Type of Asset	Number of Assets as per 2019 Stormwater Geodatabase	Number of City-Owned Assets as per 2019 Stormwater Geodatabase	Number of Assets as per STW OPS Reports
Pollution Control Structure (2)	-	-	-	
Pollution Control Device (2)	Aluminum Baffle	213	76	2
Pump Station	-	9(4)	0	4
Unknown Point	-	3,029	0	
Weir Structure	Horizontal	28	1	
	Vertical	45	0	
	Other	2	2	
	Null	125	32	
	Total (1)	200	35	
Swales (3)	Not a feature class – no asset information in stormwater geodatabase			Undefined
Unpaved Alleyways (3)	Not a feature class – no asset information in stormwater geodatabase			63 locations
Drainage Ditches (3)	Not a feature class – no asset information in stormwater geodatabase			40 locations
Drainage Canals (3)	Not a feature class – no asset information in stormwater geodatabase			
Culverts (3)	Not a feature class – no asset information in stormwater geodatabase			
Streets (to Sweep) (3)	Not a feature class – no asset information in stormwater geodatabase			Undefined
Seawalls (3)	Not a feature class – no asset information in stormwater geodatabase			35 (per Seawall Master Plan, 2018)
Light and Heavy Vehicles (3)	Not a feature class – no asset information in stormwater geodatabase			44

(1) Total count of for asset class is provided in the table (total is not an asset type in the geodatabase). (2). Asset class is under development or developed for future attribute population. (3) GIS Schema does not contain asset inventory of this asset class at this point. (4) Stormwater geodatabase needs to be corrected to reflect active stormwater pump stations as four pump stations - owned and operated by the City.

Figure 2.1 presents the stormwater assets as provided in the stormwater geodatabase.

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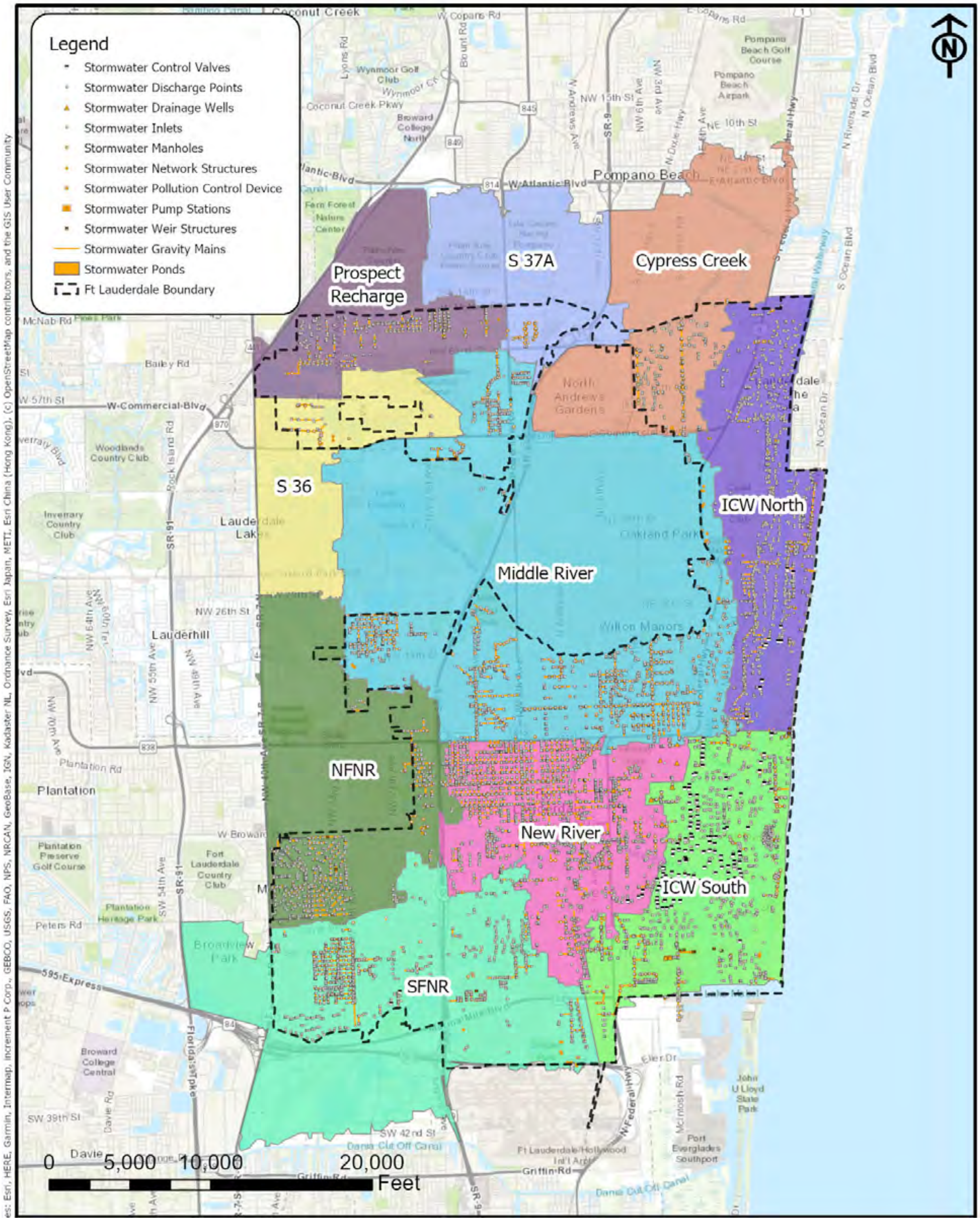
Figure 2.1: Stormwater Hard Assets (2019 Stormwater Geodatabase)



2.1.1.2 Soft Assets

Soft assets are human-determined assets managed by the Division that are not constructed or purchased outright. The lifespan of soft assets is not defined. Unlike hard assets, soft assets do not have defined replacement costs, but they can have defined operation and maintenance costs. Soft assets are tangible living documents such as policies, procedures and/or guidelines that influences intangible behavior(s) to produce measurable outcomes/results. **Table 2.2** presents an example of a City soft asset, Health and Safety Policy, and outlines the intangible and tangible behaviors, along with associated performance measurements.

Table 2.2: Soft Asset Example – City Health and Safety Policy (Tangible)

Purpose	Intangible	Tangible Measurement Results	Asset Class	Performance Measure
To establish City Health and Safety standards for employees and contractors	Influences how people think about safety, feel about its impact on them, and act to uphold the standard.	Accident/ Incident rates Near Misses Serious Injuries Deaths	Policies	# Reportable Incidents/ Accidents

Table 2.3 presents a summary of the soft assets and the respective performance measurements.

Table 2.3: Soft Assets

Soft Asset Class	Soft Assets	Description	Performance Measures
City Policies	Department Procedures	Written Procedures adopted by City Departments that are specific to watershed management (i.e. Proactive Storm Drain Inspection, Major Stormwater Outfall Inspection, Culvert Inspection, etc.)	• # of inspections per asset • % of assets inspected
City Policies	Planning Documents	City planning documents as they relate to watershed management including but not limited to: Press Play and Fast Forward Fort Lauderdale, Strategic Budgeting plans, Budget CIP, Comprehensive Plan, Stormwater Master Plan, Utility Strategic Master Plan, Canal Dredging Master Plan, Seawall Master Plan, and Park Systems Master Plan, etc. as listed in the City's Comprehensive Plan Update.	• # of planning goals attained • # of planned projects implemented • Budget compliance
City Policies	Human Resources	Human resources policies and procedures as they relate to hiring, staffing, succession planning, and knowledge transfer that influence or impact Watershed Asset Management Planning activities and projects.	• Turnover rate • # of staff succession plans developed • Knowledge transfer documentation

Soft Asset Class	Soft Assets	Description	Performance Measures
Government Statutes	Federal, State, County, City Regulatory Compliance	Policies adopted by Federal government agencies, the State of Florida, Broward County and the City of Fort Lauderdale that relate to regulating or permitting surface water, stormwater, storm drains, canals, culverts, seawalls, stormwater outfalls, flooding, tidal valves, and water quality (i.e. NPDES permitting).	• # of permits attained • Permit compliance rates • # of noncompliance issues
Government Statutes	City Ordinances	City of Fort Lauderdale Ordinances and standards with respect to surface water, storm drains, stormwater outfalls, illicit discharges, culverts, seawalls, flooding, and water quality, etc. (i.e. Seawall Ordinance) as documented in the City of Fort Lauderdale Code of Ordinances.	• # of citations issued • # of code violations reported
Government Statutes	Building Codes	Building codes adopted by the City and Broward County that address stormwater management, water quality for TMDLs, NPDES compliance, flooding events including King Tides, and NFIP CRS compliance, etc.	• # of Permits attained • # of citations issued • # of code violations reported
Government Statutes	Land Development Codes	City and County Land development regulations that address Stormwater management, water quality compliance, flood prevention and NFIP CRS compliance, etc. as documented in Broward NEXT and the City of Fort Lauderdale Code of Ordinances.	• # of permits attained • # of citations issued • # of code violations reported
Government Statutes	Non-Structural BMPs	Non-structural Stormwater BMPs adopted by the City and County that address stormwater management, water quality for TMDLs, NPDES compliance, flooding events including King Tides, and NFIP CRS compliance, etc.	• TMDL Compliance • NPDES Compliance • # of Flooding events • CRS Compliance
Education & Training	Stormwater Division Staff Training	The City of Fort Lauderdale Stormwater Division has documented staff training completed by each staff member. A list of the different trainings completed by the City are included in **Appendix E**. This training can be considered intellectual capital and as such is a soft asset. During the WAMP implementation phase, BMPs can be used to set goals to determine which staff members will be trained in each category and optimal redundancy of trained staff.	• # of training modules completed • % of staff trained • Training redundancy rates
Education & Training	Public Outreach	Non-structural Stormwater BMPs adopted by the City and County that are designed to educate City neighbors about personal responsibility for water pollution, water use, and flooding impacts.	• # of education campaigns adopted • % of market saturation • Website activity & engagement

Soft Asset Class	Soft Assets	Description	Performance Measures
Education & Training	Human Behavior and Compliance	Human behaviors exhibited by all City personnel, neighbors, government/regional partners, and other stakeholders that positively or negatively affects watershed management, water quality and flooding and compliance with all policies, procedures, regulations and ordinances.	• # of education campaigns adopted • # of noncompliance issues • # of watershed issues reported
Education & Training	Relationship and Cooperation with All City Departments, Staff and Advisory Boards	Goodwill and cooperation with respect to watershed management activities, flood risk, and water quality from all City levels and departments including Mayor and City Council, City Management Team, Budget CIP & Grants, Strategic Communications, Neighbor Support, IT/IS Department, Stormwater Operations Department, Sustainability Department, Consent Decree Program Management Team, Public Works, Public Utilities, Parks & Recreation, Sustainability Advisory Board, Utility Advisory Board, Parks, Beaches & Recreation Advisory Board, Marine Advisory Board, etc.	• # of regulatory compliance issues • # of CRS compliance issues • # of inter-department projects in progress • Advisory board contributions to master plans, studies & reports
Outreach Activities	Public Credibility with Neighbors	Goodwill relationships and credibility with the public regarding the performance of the City related to watershed management activities, flood risk, and water quality as evidenced by Neighborhood Surveys and relationships with community partners such as civic associations and Homeowners Associations (HOAs) as noted in the Neighborhood Associations Map by Watershed in **Appendix D**	• Neighbor Survey results • # of Neighbor complaints • Neighbor contributions to master plans, studies and reports through public meetings
Outreach Activities	Relationships with Government Partners	Goodwill relationships and credibility with government partners related to watershed management activities, flood risk, and water quality including Broward County Commissioners & Managers, Broward County School District, State of Florida Governor & Legislative Representatives, FDEP, Florida Department of Emergency Management (FDEM), South Florida Water Management District (SFWMD), US Fish & Wildlife Commission (USFWC), US Army Corp of Engineers (USACE), Federal Emergency Management Agency (FEMA), etc.	• # of cooperative projects undertaken • $ value of grants and funding from government partners • # of intergovernmental agreements in place

Soft Asset Class	Soft Assets	Description	Performance Measures
Outreach Activities	Relationships with Regional Partners	Goodwill relationships and credibility with regional partners related to watershed management activities, flood risk, and water quality including Southeast Florida Regional Climate Change Compact, Florida International University, Florida Power & Light Company, Greater Fort Lauderdale Chamber of Commerce, Greater Fort Lauderdale Alliance, International City County Management Association, Broward Metropolitan Planning Organization, National Oceanic & Atmospheric Association (NOAA), Port Everglades, Riverwalk Fort Lauderdale, South Florida Regional Planning Council, and Uptown Fort Lauderdale, etc.	• # of cooperative initiatives undertaken • # of projects supported or funded by regional partners
Data Management	GIS Inventory	GIS Inventory is a record of all the Geospatial data (i.e. dimension, material, installation date, location, condition, capacity, Capital Improvement Projects, etc.) of the City's hard and natural assets (i.e. stormwater manholes, ponds, drainage wells, canals, culverts, tidal valves, etc.).	• # of GIS records captured • Data accuracy rate

2.1.1.3 Natural Assets

Natural assets are not human-made assets managed by the division to comply with NPDES permit requirements, and to mitigate flood risk or water quality impacts. Natural assets include receiving waters (rivers, creeks, canals, lakes), ocean, runoff and discharges, City parcels, and multi-habitat planning areas (MHPAs), mangroves, and trees.

In relation to tree management, the City is coordinating the preparation and further implementation of an Urban Forestry Master Plan. The Urban Forestry Master Plan will serve as a guide to aid in the management, maintenance, and future planting of trees throughout the City by providing a sustainable and strategic framework. The plan will establish a clear set of priorities and objectives, while recognizing the collective ecological, environmental, economic, cultural, and social contributions of the City's trees.

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2.1.2 Asset Ownership, Asset Inventory, and Data Source

Table 2.4 summarizes the asset ownership and inventory as included in the City's stormwater geodatabase.

Table 2.4: Summary of Hard Asset Ownership (2019 Stormwater Geodatabase)

Exiting Asset Classes	City	County	State	Private	Unknown	Undefined(3)
Control Valve	151					1
Pond	18					
Discharge Point	1,049	22	141	124	3	40
Drainage Well	10	1		39		
Exfiltration Trench(1)						
Inlet	8,950	854	1,493	3,216	153	316
Manhole	1,192	284	698	269	9	478
Gravity Main	10,309(2)	974	2,348	3,356	22	1,778
Network Structure	592	13	112	675		14
Pollution Control Structure(1)						
Pollution Control Device	76					137
Pump Station						9
Unknown Point					3,029	
Weir Structure	35	2	75	8	79	1

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Segments in the stormwater geodatabase. There are 970,500 LF or 183.8 miles.

(3) The stormwater geodatabase shows values as "Null".

2.2 What is the Condition and Performance of the Assets?

An asset's condition and how well it is performing are key components to determining an asset's expected useful life (EUL) and determining when rehabilitation and/or replacement is needed.

The overall asset condition and performance leads to a Likelihood of Failure (LoF), also referred to as probability of failure, score which takes into account the typical asset failure modes:

- Mortality: the asset is at the end of its useful life
- Level of Service: the asset is not performing as well as expected and therefore the level of service provided to the stakeholder is not adequate
- Capacity: the asset is not performing at or near its design capacity
- Efficiency: the asset is not performing efficiently

The end result of the asset condition and performance assessment is a LoF score which indicates the likelihood of an asset failing.

2.2.1 Condition Assessment Methodology

Once the asset inventory for each watershed is defined and documented (see Section 2.1), an asset condition and performance assessment across the 10 watersheds should be performed. The goal of the asset condition and performance assessment is to identify the current state of assets and estimate their EULs.

The Hazen Team created a specific Fort Lauderdale Public Works Stormwater and Environmental Groups condition assessment rating form for the watershed assets. The assessment rating form outlines specific asset condition states based upon the distinctive characteristics of assets (e.g., electrical/instrumentation, HVAC, mechanical, and structural). The purpose of using this form is to ensure consistency of the condition assessment process. Each asset is assigned a numeric condition score on a scale of 0-5. The general scoring guideline is shown in **Table 2.5**.

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Table 2.5: Condition Assessment Scoring Guide

Grade	Condition	Description	Response	Residual Life (i.e. Estimated % Asset Design Life Remaining)
0	Not Rated	Asset has been properly decommissioned, no longer exists (or should be removed from inaccurate plans), has not been condition rated (or assigned an extrapolated condition), or is unable to be rated due to serviceability issues	Response will vary subject to circumstances. E.G. An abandoned asset may experience infiltration, voids, collapses, etc. and pose a real danger that should be both monitored and managed.	NA
1	Very Good	Sound physical condition. Insignificant deterioration. Asset likely to perform adequately without major work. No or insignificant loss of hydraulic capacity. No immediate action required. Maintain standard programmed condition assessment.	No immediate action required. Maintain standard programmed condition assessment.	60% to 100%
2	Good	Acceptable physical condition; minor deterioration/minor defects evident, minor loss of hydraulic performance, minimal short-term failure risk but potential for deterioration in long-term. Only minor work required (if any). No immediate action required. Maintain standard programmed condition assessment.	No immediate action required other than possible cleaning. Maintain standard programmed condition assessment.	35% to 60%
3	Fair	Moderate to significant deterioration evident; moderate loss of hydraulic performance, failure unlikely within next 2 years but further deterioration likely and major replacement likely within next 10 years. Minor components or isolated sections of the asset need replacement or repair now but asset still functions safely at adequate level of service. Work required but asset is still serviceable.	Take action as appropriate to address defects and if necessary, cleaning, silt removal, root cutting. Monitor with programmed condition assessment for rehabilitation and/or renewal in medium term.	20% to 35%
4	Poor	Serious deterioration and significant defects evident. Significant loss of hydraulic performance. Failure likely in short-term. Likely need to replace most or all of asset within 2 years. No immediate risk to health or safety but works required within 2 years to ensure asset remains safe. Substantial work required in short-term, asset barely serviceable.	Take immediate action as appropriate to address the defects. Immediately undertake risk assessment and further investigate options. Schedule appropriate action – rehabilitation or renewal in short term.	10% to 20%
5	Very Poor	Failed or failure imminent. Immediate need to replace most or all of asset. Health and safety hazards exist which present a possible risk to public safety, or asset cannot be serviced/operated without risk to personnel. Major work or replacement required urgently. Take immediate action as appropriate to address the defects.	Take immediate action as appropriate to address the defects. Immediately undertake risk assessment and further investigate options. Schedule appropriate action – immediate rehabilitation or renewal.	0% to 10%

Example condition assessment rating criteria corresponding to each asset class are provided in **Section 8** for each of the ten (10) watershed plans.

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the ten watersheds, various LoF scores for the assets in the watershed were assumed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan.

It is recommended that the staging of asset condition assessments be approached and planned as follows:

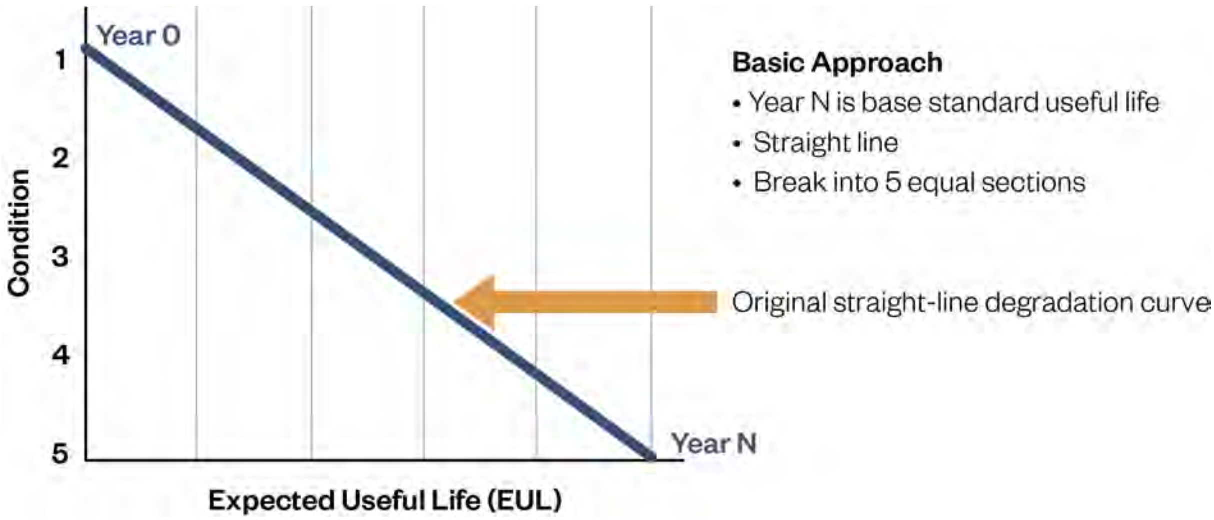
1. Identify assets with the highest CoF
2. Quantify all assets, by watershed, within the asset class deemed to have the highest CoF
3. Rank each asset class in decreasing order of CoF
4. Quantify the total number of assets by asset class that requires inspection
5. Establish the condition assessment requirements and process for each asset class
6. Estimate the time (including travel) and resources required to conduct each condition assessment
7. Calculate the total time required to complete all condition assessments
8. Calculate the total available time within each calendar year that could realistically be scheduled to complete condition assessments
9. Based upon task 8 above, project the total duration, manpower and cost required to complete all condition assessments
10. Determine best method to complete the condition assessments given personnel, time and financial constraints
    a. City staff
    b. Consultant
    c. City staff and consultant

This method helps the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined.

2.2.1.1 Useful Life

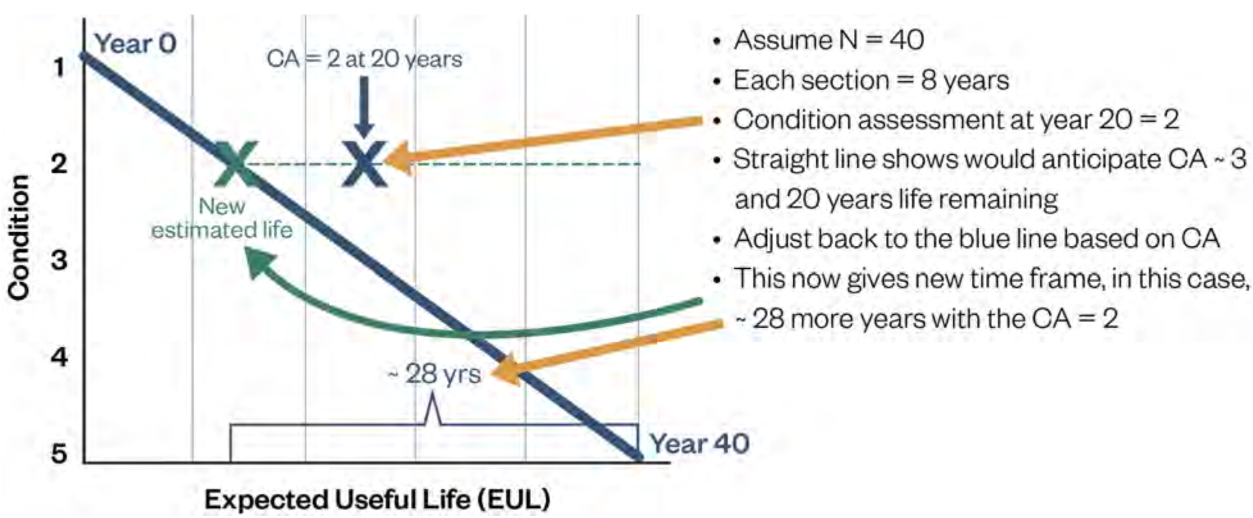
Utilizing existing attribute data, maintenance records, and condition scores, the City will need to determine the expected useful life (EUL) for each asset class. It is recommended that the simple straight-line approach be used until more detailed work order and failure history can be obtained. **Figure 2.2** highlights the initial EUL of an asset when first installed.

Figure 2.2: Initial Expected Useful Life



After the condition of each watershed's assets are known, the Remaining Useful Life (RUL) can be determined as shown in **Figure 2.3.**

Figure 2.3: Calculation of Remaining Useful Life



For assets where a visual condition assessment cannot be performed, a remaining service life score would need to be calculated. Remaining Service Life is an EUL measure of an asset and is the age of the asset divided by the expected design life. The build, install, and/or refurbishment date should be recorded for each asset from existing record documents and other available information to determine the age of the asset. **Table 2.6** shows an example service life table that can be used to display the average age, expected design life, and remaining service life of each asset class.

Table 2.6: Example Service Life Scores

Existing Asset Classes	Average Age of Asset Class (in Years)	Expected Design Life (in Years)	Remaining Service Life of Asset Class (%)
Control Valve	15	40	63
Pond	30	50	40
Discharge Point	8	20	60
Drainage Well	27	50	46
Exfiltration Trench	15	50	70
Inlet	25	50	50
Manhole	34	50	32
Gravity Main	20	50	40
Network Structure	25	50	50
Pollution Control Structure	25	40	38
Pollution Control Device	18	40	55
Pump Station	18	40	55
Weir Structure	30	50	60

Once the information in **Table 2.6** can be documented, the asset register can be updated to include this information.

2.2.1.2 Replacement Cost

The Fort Lauderdale Public Works Stormwater and Environmental Groups will need to review historical replacement cost data and determine the current replacement cost for each asset class. Current and future replacement costs form the basis for the asset valuation work. The replacement costs are used to project future budgetary requirements.

The asset register should be updated with the asset replacement costs.

2.2.1.3 Proposed Condition Assessment Framework

2.2.1.3.1 Likelihood of Failure

Likelihood of Failure (LoF) measures an asset’s likelihood of, or timing, to failure. There are several ways to determine LoF. The easiest way is to use the relative age of an asset, as previously identified in **Table 2.6**. However, using age as a guideline is not always accurate as maintenance procedures and locality weather conditions can impact LoF outside of age parameters.

A more accurate way to determine LoF is to calculate it using data sources including visual condition assessments results, known test results (e.g., run time, flow rate), EUL, and interviews with staff and asset operators. Using the more accurate LoF scoring, the following provides a detailed description of the LoF criteria and the scoring approach recommended for the City.

2.2.1.3.2 Capacity

For assets that have known test results, a comparison is made of known test results versus design criteria. The test results as a % of design criteria are assigned a Capacity Model score, with 5 being the highest priority risk. **Table 2.7** shows the value and description of each capacity model score.

Table 2.7: Capacity Condition Assessment Scoring Guide

Capacity Model Score	Description
1	Capacity >85% of design rate
2	70% ≤ Capacity ≤ 85% of design rate
3	50% ≤ Capacity ≤ 69% of design rate
4	25% ≤ Capacity ≤ 49% of design rate
5	Capacity < 25% of Design rate

A score of 1 indicates that the capacity of the asset is more that 85% of the designed capacity rate and therefore is less likely to fail. Similarly, an asset with a capacity of less than 25% of design is given a score of 5, indicating a higher risk of failure.

For assets that do not have measurable test results, a score of 3 can be assigned to the asset. If the asset is deemed critical, the City should assign an appropriate capacity score.

2.2.1.3.3 Overall LoF Score

The overall LoF score for an asset is calculated as follows:

LoF Score = (0.50*Capacity) + (0.50*Condition)

As the LoF equation shows, capacity is 50% and condition is 50% of the overall LoF score. Each asset within a given watershed should have a LoF score identified for it using the above equation.

2.3 What is the Criticality of the Assets?

An asset's criticality, identified by the Consequence of Failure (CoF), measures the direct and indirect implications and costs associated with asset failure. Criticality assessment is often performed on linear pipe networks using GIS tools for determining downstream impacts to failures and accounting for impacts to critical customers, such as hospitals or other critical care facilities. Criticality of vertical assets often considers how necessary the asset is for meeting defined levels of service, and whether redundant assets exist to allow for periodic downtime of the asset. Definition of "failure" will differ for each system and each asset class. However, to the extent possible, CoF ratings should align between classes and use the same scoring scale for purposes of comparison and prioritization. Assets deemed critical or near critical infrastructure may be reviewed individually to determine the potential CoF that may differ from the more general CoF score for the entire asset class. **Table 2.8** summarizes the IIMM standard for general Criticality (i.e., CoF) Ratings.

Table 2.8: Summary IIMM Criticality Ratings

Criticality Rating	Description	Suggested Inspection Frequency
1	Failure is not disruptive and of very low significance to surrounding community and required infrequent inspection triggered by complaint or problem evidence	As needs basis
2	Failure typically low disruption and impact to surrounding community requiring infrequent inspection but should be on proactive maintenance	15 – 20 Years
3	Failure can be moderately disruptive to the affected community and should be on proactive maintenance	10 -15 Years
4	Failure can be moderately disruptive and of significance to the community and should be on proactive maintenance	5 - 10 Years
5	Failure is disruptive, significant, and costly to repair. Inspections should be more frequent in order to proactively plan maintenance activities	1 – 5 Years

The larger the impact of an asset failure, the larger the CoF. The CoF typically has three components:

- **Allowable Loss of Service:** an asset's ability to meet demand in the event of an equipment failure or loss of power
- **Economic Impact:** the monetary value associated with repair and corrective measures required to be taken to correct an asset failure
- **Environmental/Social Impact:** risk of public contact (e.g., distance to schools, hospitals, or residences), risk to water quality (distance to water bodies), and social impacts to include travel delays and lost business in the event of an asset failure

The City can develop CoF scores by asset class for each watershed based on economic factors, environmental/social factors, or both as defined in the following sections. **Table 2.9** shows example Asset Class CoF scores based upon presumed criticality for the 10 watersheds. The City will need to establish discrete CoF scores for specific assets if they do not conform to the asset class CoF assigned.

Table 2.9: Asset Classes and CoF Score (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4

Asset Class	CoF Score
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

Grouping the classes allows determination of the cost and social impact of the various classes. Once this is done, the City can develop the specific CoF score for each asset. Typically, a specific asset CoF score will be the same as, or very near, the original asset class CoF score. Using inlets as an example, it has been determined that the asset class CoF score is a 4. The City could then verify that the specific inlet scores adhere to that original assumption, or that the specific inlet needs to be modified to accommodate a different environment and/or location.

2.3.1 Pipe Assets

2.3.1.1 Pipe Criticality

Typically, criticality scores for pipe network structures are based on relative proximity to critical locations and facilities, and dependent upon the diameter and depth of the individual pipe segments. The criteria for pipe and non-pipe assets are described in the following sections.

For pipes, **Table 2.10** shows the CoF criteria and whether they impact cost, social factors, or both. The "X" indicates if the criteria impacts the two score components.

Table 2.10: CoF Score Criteria for Cost and Social Impacts – Pipes (Example)

Criteria	Cost Impact	Social Impact
Surface Type - Vicinity to Pavement and Road Type	X	X
Surface Type - Vicinity to Buildings	X	X
Surface Type - Vicinity to Railroads	X	X
Surface Type - Vicinity to Water (Streams and water bodies)	X	X
Pipe Diameter (where applicable)	X	
Depth to Pipe Invert (where applicable)	X	
Vicinity to Critical Facilities • Parks • Schools • Hospitals • Fire stations • Police stations • Other local critical locations (e.g., City Hall, evacuation routes, airports, etc.)		X

When evaluating CoF, pipe assets are given a score on a scale of 1-5 (1 being best and 5 being worst) for each criterion based on a range of metrics. For example, a deeper pipe (> 18’) receives a higher CoF score versus a more shallow pipe (< 8’), as the relative impact of the repair would be larger.

The values and distances pertaining to the various criteria are calculated using available GIS data and conducting a “near analysis”. The GIS is also used as the intial source for determing distance to critical facilities, water bodies, police stations, fire stations, schools, and hospitals. This data should be validated by the City. **Tables 2.11** and **2.12** are example frameworks summarizing what the scoring criteria could be for each pipe asset.

Table 2.11: Social Factor Criteria Scores – Pipes (Example)

CoF Social Criteria	CoF Social Score	Value Range
Near critical facilities	1	Pipe is further than 1000’ from a critical facility
Near critical facilities	2	Pipe is 750’-1,000’ from a critical facility
Near critical facilities	3	Pipe is 500'-750' from critical facility
Near critical facilities	4	Pipe is 250'-500' from critical facility
Near critical facilities	5	Pipe is less than 250' from a critical facility
Surface Type	1	All other
Surface Type	2	Asset within 20’- 30’ of a building
Surface Type	3	Asset under a rural or urban local road
Surface Type	4	Asset under an urban collector or arterial road
		Asset within 10’-20’ of a building
Surface Type	5	Asset under a major road such as a highway, freeway, principal arterial, major collector
		Asset within 10' of a building
Vicinity to water	1	Asset is greater than 250' from water
Vicinity to water	2	Asset is between 101' and 250' from water
Vicinity to water	3	Asset is between 40' and 100' from water
Vicinity to water	4	Asset is between 20' and 40' from water
Vicinity to water	5	Asset is within 20' of water

Table 2.12: Cost Factor Criteria Score Summary – Pipes (Example)

CoF Cost Criteria	CoF Cost Score	Value Range
Depth to Invert	1	<= 4'
Depth to Invert	2	Between 4' and 8'
Depth to Invert	3	Between 8' and 12'
Depth to Invert	4	Between 12' and 17'
Depth to Invert	5	Greater than 17
Diameter	1	<=9"
Diameter	2	10"-14"
Diameter	3	15" - 20"

CoF Cost Criteria	CoF Cost Score	Value Range
Diameter	4	21" - 30"
Diameter	5	>30"
Surface Type	1	All other
Surface Type	2	Pipe between 100' - 200' of a river, lake, or pond
Surface Type	3	Pipe under a rural or urban local road
Surface Type	4	Pipe under an urban collector or arterial road
		Pipe between 20'-40' from a railroad
		Pipe is within 10'-20' of a building
		Pipe between 100' - 200' of a river, lake, or pond
Surface Type	5	Pipe under a major road such as highway, freeway, principal arterial, major collector
		Within 20' of a railroad
		Within 50' of a stream
		Within 10' of a building
		Within 100' of a river, lake, or pond

2.3.1.2 Pipe Asset Criticality Scoring

With respect to pipe assets, **Tables 2.13 and 2.14** show some typical criteria weightings. There is no industry standard for applying weighting factors to pipe assets. The values below are representative values the Hazen team recommends based on previous experience in working with other utilities and represent a relatively even distribution. The City should tailor these to their specific interests.

Table 2.13: Cost and Weights – Pipes (Example)

Cost Criteria	Weight
Depth to Invert	30%
Pipe Diameter	35%
Surface Type	35%

Table 2.14: Social Impact Criteria and Weights (Example)

Social Criteria	Weight
Vicinity to Water	50%
Surface Type	50%
Near Critical Facilities	See Note

Note: The Social Impact Score is calculated as the higher of the Near Critical Facilities Score or the Weighted Combination of Vicinity to Water and Surface Type. Therefore, a pipe near a critical facility should be considered a high CoF regardless of its other criteria scores.

For each pipe, a weighted cost score and a weighted social score are calculated as shown below:

Cost CoF = (0.3 x depth to invert) + (0.35 x pipe diameter) + (0.35 x surface type)

Social CoF = (0.50 x vicinity to water) + (0.50 x surface types)

The total CoF score is then calculated as shown below, incorporating relative weights of each:

TOTAL CoF = (0.65*Cost CoF) + (0.35*Social CoF)

The direct cost factors are weighted more heavily because direct cost impacts are more quantifiable and easier to justify to rate payers. Social costs are important to incorporate but are more subjective and difficult to quantify.

Some CoF scores may need to be manually adjusted and refined based on certain factors that were not identified through the initial GIS-based analysis. It is important to recognize that local knowledge and manual assessment of pipe locations is still necessary to ensure accurate reflections of pipe criticality. To that end, the City should identify locations known to be critical regardless of the findings of the initial GIS analysis. This is typically accomplished by reviewing and marking up a map with staff showing the locations which are highly critical from a CoF standpoint. These locations should be assigned a CoF score of 5 regardless of the other factors.

2.3.2 Non-Pipe Assets

2.3.2.1 Non-Pipe Criticality

For non-pipe assets such as inlets, weirs, manholes, etc., **Table 2.15** shows the criteria typically used in the risk analysis and whether it is a cost factor, a social factor, or contributes to both. The “X” indicates if the criteria impacts the two score components.

Table 2.15: CoF Score Criteria for Cost and Social Impacts – Non-Pipe Assets (Example)

Criteria	Cost Impact	Social Impact
Regulatory Compliance	X	X
Level of Service	X	X
Safety	X	X
O&M Impacts	X	X

Tables 2.16 and **2.17** summarize the scores typically used for each non-pipe asset criteria. The City should validate these criteria for their specific use.

Table 2.16: CoF Score Criteria for Social Impacts – Non-Pipes (Example)

CoF Social Criteria	CoF Social Score	Value Range
Regulatory Compliance	1	100% Compliance with permits and regulations
Regulatory Compliance	2	Violation without an enforcement action
Regulatory Compliance	3	Violation with potential for minor enforcement actions

CoF Social Criteria	CoF Social Score	Value Range
Regulatory Compliance	4	Violation with potential for major enforcement actions and fines
Regulatory Compliance	5	History of violation or strong potential for major enforcement action and fines
Level of Service	1	No Impact, can responds in 2 days
Level of Service	2	No immediate impact, but if event continues could have some minor flooding of less than 2” on streets
Level of Service	3	Impact if no response. Minor flooding of less than 6”, but can become major flooding if not addressed within 8 hours
Level of Service		Immediate localized flooding between 6” and 12”, Respond within 4 hours
Level of Service		Immediate widespread impact, flooding >12”. Response required within 30 minutes
Safety	1	No impact
Safety	2	Little impact to surrounding property
Safety	3	Minor damage to surrounding property
Safety	4	Major damage to surrounding property
Safety	5	Potential injury to staff or public
O&M Impact	1	No Impact
O&M Impact	2	Minimal impact, minor flooding of up to 2: on streets
O&M Impact	3	Minor flooding of between 2”-6 on streets”
O&M Impact	4	Service interruption due to flooding of 6” - 12”
O&M Impact	5	Service interruption flooding of > 12”

Table 2.17: CoF Score Criteria for Cost Impacts – Non-Pipe Assets (Example)

CoF Cost Criteria	CoF Social Score	Value Range
Regulatory Compliance	1	No fines
Regulatory Compliance	2	Fines from $0 to $100,000
Regulatory Compliance	3	Fines from a regulatory agency(ies) between $100,001 and $250,000
Regulatory Compliance	4	Fines from a regulatory agency(ies) between $250,001 and $1M
Regulatory Compliance	5	Fines from a regulatory agency(ies) >$1M and a long-term impact on meeting regulatory mandates
Level of Service	1	No Impact
Level of Service	2	Cost <$2,500
Level of Service	3	Cost between $2,500 and $25,000
Level of Service	4	Cost between $25,001 and $50,000
Level of Service	5	Cost greater than $50,000

CoF Cost Criteria	CoF Social Score	Value Range
Safety	1	No Impact
Safety	2	Potential damage to equipment, cost between $1-5,000
Safety	3	Potential damage to equipment, cost between $5,001-14,999
Safety	4	Potential damage to equipment, lawsuits, cost between $15,000-24,999
Safety	5	Potential damage to equipment, lawsuits, cost >$25,000
O&M Impact	1	No Impact
O&M Impact	2	Cost <$2,500
O&M Impact	3	Cost between $2,500 and $25,000
O&M Impact	4	Cost between $25,001 and $50,000
O&M Impact	5	Cost greater than $50,000

2.3.2.2 Non-Pipe Asset Criticality Scoring

Each criterion is given a weight to develop weighted cost scores and weighted social impact scores. The cost and social impact scores are combined into a single CoF score of 20-100 and then converted into a normalized score of 1-5 for consistency throughout the risk evaluation process. With respect to non-pipe assets, **Table 2.18** summarizes typical criteria weightings. As with pipes, there is no industry standard for applying weighting factors. The values recommended are based on previous experience in working with other utilities and with input from Fort Lauderdale Public Works Stormwater and Environmental groups.

Table 2.18: Cost Criteria and Weights – Non-Pipe Assets (Example)

Criteria	Cost Weighting	Social Weighting
Regulatory Compliance	25%	10%
Level of Service	25%	35%
Safety	25%	35%
O&M Impacts	25%	20%

For each non-pipe asset, a weighted cost score and a weighted social score can be calculated as shown below:

Cost CoF = (0.25*regulatory compliance) + (0.25*level of service) + (0.25*safety) + (0.25*O&M impacts)

Social CoF = (0.10*regulatory compliance) + (0.35*level of service) + (0.35*safety) + (0.20*O&M impacts)

To be consistent in the CoF calculation, the same calculation should be used for all asset classes. Then, the total CoF score can be calculated as shown below, incorporating relative weights of each:

TOTAL CoF = (0.65*Cost CoF) + (0.35*Social CoF)

The direct cost factors are weighted more heavily because direct cost impacts are more quantifiable and easier to justify to rate payers. Social costs are important to incorporate but are more subjective and difficult to quantify. The total CoF score ranges from 1-5 score (1 being the best and 5 being the worst). The CoF score is not an absolute risk score; but rather a component of risk which can be used to provide an order of priority.

Some CoF scores may need to be manually adjusted and refined based on certain factors that were not identified through the initial GIS-based analysis. It is important to recognize that local knowledge and manual assessment of pipe locations is necessary to ensure accurate reflections of pipe criticality. To that end Fort Lauderdale Public Works Stormwater and Environmental groups should identify locations known to be critical regardless of the findings of the initial GIS analysis. A typical way of accomplishing this is to use staff to review maps to identify locations which are highly critical from a CoF standpoint. These locations can be assigned a higher CoF score.

2.3.3 Soft Asset Criticality

With respect to soft assets, **Tables 2.19 and 2.20** show the risk analysis criteria. There is no industry standard for applying CoF and LoF scores to soft assets. The values below are representative values recommended based on previous experience working with other utilities. These should be reviewed and tailored to the City's specific interests.

Table 2.19: Soft Asset Example – City Health and Safety Policy (Tangible)

Purpose	Asset Class	CoF	LoF	Performance Measure
To establish City Health and Safety standards for employees and contractors	Policies	(5) May have catastrophic consequence if policy is not followed or adhered to	Varies subject to situation under review	# Reportable Incidents/ Accidents

Table 2.20 presents three soft asset examples and the respective CoF criteria and scoring.

Table 2.20: Soft Asset Scoring Consequence of Failure (CoF) Example

Soft Asset Type					
City Policy Department Procedure Proactive Storm Drain Inspection (Tangible)					
Behavioral CoF Failure to follow or conform to Procedure	Minor-Minimal Flooding	Can be out of service for less than one month	Moderate	Major	Critical – Severe Flooding, Major
Health & safety (due to failure and during repairs)	No impact	Minor injury during repair or minor safety concern due to failure	Moderate injury / some sickness due to failure or during repair	Potential injury or sickness during repair; Potential safety concern due to failure; Failure of safety asset (not solitary protection)	Probable injury or sickness during repair; Immediate safety risk due to failure, Failure of safety asset (only source of safety)
Score	*1*	*2*	*3*	*4*	*5*

Vital Economy					
Financial impact	$0 - $9,999	$10,000 - $49,999	$50,000 - $149,999	$150,000 - $499,999	$500,000 or higher
Score	*1*	***2***	*3*	*4*	*5*
Healthy Environment					
Regulatory (permit) compliance or Recordable Violations	No violation	Exceed regulatory daily permit limit	Exceed regulatory weekly permit limit or results in a minor recordable violation	Exceed regulatory monthly permit limit or results in a moderate recordable violation	Cited for regulatory permit violation or results in a major recordable violation
Score	*1*	*2*	*3*	*4*	*5*

Table 2.21 summarizes the City's Soft Assets and the CoF scoring.

Table 2-21: Soft Assets Criticality

Soft Asset Class	**Soft Assets**	**CoF**
City Policies	Department Procedures	5 (5=Hi)
City Policies	Planning Documents	5
City Policies	Human Resources	3
Government Statutes	Federal, State, County, City Regulatory Compliance	5
Government Statutes	City Ordinances	5
Government Statutes	Building Codes	5
Government Statutes	Land Development Codes	5
Government Statutes	Non-Structural BMPs	3
Education & Training	Stormwater Division Staff Training	4
Education & Training	Public Outreach	3
Education & Training	Human Behavior and Compliance	4
Education & Training	Relationship and Cooperation with All City Departments, Staff and Advisory Boards	4
Outreach Activities	Public Credibility with Neighbors	4
Outreach Activities	Relationships with Government Partners	4
Outreach Activities	Relationships with Regional Partners	3
Data Management	GIS Inventory	5

2.4 What is the Overall Stormwater System Risk?

Asset management seeks to find the balance between high levels of service and low costs for operating and maintaining a system of assets. The risk assessment associated with asset management helps determines the assets that can be ran to failure and other assets that may need to be repaired or replaced immediately. Risk is a primary component of prioritizing rehabilitation/replacement planning in any asset management plan. Higher risk can result from too little investment in the assets and not meeting target levels of service. However, there is also a risk of overspending to provide levels of service above and beyond what customers require or expect. The goal of asset management is to avoid creating an imbalance between risk and cost, and instead is focused on finding agreement between the two, as shown in **Figure 2.4**.

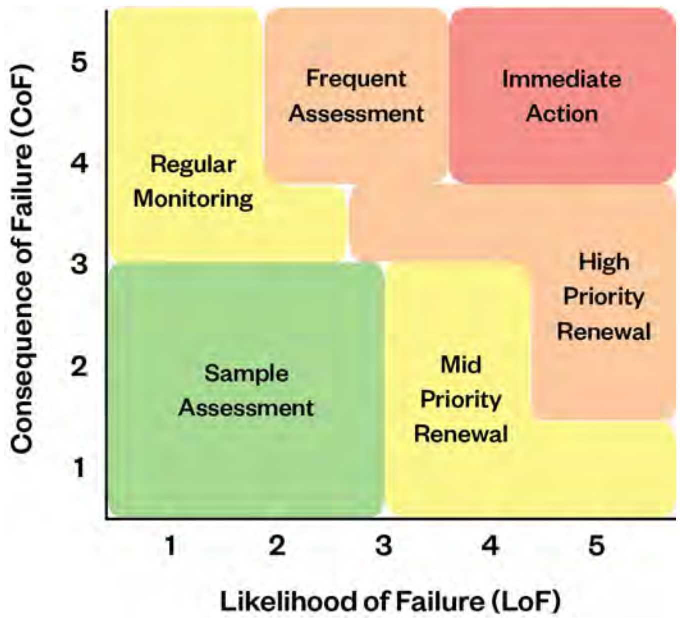
Figure 2.4: Asset Management Risk-Cost Balance

Business Risk Exposure (BRE), or simply risk, is a calculated measurement used to determine the course of action needed for managing an asset. BRE is calculated as the product of the LoF and the CoF. It can also include a redundancy component for critical assets. The BRE score is used to help support the prioritization of improvements across the watersheds.

A BRE score is calculated and documented for each asset in the asset register to help prioritize the needs to focus limited resources. BRE scoring results are used to help prioritize investments in inspection, maintenance, rehabilitation, and replacement activities, informing the prioritization of near-term actions needed to mitigate asset risk and/or help meet level of service goals.

The risk score, plotted on a matrix, can provide an indication of the best management approach for a collection of assets. For low CoF and low LoF assets, a run-to-failure approach may be most appropriate. For high CoF and high LOF assets, immediate action, such as replacement or repair, is needed. For those assets with high CoF but low LoF, frequent inspection may be the best management approach to ensure the critical asset does not degrade at a rapid rate. Finally, for those assets with low CoF but high LoF, a prioritization may be placed on renewal versus continued maintenance, depending on which provides the highest level of service at the lowest lifecycle cost to the City. **Figure 2.5** provides a recommendation of the various management strategies for different risk profiles.

Figure 2.5: Typical Risk Matrix and Associated Management Approaches



2.4.1 Risk-Based Asset Management

Using the LoF scores and CoF scores, the City can calculate the BRE scores for all the assets. Each BRE score can be calculated as follows:

BRE = LoF x CoF

As the calculation shows, BRE score is equally weighted between the LoF and CoF scores with differentiation being determined when calculating the specific LoF and CoF. This provides a BRE score range of from 1 – 25. Another method of viewing the overall risk for each individual asset is to plot the LoF and CoF scores in a matrix to identify the specific “regions” of risk. Results of each watershed’s BRE scores and risk matrices are presented in each watershed’s respective section of this Plan. The goal is to provide data to support subsequent remedial measures as well as to inform ongoing maintenance of each asset. **Figure 2.6** displays the BRE scoring methodology.

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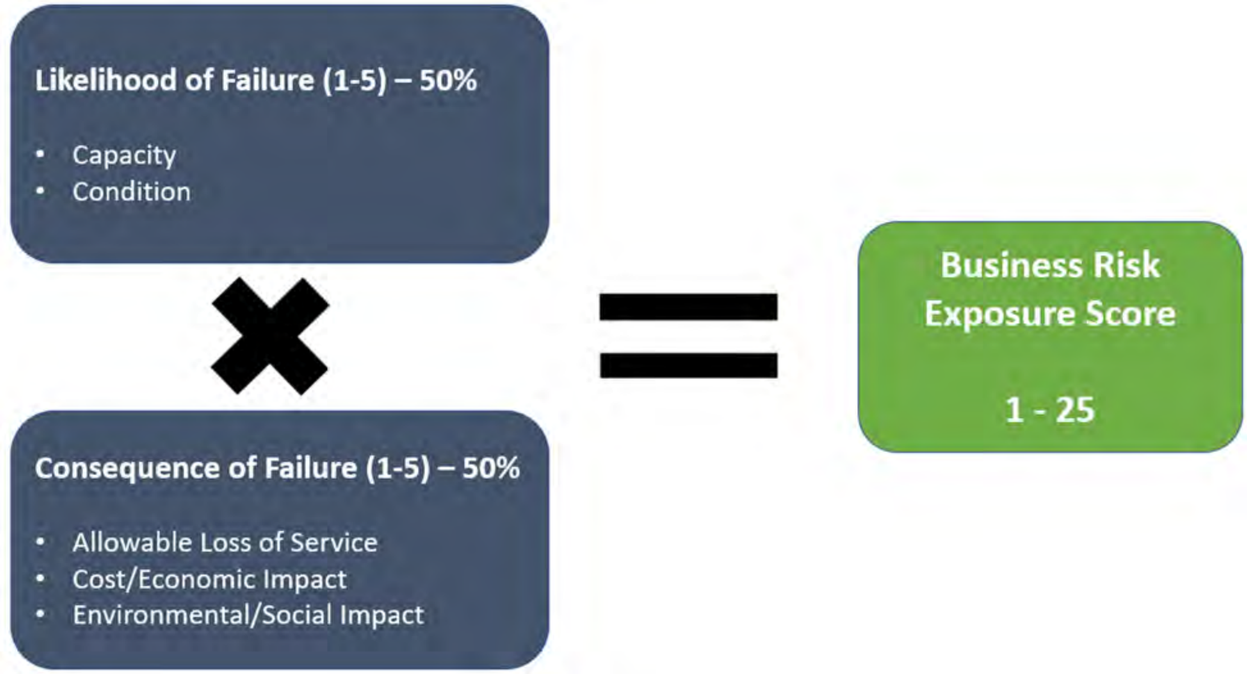
Figure 2.6: Business Risk Exposure Score Breakdown (Example)



Once the BRE scores are calculated for each asset, a relative risk rating can be assigned to each asset based upon the LoF and CoF scores. The scores for the individual watersheds can be plotted on a risk matrix, an example of which is shown in **Figure 2.7**. The color codes for the risk matrix are defined in **Table 2.22**.

Table 2.22: Risk Color Scheme

Risk	Color
Low	Green
Medium	Yellow
High	Orange
Critical	Red

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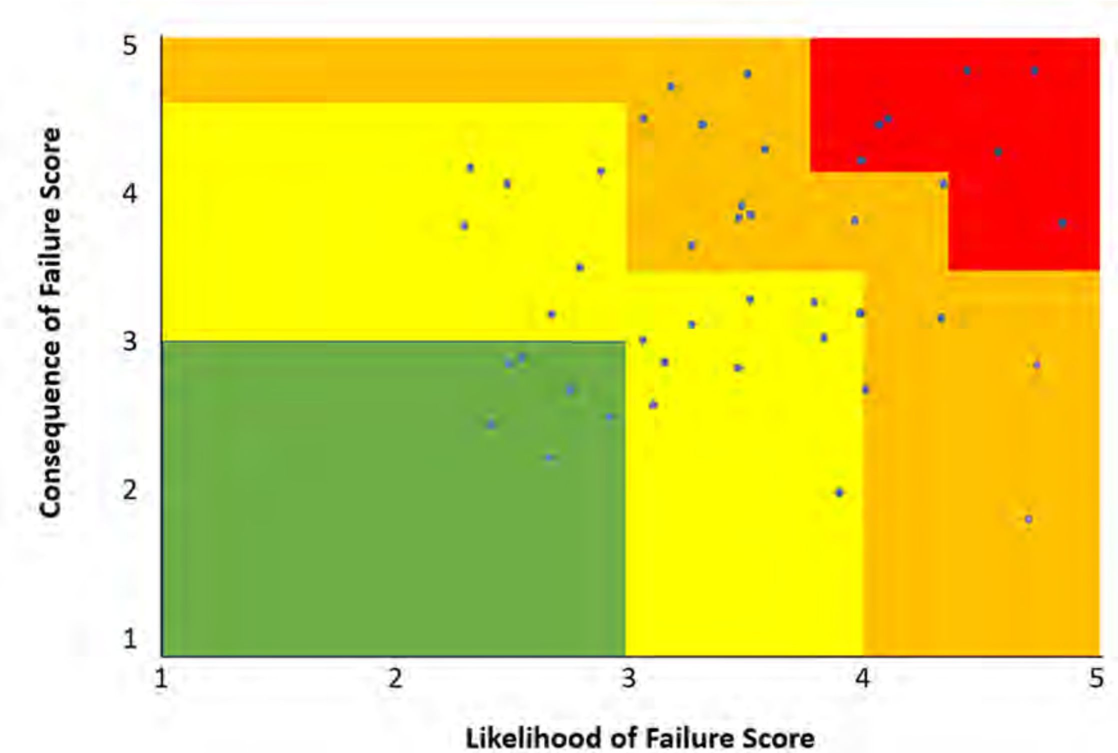
Figure 2.7: Risk Matrix



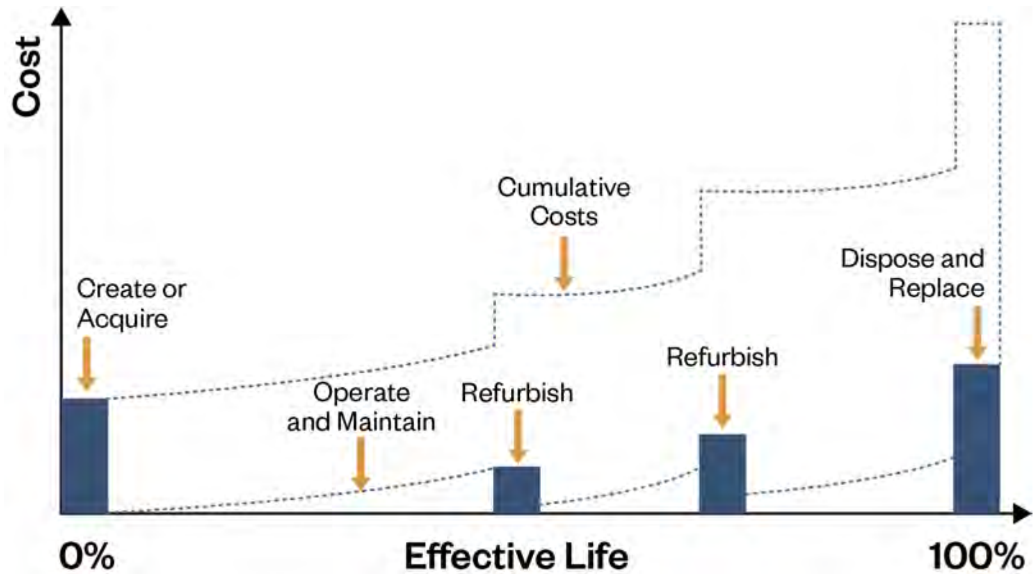
2.4.2 Operations, Maintenance and Replacement Strategies

To achieve its program objectives, the City stormwater group builds new infrastructure assets to meet growth needs and manages existing assets to meet reliability needs – all with limited funds. Asset lifecycle management strategies are planned actions that enable assets to provide the defined levels of service in a sustainable manner, while managing risk, at the lowest lifecycle cost. Asset lifecycle management strategies are typically organized into the following categories: **Operations & Maintenance activities –** including regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.

- **Renewal activities –** significant rehabilitation designed to extend the life of the asset and replacement activities that are expected to occur once an asset has reached the end of its useful life and rehabilitation is no longer an option.
- **Expansion activities –** planned activities required to extend services to previously unserviced/underserviced areas or expand services to meet growth demands. Also includes redevelopment activities.
- **Disposal activities –** the activities associated with the disposal of an asset once it has reached the end of its useful life or is otherwise no longer needed by the municipality.
- **Non-asset solutions –** actions or policies that can lower costs, lower demands, or extend asset life (e.g. better integrated infrastructure planning and land use planning, demand management, insurance, process optimization, education of public).

The City stormwater group assesses the costs of potential lifecycle activities to determine the lowest lifecycle cost strategy to manage each asset type. The sum of all asset lifecycle management strategies informs the minimum cost to sustain each asset type. Failing to take care of assets can impact the total cost of ownership for that asset portfolio and can also have other impacts such as causing damage to other infrastructure or causing interruption to service delivery. Maintenance and renewal activities are timed to reduce the risk of service failure from deterioration in asset condition and to minimize the total cost of ownership. Sufficient investment, of the right type, at the right time, is crucial. The conceptual lifecycle cost model is illustrated in **Figure 2.8**, and it shows the cash flow associated with creating and sustaining the asset over time.

Figure 2.8: Conceptual Lifecycle Cost Model



2.4.3 Operation and Maintenance Strategies

The distinction between renewals (which are capital works) and maintenance (which is an operational expense) is set by accounting policies and standard operating procedures. Operations & Maintenance (O&M) ensures the asset continues to deliver defined LoS, while renewals can extend the asset's useful life through the implementation of new technologies. Renewals and maintenance are strongly linked; maintenance strategies can hasten or delay the need for renewals, and if renewals are deferred, maintenance needs will often increase.

Asset O&M requirements and required resources are assessed and prioritized subject to:

- Achieving legislated O&M activities to ensure safety and environmental sustainability in accordance with appropriate regulations.
- Conducting routine inspection and testing and preventive maintenance activities to ensure preservation of existing assets.

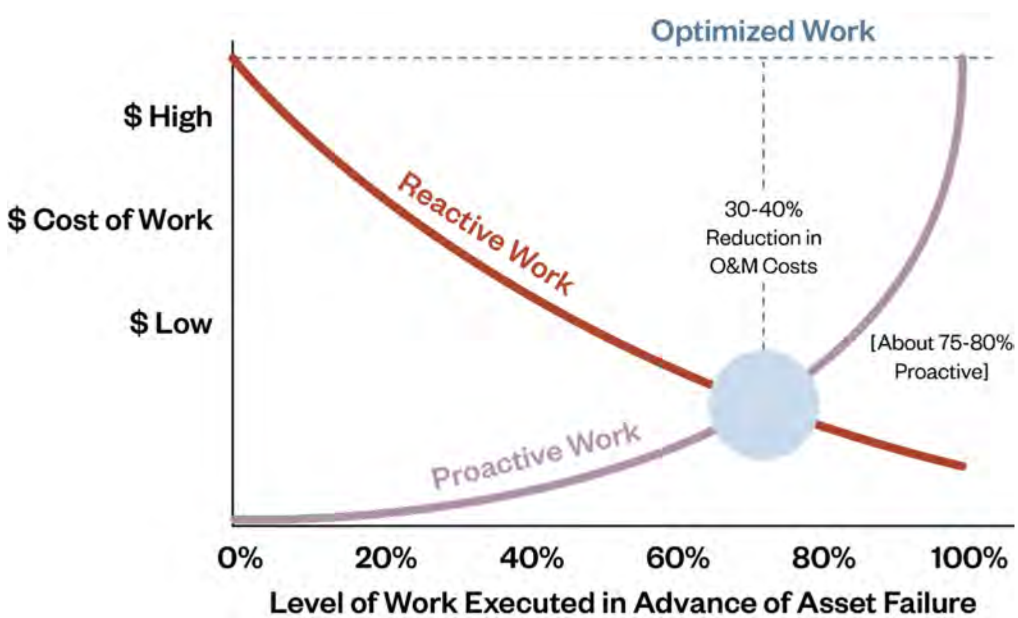
- Analysis of current O&M contracts and known historical costs of delivering defined levels of services to forecast future O&M costs.

Best in class asset management practices seek to maximize asset reliability and extend asset life though the appropriate mix of maintenance management techniques based on asset criticality (CoF). These maintenance management techniques include:

- **Reactive maintenance:** run to failure for non-critical items
- **Proactive maintenance:** doing work in advance of the asset failing for critical items:
- **Predictive (PdM):** proactively determine and track asset health parameters on a regular basis to help asset managers follow asset deterioration over time
- **Preventive (PM):** proactively conduct maintenance work based on time of asset in service (or using other level of service performance statistics such as fuel consumption, gallons pumped, etc.)
- **Corrective (CM):** proactively conduct maintenance work on assets that are identified with potential failure or close to marginal performance from predictive maintenance activities.

Optimal maintenance performance is shown in **Figure 2.9**, with the goal being to implement the right mix of techniques to stay in the "sweet spot", which is typically 75 - 80% proactive work.

Figure 2.9: Optimized Maintenance: Optimal Mix of Proactive and Reactive Work



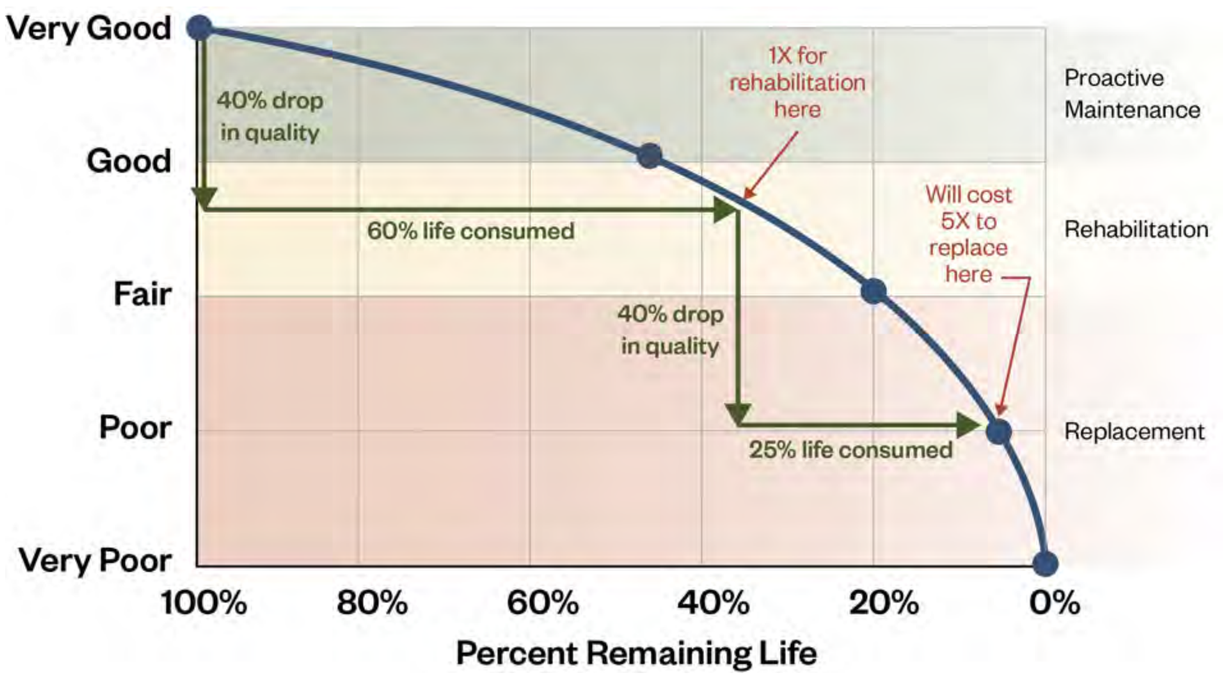
Preventive and corrective maintenance activities are typically identified through the regular inspections (i.e., annual) of stormwater infrastructure, as discussed in **Section 8.1.4.1**. The WAMP is funded through the operating budget and is resourced using a mix of internal and external resources. It will result in a realistic understanding of the overall asset condition and what assets must be prioritized for replacement or refurbishment to restore them to full functionality.

Understanding asset condition will also guide the City in deciding what short-term, mid-term and long-term maintenance strategies need to be adopted to preserve asset functionality pending refurbishment or replacement and sustaining and preserving functionality once the asset has been restored or replaced as new.

2.4.4 Renewal Strategies

All assets physically deteriorate at different rates to eventual failure and loss of ability to deliver the required LoS. Asset condition is a measured assessment of an asset's current position or place on the asset "decay" or deterioration curve. Many assets deteriorate slowly at first to a fair condition and then progress to more rapid degradation. This typical lifecycle pattern is illustrated in **Figure 2.10**, which shows the relationship between the condition and effective life (i.e., age). A key observation is that it is far more cost effective to maintain and rehabilitate assets before they reach a condition where the only option is costly reconstruction. For assets where preventive maintenance and rehabilitation activities are technically feasible, understanding the asset's current condition and place on the asset decay curve enables forecasts of future condition and determination of optimal treatment type and timing – key aspects of lowest lifecycle cost renewal decision making. The City is looking to invest more in condition assessments to gain the critical knowledge needed to determine the lowest lifecycle strategies.

Figure 2.10: Typical Asset Decay Curve



For each asset class, the City will need to develop an asset renewal strategy that identifies the frequency and cost of activities that provide the defined LoS at the lowest lifecycle cost. The renewal strategies are applied to the asset portfolio over time to determine the program of renewal activities and the amount that must be invested in the asset portfolio to sustain service levels. As part of the proposed WAMP Implementation phase, various options will be considered, and the proposed activities and frequencies (proposed LoS) will reflect the City's best estimate of level of effort that constitutes the lowest lifecycle cost while meeting LoS. For example, the City's overall Level of Service standards for stormwater drainage are established as: A minimum public road elevation to withstand flooding that will occur during a ten year, one-day storm event, and a minimum floor elevation to withstand flooding during a 100 year, three day storm event. In addition, new development and redevelopment must provide for retention and treatment of the first inch of stormwater runoff through the use of vegetative swales, perforated pipes, deep well injection, or other means acceptable to City, County and/or State agencies or departments. The City's stormwater drainage infrastructure includes 184 miles of stormwater pipes, 1,192 manholes, 1,049 discharge points, 10 drainage wells, and 8,950 inlets. The City participates in the Federal Emergency Management Agency's (FEMA) Community Rating System, which allows residents to receive discounts on federal flood insurance. In addition, the City maintains a Stormwater Master Plan, which identifies projects to maintain and improve drainage performance through 2025.

The City currently performs CCTV inspection and cleaning activities that require further review to determine the appropriate inspection frequency and percentage per year. **Table 2.23** provides an illustration of an approach to determining maintenance strategies, inspection, and cleaning frequencies. **Figure 2.11** is a proposed decision-making framework for determining maintenance and renewal work based on the CCTV data. The example is based on using the structural PACP score and length of major and minor defects. Other decision logic trees may be based on other parameters such as specific PACP defect codes. This is a network-level decision tree to assist in determining possible renewal and rehabilitation work; actual projects should be based on a review of CCTV inspection reports on a segment by segment basis. The City should further refine this approach to determine logic, exact treatment categories, and CCTV data that may be incorporated into GIS. Possible treatment categories:

- Emergency Replacement
- Full Replacement
- Full Lining
- Point Repair and or Partial Lining
- Flushing and/or Robotic cutting
- Re-inspection
- Standard inspection

Table 2.23: Example of an Approach to Determine Operations & Maintenance and Renewal Strategies (Linear Stormwater System)

			Operate / Maintain			Rehabilitate			Replace	
Level 6	Level 7	Unit	Description	Freq (yrs)	Unit Cost ($)	Description	Freq (yrs)	Unit Cost ($)	Freq (yrs)	Unit Cost ($)
Conveyance	Foundation Drain / Weeping Tile Collector	km	CCTV	25	$1,639*	Repair	25	$1,821**	100	Refer to each segment's replacement cost; varies by material/diameter
Conveyance	Sewers (100-yr replacement includes replacement of CBs/MHs/ditch leads)	km	CCTV	25	$1,639*	Repair	25	$1,821**	100	Refer to each segment's replacement cost; varies by material/diameter
Conveyance	Manholes (MHs)	Ea.	-	-	-	Adjust & Rebuild	25	$552	50	Refer to unit costs (varies by manhole diameter)
Collection	Catch basins (CBs)	Ea.	Clean	3	$100	Adjust & Rebuild	25	$364	50	Unit costs vary for single vs double catch basin
Treatment	Oil/Grit Separators	Ea.	Clean	3	$1,200	-	-	-	50	Refer to database (unit cost by model size)

** $1,639 per km estimated based on $120,000 for 4% of network*

*** $1,821 per km estimated based on $100,000 per year in repairs (assumed to cover 4% of network)*

Table 2.24: Example of an Approach to Determine Operations & Maintenance and Renewal Strategies (Stormwater Ponds)

		Operate / Maintain				Rehabilitate				Replace			
Level 6	Level 7	Desc.	Freq (yrs)	% of Component Cost	Unit Cost per Pond ($)	Desc.	Freq (yrs)	% of Component Cost	Unit Cost per Pond ($)	Desc.	Freq (yrs)	% of Overall Pond Cost	Unit Cost per Pond ($)
												100%	**$1,250, 000**
Access Control (Security)	Fencing					Spot repairs	15	15.0%	$1,875		30	1.0%	$12,500
	Signage										30	1.0%	$12,500
Siteworks	Safety Lighting					Replace light bulbs	25	15.0%	$1,875		50	1.0%	$12,500

Level 6	Level 7	Operate / Maintain				Rehabilitate				Replace			
		Desc.	Freq (yrs)	% of Component Cost	Unit Cost per Pond ($)	Desc.	Freq (yrs)	% of Component Cost	Unit Cost per Pond ($)	Desc.	Freq (yrs)	% of Overall Pond Cost	Unit Cost per Pond ($)
	Safety Station										30	1.0%	$12,500
	Vegetation	Remove overgrowth, debris	5	10.0%	$3,750						infinite	3.0%	$37,500
Maintenance Access	Roadway (gravel or asphalt)	Grade (gravel only)	5	5.0%	$3,125					Asphalt only	20	5.0%	$62,500
Flood Control	Berm					Reshape	40	25.0%	$6,250		infinite	2.0%	$25,000
	Liner										infinite	3.0%	$37,500
	Overland Flow Route (swale, ditch)					Reshape	15	20.0%	$12,500		infinite	5.0%	$62,500
Inlet Structure	Grate										25	2.0%	$25,000
	Inlet Headwall					Fix cracks and other defects	15	10.0%	$3,750		30	3.0%	$37,500
Outlet Control	Control Manhole					Fix cracks and other defects	15	15.0%	$1,875		60	1.0%	$12,500
	Maintenance Valve	Routine maintenance	5	5.0%	$625						30	1.0%	$12,500
	Overflow Weir (stone or concrete)	Rehab (stone)	15	5.0%	$1,250	Fix cracks and other defects (concrete)	15	10.0%	$2,500		Infinite	2.0%	$25,000
	Pond Headwall					Fix cracks and other defects	15	15.0%	$3,750		30	2.0%	$25,000

Level 6	Level 7	Operate / Maintain				Rehabilitate				Replace			
		Desc.	Freq (yrs)	% of Component Cost	Unit Cost per Pond ($)	Desc.	Freq (yrs)	% of Component Cost	Unit Cost per Pond ($)	Desc.	Freq (yrs)	% of Overall Pond Cost	Unit Cost per Pond ($)
	Riser (CSP)	Remove overgrowth, debris	15	10.0%	$1,250						30	1.0%	$12,500
	Stone Jacket (around riser)					Reshape	5	10.0%	$1,250		15	1.0%	$12,500
Outlet Conveyance	Flow Spreaders					Reshape	15	20.0%	$5,000		infinite	2.0%	$25,000
	Outflow Channel (ditch, etc.)					Reshape	15	20.0%	$2,500		infinite	1.0%	$12,500
	Stilling Basin / Apron (stone or concrete)	Reshape (stone only)	5	5.0%	$1,250	Fix cracks and other defects (concrete)	15	10.0%	$2,500	Concrete only	30	2.0%	$25,000
Sediment Removal / Flood Control	Forebay & Main Cell Active & Permanent Storage	Bathymetric Surveys	5	1.0%	$7,500	Remove sediment	15	66.7%	$500,000		infinite	60.0%	$750,000

** Inlet, Outlet, Bypass and Conveyance Pipes are included as part of stormwater system*

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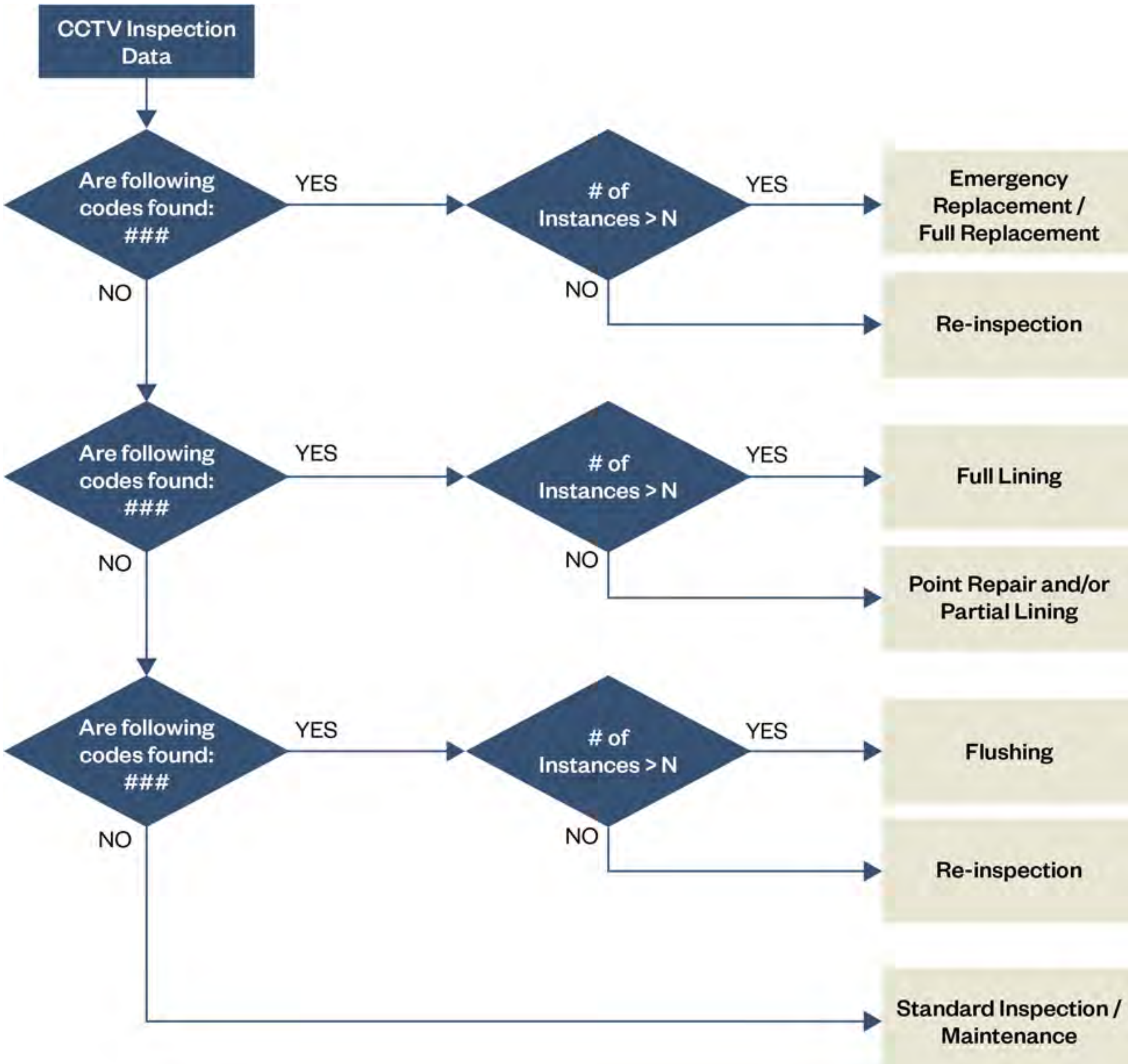
Figure 2.11: Example CCTV Decision-Logic Chart



The lifecycle activity frequencies for ponds in **Table 2.24** summarize network level activities; to determine pond-specific renewal work, the City currently performs regular inspections with a dedicated inspector/coordinator. The City will need to complete a condition inspection of all ponds and categorize them on the 1 to 5 condition rating scale shown in **Table 2.25**.

Table 2.25: Stormwater Pond Component Inspection Rating Scale (Example)

Rating	Description
1	Excellent
2	Satisfactory
3	Attention Required
4	Non-Functional
5	Safety Hazard

Future inspections will also provide recommendations on the required maintenance and renewal work for each pond.

Based on historic data from inspections, including CCTV, the City can develop an up-to-date list of work required to be performed for both maintenance and renewal. These are currently prioritized by City staff to effectively utilize available funding. The City is planning to develop a Risk Management Strategy. This strategy should provide a formal risk framework through which work can be prioritized based on asset criticality. For example, catch basins may be prioritized for cleaning in areas of construction and development. Sewers may be prioritized based on a number of factors, including diameter and type of road in proximity. Ponds servicing a larger drainage area or that have species of fish may be assessed to be more critical than ponds servicing a smaller drainage area. Assessing risk in a formal, consistent, and repeatable approach will require improvements in data collection.

2.4.5 Disposal Strategies

Asset disposal includes any activity associated with the disposal of a decommissioned asset such as its sale, demolition, or relocation. An asset disposal plan is an essential component of a sound asset management plan because the disposal of assets accounts for a significant portion of the full life-cycle cost of an asset.

The IIMM recommends that an asset disposal plan should include forecasts of the timing for future asset disposals and cash flow forecasts identifying income and expenditures associated with asset disposal. This also allows the City to know when replacement assets are operational and ready to absorb the workload of the decommissioned asset. That way, stormwater system operations can continue without interruption.

Stormwater assets can be disposed of in a number of ways. They can be demolished, recycled, relocated, or sold. Selling an asset would generate the highest income and may be the preferred option in certain circumstances where the asset is no longer needed. The sale price would depend on the physical state of the asset, the level of service it has provided to the City, its maintenance history, and its RUL.

Disposal costs are expenses that are directly related to asset disposal. The costs can be significant because of the difficulty associated with the disposal of stormwater infrastructure assets. Income and expenses associated with asset disposal are dependent on whether the assets are sold, demolished, or relocated.

As the WAMP Implementation phase is completed, appropriate disposal plans for each asset class within each watershed will need to be developed, along with a forecast of the timing and cost associated with the disposal.

2.4.6 Expansion Strategies

Based on the City's 2035 Vision Plan, the City's census population in 2035 is expected to grow to a projected 205,769. The distribution of population growth for the City is depicted in **Figure 2.12** and summarized in **Table 2.26**

Figure 2.12: Fort Lauderdale Population Projections

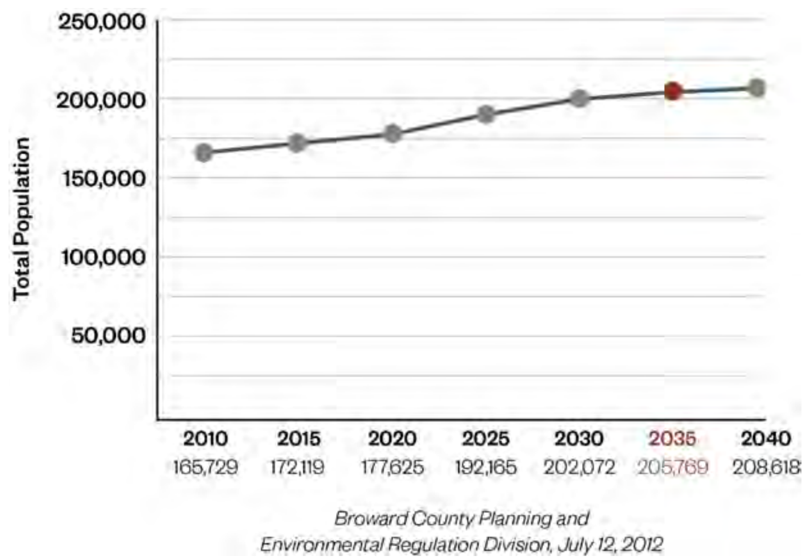


Table 2.26: Population Forecasts and Population Growth Rate for City of Fort Lauderdale

Year	Population	Compounded Growth Rate
2010	165,729	
2020	177,625	2010 to 2020: 0.70%
2030	202,072	2020 to 2030: 1.30%
2040	208,618	2030 to 2040: 0.32%

Based on the above population estimates, the compounded growth rate in the next ten years of the forecast period (2020 to 2030) is much higher than the growth rate in the last ten (2010 to 2020), as shown in **Table 2.26**. Overall, the compounded annual growth rate from 2020 to 2040 is 0.81%.

The level of expected population and asset portfolio growth will also place significant pressure on the capacity of existing operations and maintenance. Consequential operational expenditure (OPEX) is the O&M cost associated with new assets. For example, for a new asset, the costs of inspections and routine maintenance all contribute to the consequential OPEX associated with that new asset. These costs will be incurred by the City in the future for as long as the asset is in use. Similar to the construction of new linear assets, a good estimate of the consequential OPEX required to operate and maintain the new assets is simply the existing O&M cost multiplied by the growth factor. Based on the expected average annual population growth outlined above, the City's O&M activities and associated costs could be assumed to grow by approximately 1.3% from now until 2030.

2.4.7 Non-Asset Solutions

Non-asset solutions that assist in reducing demand on the City's stormwater infrastructure include public education where efforts focus on educating residents about the impact of surfaces that do not absorb water, such as resident roofs, driveways, roads and parking lots. Recommendations are posted on the City's website to keep storm sewer inlets clear as well as cleaning and maintaining assets such as downspouts, weeping tiles, sump pumps, back water valves and sewer lines from resident properties to the municipal lines. Suggestions for residents also include rain barrels and plant vegetation to minimize flows draining from residential properties into the City's stormwater system.

In addition to advising residents on the impact of impervious surfaces, the City is developing alternative City standards and practices through Low Impact Development (LID) strategies that address stormwater management.

2.4.8 Risks Associated with the Asset Strategies

The lifecycle activities have been selected based on an informal assessment of risk, summarized in **Section 4**. The proposed LoS establishes proactive maintenance programs that include predictive, preventive and corrective maintenance, and capital renewal programs to ensure that the work required to achieve the established LoS is identified and implemented.

Annual maintenance, capital programs, and associated budgets ensure that funding to undertake the necessary work is identified and understood. A possible risk is inadequate funding to undertake the programmed maintenance and renewal work (refer to **Section 6** for additional discussion on finance).

2.4.9 Procurement Methods

Procurement is the delegated authority to perform the following functions: sourcing of products/services, issuance of bids, issuance of purchase orders and contracts, monitoring of the bid process, conducting public tender openings, coordination of the evaluation process, participation in evaluating committees, issuance of reports to Council, recommending contract awards, settling vendor disputes, as well as the disposal of surplus goods.

Appropriate procurement methods help to ensure the most efficient allocation of resources when executing asset management strategies such as maintenance and renewal work completed by external contractors and suppliers. The City's objective is that goods and services are acquired on a competitive, fair, and open basis in a manner that is efficient and accountable. The City's Purchasing Bylaw guides all procurement practices and is supported by internal policies and procedures.

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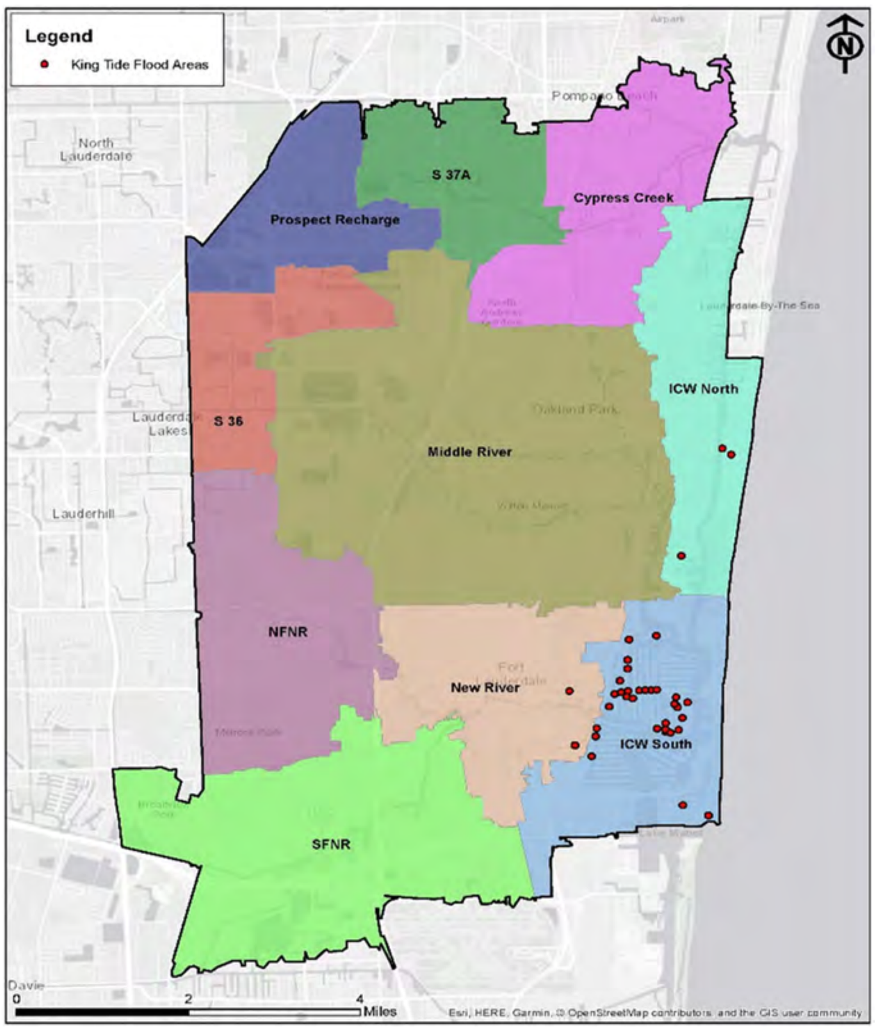
SECTION 3 – CITY FLOOD PROTECTION AND COMMUNITY INVESTMENT PLAN

3.1 City Roadway Flood Protection Criteria

In recent decades, several of the City's coastal watersheds have experienced more routine flooding associated with both spring and king tides. The events are often referred to as "Sunny Day/Nuisance Flooding" resulting from higher than normal tides in association with Sea Level Rise (SLR). There are three (3) watersheds identified with flooding as a result of changes to the historic tidal patterns. As shown in Figure 3.1, these watersheds include the Intracoastal Waterway (ICW) North, Intracoastal Waterways (ICW) South and the New River basin areas. Most of the flooding has been associated with roadways, residential properties and common areas.

Figure 3.1: King Tide Flood Areas



Within those watersheds, the roadways that are the most critically impacted are:

ICW North

East Oakland Park Boulevard

East Commercial Boulevard

ICW South

East Las Olas Boulevard

Southeast 17th Street

New River

West Broward Boulevard (SR 842)

Each of these roadways are designated as evacuation routes with important tenants, such as hospitals, police, fire stations and other essential services along these corridors. Therefore, thorough evaluations of the potential impacts to the operating LoS along these roadways is needed and essential in maintaining public safety and mobility of goods and services. Other considerations include access to businesses and employment, as well as damage to private property, since ponding water on streets has the potential to flood homes and businesses.

The roadway with the highest likelihood of flooding during a severe weather event is Las Olas Boulevard, which is designated as an evacuation route. Fort Lauderdale hospital lies at the western end of the watershed area (at SE 16th Ave) and if the roadway floods, access to and from the hospital for staff and emergency services may be compromised.

To address these issues, the City has built into its Comprehensive Plan Update POLICY SWS 6.1.4: Roadway stormwater standards, which states, “Stormwater systems for new roads or road reconstruction shall be designed to meet the minimum criteria in the South Florida Water Management District’s Environmental Resource Permit Applicant’s Handbook”. The City’s Comprehensive Plan Update also includes POLICY SWS 7.1.2 which sets design storm criteria for public road elevation as a ten-year, one-day storm event. In addition, POLICY SWS 7.1.4 requires drainage and stormwater management utilizing the following standards for new development of roads:

- Road Protection - Residential streets with rights-of-way less than fifty feet wide to have crown elevations no lower than the elevation for the respective area depicted on the ten year “Flood Criteria Map.”
- Streets in rights-of-way greater than fifty feet wide to have an ultimate edge of pavement no lower than the elevation for the respective area depicted on the ten year “Flood Criteria Map”.

3.1.1 Roadway Asset Evaluation Criteria

To address Policy SWS 6.1.4, 7.1.2, and 7.1.4, the WAMP implementation team will work with Public Work’s Roads, Bridges, and Stormwater divisions to integrate the WAMP activities with the Road/Bridges/Stormwater AMPs to assess the identified roadways vulnerable to flooding for LoF and CoF, taking into account the following considerations:

- Past flooding history
- Limits of flood inundation
- Period of flood inundation
- Hydraulic analysis for Sea Level Rise (SLR) to assess the peak stage increases for drainage
- Vulnerability to structural damages (base failure) as a result of increases to groundwater elevations
- Maintenance of Traffic (MOT) strategies for emergency repairs and reconstruction activities
- Interruptions to First Responder routes and services
- Roadway flooding impacts to existing utilities
- Roadway flooding impacts to adjacent properties and businesses

- Remaining service life of roadways most vulnerable to flooding

3.1.2 Potential Roadway Capital Projects

The WAMP implementation team will also assist the Roads and Bridges divisions in assessing potential roadway capital projects for stormwater permitting and constructability considerations to ensure the proposed solution is cost effective and manageable for the necessary long term stormwater maintenance activities and flooding mitigation. Possible roadway facility upgrades that could reduce flooding impacts include, but are not limited to the following:

- In some areas the roadway profile may be raised without adversely affecting adjacent buildings, cross roads, and driveways. However, in highly developed areas like eastern Fort Lauderdale, this is an unlikely solution.
- Rebuilding roads with new pavement that utilizes asphaltic base material may help to prevent base material washout during future flooding events.
- Upgrading facilities to include improved inlet spacing, pipe diameter, and outlet conditions.
- Where applicable, addition of detention ponds may alleviate roadway flooding conditions.

3.1.3 Considerations for City Roadways Resiliency Planning

Other critical issues that may need to be considered as part of the City's roadway resiliency planning include:

- Evacuation route plans and alternatives
- Coordinated roadway and drainage designs to ensure First Responder access into critical areas immediately following an extreme storm event
- Long term Land Use planning
- Infrastructure planning for improvements to roadways and bridges
- Habitat and wetland preservation and restoration
- Integration of Comprehensive Plan Update goals for flood/risk mitigation, utilizing Florida-Friendly ™ Landscaping principles, utilizing blue-green infrastructure to manage water more sustainably, Complete Streets program implementation, etc.

3.2 Stormwater Master Plan Modeling and Design Implementation Program

The Stormwater Master Plan Modeling and Design Implementation Program is a holistic and future-focused effort that involves several interconnected phases as described in the next sections.

3.2.1 Phase I

Phase I included implementation and completion of 37 small-scale stormwater Capital Improvement Planning (CIP) projects managed by the City.

3.2.2 Phase II – Seven Priority Neighborhoods

Phase II included development of a city-wide stormwater model as described in Section 1.8.3. It also addressed storm and tidally driven flooding issues in seven priority neighborhoods. Those seven neighborhoods and the watersheds in which they are located are listed in **Table 3.1** and shown in **Figure 3.1.**

Table 3.1: Priority Neighborhoods and Corresponding Watersheds

Neighborhood	Watershed(s)
Edgewood	South Fork New River
Victoria Park	New River, ICW South
Progresso Village	New River
Southeast Isles	ICW South, New River
Durrs	North Fork New River
Dorsey Riverbend	North Fork New River, New River
River Oaks	South Fork New River

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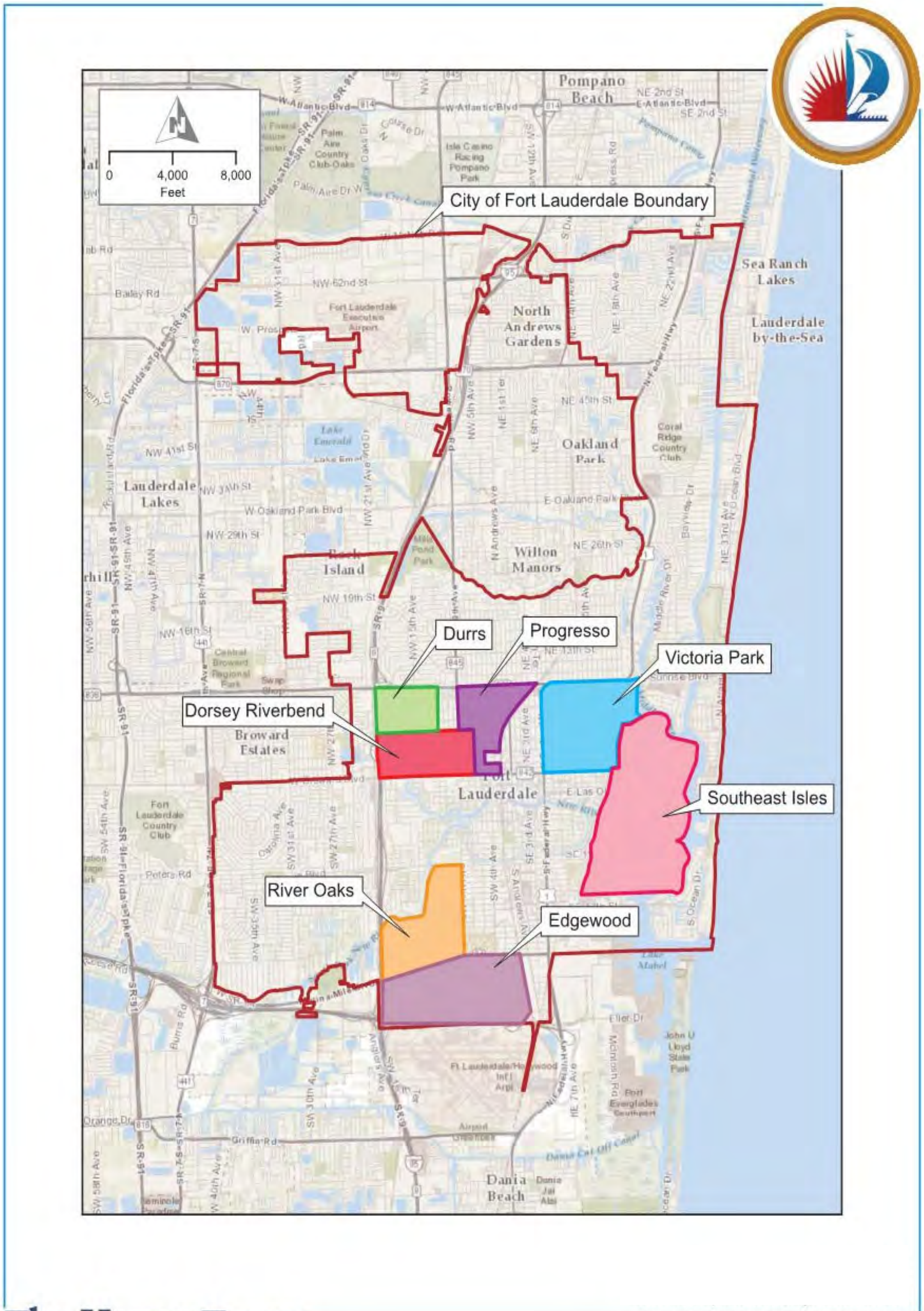
Figure 3.2: Stormwater Master Plan – Phase II, Seven Specific Neighborhoods



The Hazen Team

Additionally, under Phase II, the City of Fort Lauderdale will construct the projects identified, planned, designed, and permitted in the seven priority neighborhoods. The sections below provide additional information on the seven priority neighborhoods.

3.2.2.1 Dorsey Riverbend

Dorsey-Riverbend is a 382-acre neighborhood located in the New River watershed. Proposed stormwater management improvements will serve approximately 129 acres of the overall neighborhood. The proposed improvements include:

- a collection and conveyance system with pipe sizes ranging from 18 to 66 inches,
- approximately 2,299 LF exfiltration trenches ranging from 18 to 36-inches,
- an approximately 10,800 gpm (24 cfs) stormwater pump station and a 24-inch force main interconnection,
- one water quality structure and approximately 66,728 SQ FT of new or rehabilitated swales,
- approximately 22,651 SQ FT of pervious pavement, and
- one backflow preventer at the new outfall.

The proposed design focuses on increasing overall system conveyance capacity, reduce flooding, minor water quality improvements and rerouting drainage to a new outfall to the New River.

3.2.2.2 Durrs

Durrs is a 237-acre neighborhood located in the New River watershed. Proposed stormwater management improvements will serve approximately the overall neighborhood. The proposed improvements include:

- a collection and conveyance system with pipe sizes ranging from 12 to 36 inches,
- 6,857 SQ FT of permeable pavement,
- approximately 0.67 acres of grass swales, and
- two water quality structures.

The proposed design focuses on reducing nuisance flooding and improving system conveyance. Stormwater conveyance will be facilitated by creating redundant stormwater discharge piping to the Dorsey Riverbend neighborhood. The new point of discharge is proposed at NW 18th Avenue which is anticipated to convey additional stormwater run-off out of the neighborhood. Additionally, road grades will be modified in some areas to improve drainage.

3.2.2.3 Edgewood

Edgewood is a 745-acre neighborhood located in the SFNR watershed. Proposed stormwater management improvements will serve approximately 220 acres of the overall neighborhood. The proposed improvements include:

- a collection and conveyance system with pipe sizes ranging from 18 to 66 inches,
- approximately 5,990 LF of 18-inch exfiltration trenches,
- three water quality structures and 93,348 SQ FT of new or rehabilitated swales,
- approximately 303,613 SQ FT of pervious pavement, and
- one new outfall and two upgrades to existing outfalls to Osceola Creek.

The proposed design focuses on redirecting runoff from the low areas in central Edgewood north, through River Oaks, and ultimately to the SFNR. Improvements will increase storage, promote infiltration and reduce nuisance flooding.

3.2.2.4 Progresso

Progresso Village is a 314-acre neighborhood located in the New River watershed. Proposed stormwater management improvements will serve approximately 125 acres of the overall neighborhood. The proposed improvements include:

- a collection and conveyance system with pipe sizes ranging from 18 to 72 inches,
- approximately 558 LF of 24-inch exfiltration trench,
- an approximately 16,200 gpm (36 cfs) stormwater pump station and a 30-inch force main interconnection,
- one drainage well,
- one water quality structure and 30,280 SQ FT of new or rehabilitated swales, and
- approximately 34,412 SQ FT of pervious pavement.

The proposed design focuses on reducing flooding and providing some water quality treatment for runoff from already developed areas. There is no additional development being proposed associated with this infrastructure. All drainage will be discharged to existing infrastructure prior to discharge to the receiving body. No new outfall structures are proposed.

3.2.2.5 River Oaks

River Oaks is a 518-acre neighborhood located in the SFNR watershed. Proposed stormwater management improvements will serve approximately 256-acres of the overall neighborhood. The proposed improvements include:

- a collection and conveyance system with pipe sizes ranging from 12 to 72 inches,
- two stormwater pump stations at approximately 65,978 gpm (147 cfs) and 8,977 gpm (20 cfs),
- approximately 33,929 SQ FT of grass paver plastic grid system,
- four water quality structures, and
- approximately three backflow preventers.

The proposed design focuses on reducing tidal flooding and improving system conveyance. Stormwater conveyance will be facilitated by installing two pump stations. Both proposed stormwater pump stations will be located at the existing City preserve park at 2117 SW 19th Ave. and SW 19th Ave. Additionally, road grades may be modified in some areas to improve drainage.

3.2.2.6 Southeast Isles

Southeast Isles is a 1,243-acre neighborhood located in the ICW South. Proposed stormwater management improvements will serve approximately 188 acres of the overall neighborhood. The proposed improvements include:

- a collection and conveyance system with pipe sizes ranging from 12 to 42 inches,
- approximately 2,250 LF of seawall replacement as shown in **Table 3.2 and Figure 3.2**,
- two stormwater pump stations at approximately 13,465 gpm (30 cfs) and 15,260 gpm (34 cfs),
- approximately 2,720 SQ FT of grass paver plastic grid system,
- one water quality structure, and
- approximately 100 backflow preventers.

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Table 3.2: Seawalls to be Raised within Southeast Isles

Seawall within Southeast Isles	Approximate Length	Existing Average Height
Seawall 9 – Victoria Park	120	1.79
Seawall 10 – Seven Isles Drive at del Mar Pl.	291	1.61
Seawall 12 – E. Las Olas Blvd East of Lido Drive	96	2.19
Seawall 13 – E. Las Olas Blvd. East of Marco Drive	75	2.38
Seawall 14 - E. Las Olas Blvd east of Coral Way	80	2.38
Seawall 17 – Solar Plaza Drive	157	2.27
Seawall 30 – SE 10th Street	470	1.86
Seawall 34 – Barcelona Drive	148	1.87
Seawall 35 – SE 8th Street	470	1.48
Seawall Y – Hendricks Isle – Seawall 1	280	2.84
Seawall Y – Hendricks Isle – Seawall 2	67	2.53

The proposed design focuses on reducing tidal flooding and improving system conveyance. Stormwater conveyance will be facilitated by installing two pump stations. One proposed stormwater pump station will be located at the existing City wastewater pump station at 301 Lido Dr., and the second pump station will be located at Merle Fogg Park. Additionally, road grades may be modified in some areas to improve drainage.

3.2.2.6.1 Cordova Road and Isle of Palms Drive Seawall Replacement Projects

The Cordova Road Seawall Replacement project is located in the City of Fort Lauderdale’s Southeast Isles Neighborhood, runs along the east side of Cordova Road from SE 11th Court to SE 7th Street and within the City’s Right of Way. The proposed improvements include:

- approximately 2,166 LF of seawall replacement,
- three stormwater outfalls,
- nine existing stormwater inlets/outfalls to be extended through new seawall, and
- 12 backflow preventers, one for each outfall.

The proposed design focuses on reducing tidal flooding and improving system conveyance.

The Isle of Palms Seawall Replacement project is located in the City of Fort Lauderdale’s Southeast Isles Neighborhood, runs along the west side of Isle of Palms Drive, south of East Las Olas Boulevard and within the City’s Right of Way. The proposed improvements include:

- approximately 888 LF of seawall replacement,
- four stormwater inlets and outfalls, and
- four backflow preventers, one for each outfall.

The proposed design focuses on reducing tidal flooding and improving system conveyance.

The approximate seawall elevation and average wall height is included in **Table 3.3.**

Table 3.3: Cordova Road and Isle of Palm Drive Seawalls

Seawall within Southeast Isles	Approximate Length	Existing Average Height
Seawall 29 – Cordova Rd.	2,186	2.35[(1)]
Seawall 15 – Isle of Palms Drive	894	1.26

3.2.2.7 Victoria Park

Victoria Park is a 668-acre neighborhood bound by Federal Highway to the west, Sunrise Boulevard to the north, Broward Boulevard to the south, and the Middle River to the east. Victoria Park neighborhood is located in the New River and ICW South watersheds. The proposed stormwater improvements will serve approximately 25 acres of public right of way with the neighborhood. The proposed improvements include the following elements:

- improvements to stormwater collection system with pipe diameters ranging from 15 inches to 42 inches,
- approximately 9,000 LF of exfiltration trench,
- approximately 25 LF of seawall replacement,
- one stormwater pump station with discharge of approximately 8,530 gpm (19 cfs),
- one water quality structure immediately upstream of the proposed stormwater pump station,
- five in-line tidal control valves at existing stormwater outfalls, and
- three control structures with overflow weirs.

Due to the variable ground surface elevations on either side of the coastal ridge with the Victoria Park neighborhood, the design of the proposed stormwater improvements is different for the east and west basins within the neighborhood.

3.2.3 Phase III

Phase III will further provide stormwater improvements to neighborhood experiencing chronic flooding. The proposed additional neighborhoods for phase III stormwater improvements include: Melrose, Sailboat Bend, Riverland, Harbor Isles, Flagler Village, and Downtown. The design improvements for these neighborhoods shall be coordinated with the WAMP objectives, recommendations, and initiatives.

SECTION 4 – STANDARD OF CARE, LEVEL OF SERVICE (LoS) AND KEY PERFORMANCE INDICATORS (KPIs)

4.1 Asset Classes

The City's watersheds contain asset classes that fall into one of three major asset categories: hard, natural, and soft. Hard and natural assets are considered tangible and require Operations & Maintenance (O&M) resources to inspect, maintain, repair or replace. Soft assets, while not constructed or purchased, can have defined O&M costs to implement or maintain. Asset classes are comprised of like assets, such as Tidal Control Valves, that may exist in one or many locations within the City's watersheds. **Tables 4.2** through **4.4** present the City's asset classes, along with their corresponding asset type (hard, natural, soft).

4.2 Level of Service Overview

Each asset class has a related, existing/present Level of Service (LoS P). Respective asset classes expose the City to varying levels of risk subject to their physical location (i.e., watershed) and Consequence of Failure (CoF).

In order to more effectively manage risk, the City has established three LoS tiers (A, B, and C). This approach affords the City the ability to offer reactive and planned LoS activities appropriate to each respective watershed location, relative risk and the City's ability to mitigate flooding starting with the highest CoF assets/asset classes. **Figure 1** presents the proposed LoS framework for the City's stormwater system.

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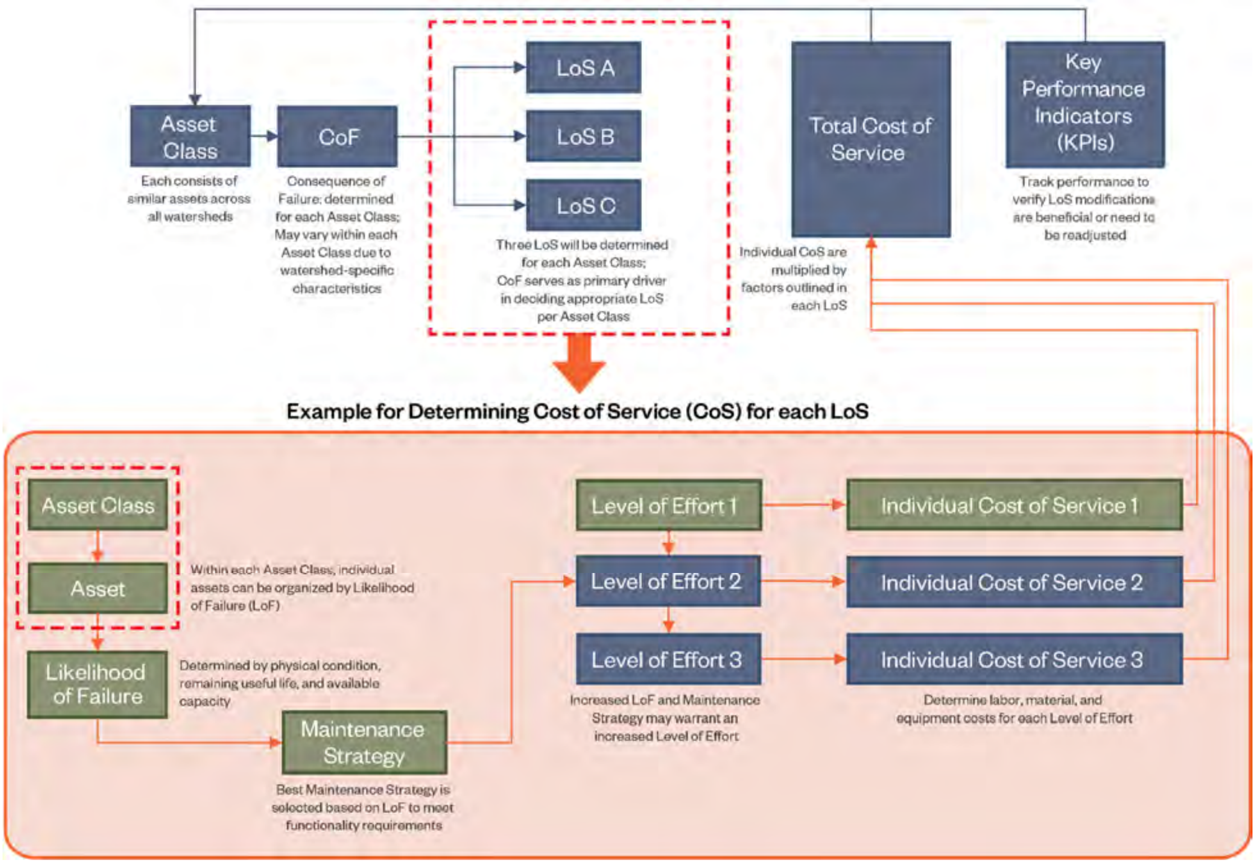
Figure 4.1: Proposed LoS Framework



4.2.1 Reactive **LoS**

Each LoS considers CoF as the primary concern. The LoS serves to establish and communicate response times to which the City will adhere. These can range, for example, from less than 2 hours for a tidal valve to 10 business days for a swale. By establishing appropriate response times, STW OPS can better prepare for and react to each situation at the correct degree. This approach serves to reduce downtime and better apply resources to more proactive activities.

4.2.2 Proactive **LoS**

Proactive LoS serves to establish the appropriate frequency, duration, and resources needed to inspect and test relative asset classes, either individually or by group and location. This approach ensures effective utilization of resources and the right level of maintenance for asset classes irrespective of the watershed in which they reside.

Special cases will exist in one or more watersheds that require unique consideration and response time to mitigate the unique risk they pose. These will be handled on a case-by-case basis by the STW OPS staff.

Each of the three LoS determined for each asset class corresponds to a different magnitude of resource needs (financial, human, physical, information). After selecting an LoS for each asset class, the City can determine the Total cost of service (CoS) to maintain the LoS and make modifications to resource allocations based on observed key performance indicator (KPI) performance.

4.3 LoS and KPIs

The LoS provides the level of inspection, maintenance, repair, and replacement schedules associated with the City's stormwater management, engineering, and environmental programs. The City's current LoS elements are presented in **Table 4.1**. **Appendix F** present examples of the City's LoS including frequency and number of assets per asset class.

Table 4.1: City of Fort Lauderdale Example LoS

Exiting Hard Assets	Reactive Inspection (non-emergency)	Proactive / Routine Inspection	Proactive Routine / Preventive Maintenance	Reactive / Corrective Maintenance
Control Valve	As needed	Quarterly	NPDES Permit: Clean XX Annually	Respond to Reactive Maintenance Efforts
Pond	Undefined	Undefined	Undefined	Undefined
Discharge Point	As needed	Critical Only - Monthly	Respond to Critical Outfall	Respond to Reactive Maintenance Efforts
Drainage Well	As needed	Semi-Annual (Feb/Aug)	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis from Reactive Inspections
Exfiltration Trench	Undefined	Undefined	Undefined	Undefined
Inlet	As needed	Semi-Annual	Clean XX Annually	Perform XX Reactive / Corrective Maintenance Annually
Manhole	Respond to Maintenance Efforts on a First Come First Serve Basis	Respond to Maintenance Efforts on a First Come First Serve Basis	Clean XX Annually	Perform XX Reactive / Corrective Maintenance Annually
Gravity Main	Respond to Maintenance Efforts on a First Come First Serve Basis	Respond to Maintenance Efforts on a First Come First Serve Basis	Clean XX Annually	Perform XX Reactive / Corrective Maintenance Annually
Network Structure	Undefined	Undefined	Undefined	Undefined
Pollution Control Structure	As needed	Quarterly (Feb/May/Aug/Nov)	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Perform XX Reactive / Corrective Maintenance Annually
Pollution Control Device	As needed	Quarterly	Respond to Maintenance Efforts	Perform XX Reactive / Corrective

Exiting Hard Assets	Reactive Inspection (non-emergency)	Proactive / Routine Inspection	Proactive Routine / Preventive Maintenance	Reactive / Corrective Maintenance
		(Jan/Apr/Jul/Oct)	on a First Come First Serve Internal Referral Basis	Maintenance Annually
Pump Station	As needed	PS No. 1&2 – Semi-Weekly PS No. 4&5 - Quarterly	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Perform XX Reactive / Corrective Maintenance Annually
Weir Structure	As needed	Semi-Annual (Apr-Oct)	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis	Respond to Maintenance Efforts on a First Come First Serve Internal Referral Basis from Reactive Inspections
Swales(1)	Undefined	Undefined	Undefined	Undefined
Culvert	Undefined	Weekly (Jan-Dec)	Undefined	Undefined
Ditch	Undefined	Melrose Ditch – Monthly (Jan-Dec)	Undefined	Undefined
Pressure Pipe	Undefined	Undefined	Undefined	Undefined
Right of Way	Undefined	Undefined	Undefined	Undefined
Seawall	Undefined	Undefined	Undefined	Undefined
Rock and Grade(2)	Undefined	Undefined	Undefined	Undefined
KT Delineators	Undefined	Deployed Annually (Sept)	Undefined	Undefined
KT No Wake Signs	Undefined	Deployed Annually (Sept)	Undefined	Undefined
Riverland Delineators(3)	Undefined	Undefined	Undefined	Undefined
High Water Signs(3)	Undefined	Undefined	Undefined	Undefined

(1) New asset to be mapped during the WAMP implementation.
(2) New asset. Ownership to be determined.
(3) On hold.
(4) SWML (a soft asset) has a 5-year renewal cycle.

4.4 Proposed LoS and KPIs

The three proposed LoS tiers are as follows:

- **LoS C** would allow the City to meet its watershed goals, focusing on the most critical stormwater infrastructure, high priority areas, and addressing environmental compliance.
- **LoS B** would be implemented in watersheds requiring an improved level of inspection and preventive and corrective maintenance in order to meet the established watershed goals.
- **LoS A** would be required where watershed goals require the maximum feasible level of inspection and preventive and corrective maintenance.

Each LoS will have one or more KPIs that will measure whether or not the City is meeting its watershed goals and will identify if any additional resources are needed to accomplish those goals.

4.5 Proposed LoS Framework

The objective of a LoS framework is to identify maintenance strategies for each asset class within each watershed, and then identify three potential LoS tiers (C, B, and A) for each asset class. The following sections provide a description of the various components of the LoS framework depicted in **Figure 4.1**. Maintenance strategies are applied to each asset class based upon the LoF and CoF they pose to the City. Maintenance strategies include: Run-To-Failure (RTF), Inspection and Testing (I&T), Preventive Maintenance (PM), Corrective Maintenance (CM), and Predictive Maintenance (PdM).

4.5.1 Asset-Imposed Risk

Each asset poses a degree of risk, measured by CoF and LoF, to the respective watersheds. The CoF and LoF for each asset class establish the business risk exposure (BRE) for each asset class. Section 9 contains representative examples of asset class tables for each watershed. A complete list of asset classes and their respective CoF will be determined during the Implementation Phase of the WAMP.

The LoF for each respective asset can only be established through a formal condition assessment to determine the current condition relative to design life. A condition assessment will need to be performed for each asset class during the implementation phase.

4.5.1.1 Consequence of Failure

The CoF will determine the severity and environmental, financial, and social impacts of an asset failure. While it would be ideal to establish a CoF for each asset within each asset class, the most cost-effective approach recommended is to consider that most of the assets within each asset class generally pose a similar risk should they fail, due to their functional requirements. However, special cases do exist within some asset classes that will require individual assessment due to the asset’s unique watershed characteristics and physical location. In such cases, additional analysis will be performed to determine the CoF for the respective assets during implementation of the WAMP.

The types of maintenance strategies recommended for an asset class will be determined by the asset class’s potential CoF impacts, as discussed in **Section 2.3**. For example, assets of low consequence may be limited to either I&T or RTF maintenance strategies, since the resources required for higher degrees of maintenance would outweigh the cost of replacing the asset outright. In cases where an asset class has assets with varying CoF due to unique characteristics, the highest CoF within that asset class will determine the maintenance strategies best suited to maximize operational life and reliability.

4.5.1.2 Likelihood of Failure

While the CoF determines the appropriate LoS to apply to a particular asset class, the asset’s LoF determines which applicable maintenance strategies best support the level of effort required to sustain asset life and reliability.

The LoF is determined based on the current condition, remaining useful life, and capacity of the asset, and is used to determine the appropriate maintenance strategy. The LoF of an asset, relative to its expected LoS, helps to identify the required resources (Financial, Human, Physical, and Informational) to restore the asset to a level necessary to provide the expected LoS or to replace it; whichever is most cost effective. Determining LoF requires assessing the current condition of each respective asset and verifying that its condition and information is reflected in the GIS database. This task is expected to occur during the Implementation Phase of the WAMP.

4.5.2 Maintenance Strategies

Knowing the asset condition and how it will impact overall risk, the City's STW OPS team can establish which of the following maintenance strategies best apply to each particular situation.

4.5.2.1 Low CoF Maintenance Strategies

Asset classes with a low CoF, such as manholes, are readily replaced upon failure and require minimal inspection as they are typically "run-to-failure" (RTF), indicating that replacement of the asset is more cost effective than the time and materials required to perform routine, preventive, or corrective maintenance. Maintenance strategies for asset classes in this category are limited to RTF, Inspection, and Testing.

The following asset classes are categorized as having low CoF:

Table 4.2: Asset Classes of Low CoF (Example)

Asset Class	Asset Type
Pond	Hard
Ditch	Hard
Swales	Hard
Exfiltration Trench	Hard
Manhole	Hard
Neighbor Survey	Soft
Wetland	Natural
Mangroves	Natural

4.5.2.2 Moderate CoF Maintenance Strategies

Moderate CoF asset classes require maintenance strategies necessary to mitigate risk of service interruption to complex systems. Complex systems are comprised of predominantly engineered systems such as pump stations, which are required to provide consistent service to customers. The CoF is primarily related to social impacts, resulting in moderate customer dissatisfaction and medium - but not large or catastrophic - environmental or financial consequences. Maintenance strategies for asset classes in this category are limited to those for Low CoF plus preventive and corrective maintenance.

The following asset classes are categorized as having moderate consequence:

Table 4.3: Asset Classes of Moderate CoF (Example)

Asset Class	Asset Type
Pollution Control Devices	Hard
Weir Structure	Hard
Inlet	Hard
Drainage Well	Hard
Gravity Main	Hard
Culvert	Hard
Network Structure	Hard
Budget	Soft
Training	Soft
Human Resources	Soft
River	Natural
Waterways	Natural
Water Bodies	Natural

4.5.2.3 High CoF Maintenane Strategies

Asset classes with high CoF utilize the full extent of maintenance strategies to reduce the potential for catastrophic environmental impacts, significant financial consequences to the City, and harm to the City's brand image and reputation. Maintenance strategies for asset classes in this category include those for Low and Moderate CoF plus predictive maintenance and replacement.

The following asset classes are categorized as having high CoF:

Table 4.4: Asset Classes of High CoF (Example)

Asset Class	Asset Type
Discharge Point/Outfall	Hard
Pump Stations	Hard
Tidal Control	Hard
Pollution Control Structure	Hard
Seawall	Hard
Permits	Soft
Ordinances	Soft
Policies and Procedures	Soft
City Plan Alignment	Soft
Partners	Soft
Land Development Regulations	Soft
GIS Inventory	Soft
Ocean	Natural

4.5.3 Functional Requirements and Level of Effort

Each asset class conforms to an established CoF across all watersheds. However, the functions of an asset, while similar, may vary subject to the operating context of each respective watershed. The design of each asset within its asset class, while similar, may vary in size, criticality, and condition. A successful asset management program requires a good understanding of asset class functional requirements in order to determine respective performance standards and the corresponding acceptable service tolerances.

After available maintenance strategies are defined for each asset class, the various levels of effort (LoE) to restore an asset to meet its basic functional requirements are determined. The LoE includes labor needs, type of work, and material resources that can be equated to an individual Cost of Service (CoS) once these values are quantified. At an asset level, the complexity of the LoE can increase with a higher LoF.

The correct LoE selected will directly correlate with the cost associated with delivering service. The LoS selected along with other LoE will influence the total CoS, which can be measured both quantitatively and qualitatively using KPIs.

4.5.4 Reactive and Proactive LoS

The LoS can be considered both reactive and proactive. Reactive LoS defines how the City will respond to external requests for service and/or customer complaints. Establishing clearly-defined and well-communicated reactive maintenance response times will establish clear expectations to the community and can be achieved by educating citizens through community outreach programs. For example, the City may choose to respond to a report of a blocked storm drain within two business days as compared to an asset issue that may require response within two hours due to public safety concerns such as a missing manhole cover or a sinkhole on a vehicular roadway.

Proactive LoS defines how and to what degree the City will inspect, test, maintain, and repair its watershed assets. This approach is internal-facing and determined by Operations and Maintenance. It affords the City a more level and balanced approach to controlling O&M costs, maximizing resources through effective planning and scheduling, and optimizing the execution of work.

As previously discussed, three separate LoS tiers will be provided for each asset class to provide the City the flexibility to decide what LoS is the best tier to provide to each watershed. Each LoS will outline the frequency (for proactive LoS) or efficiency and timeliness (for reactive LoS) at which work is to be completed, with values more stringent as the LoS increases. For example, the Discharge Point/Outfall asset class may have the LoS shown in **Table 4.5.**

Table 4.5: Discharge Point/Outfall LoS - Example

Levels	Levels of Service			
	Reactive Inspection (non-emergency)	**Proactive/ Routine Inspection**	**Proactive/Routine Preventive Maintenance**	**Reactive/ Corrective Maintenance**
LoS C	Respond within 3 days	33% of assets inspected each fiscal year	33% of all assets restored to performance standards each fiscal year	100% of all asset repairs completed within 60 calendar days of notification
LoS B	Respond within 2 days	66% of assets inspected each fiscal year	66% of all assets restored to performance standards each fiscal year	100% of all asset repairs completed within 45 calendar days of notification
LoS A	Respond within 1 day	100% of assets inspected each fiscal year	100% of all assets restored to performance standards each fiscal year	100% of all asset repairs completed within 30 calendar days of notification

Each asset class aims to achieve a certain LoS, dependent upon stakeholder expectations and funding availability. Data collected during routine inspections and preventive and corrective maintenance can then be compiled to inform the LoS and develop and track associated KPIs for each asset class. As an example, the following LoS B and corresponding KPIs might be proposed for Discharge Point/Outfalls in a particular watershed:

LoS B: As shown in **Table 4.5**, an established LoS can be achieved by measuring the following activities, frequencies, and response times of key maintenance activities, which represent the KPIs:

a. Reactive (non-emergency) inspection response time within two days
b. Proactive/Routine inspection completion (66% inspected each year)
c. Proactive/Routine Preventive Maintenance (66% restored to established performance standard)
d. Reactive/Corrective Maintenance response time – 100% of all repairs completed within 45 calendar days of notification

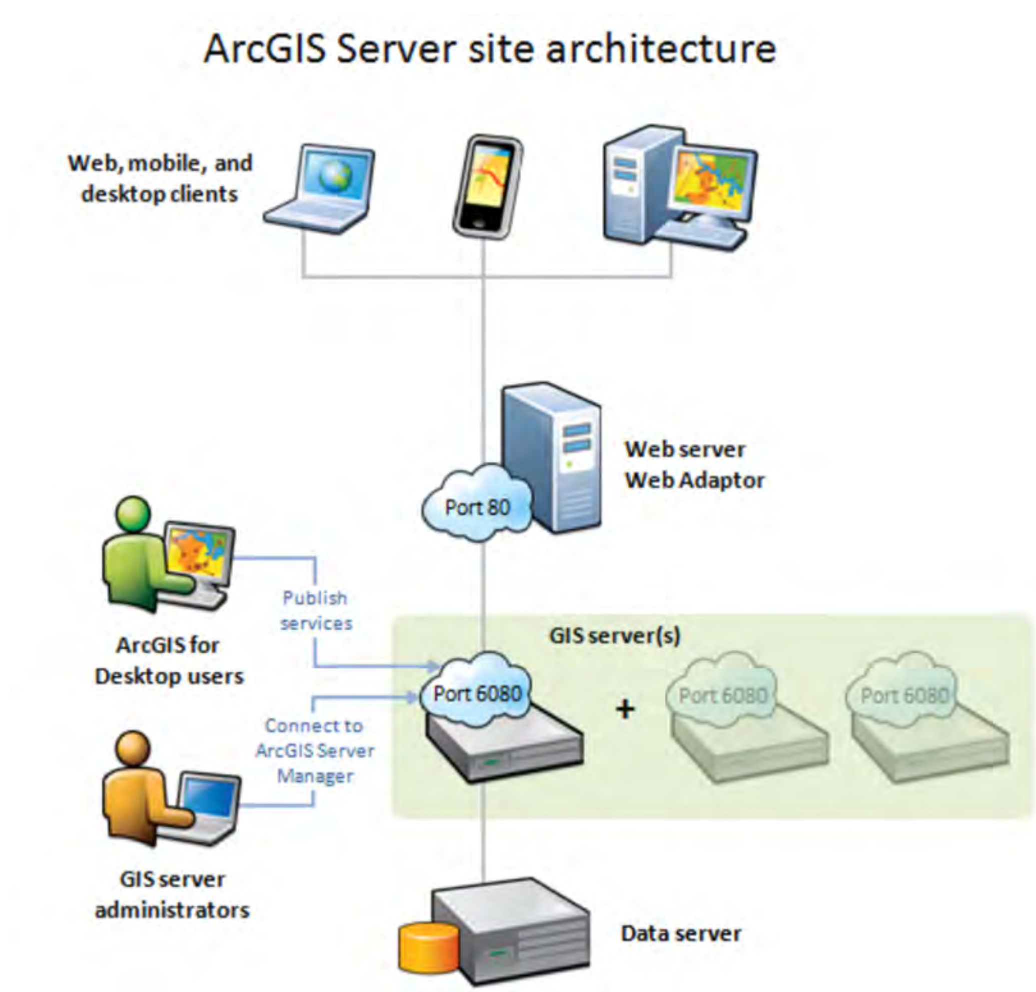
Once each asset class has an appropriate LoS tier identified based on CoF and the maintenance strategies have been developed based on the LoF of the asset class within each watershed, the corresponding level of effort (resources, staff, equipment, etc.) and CoS to provide the established LoS tier can be determined. The KPIs associated with each agreed upon LoS can then be measured and tracked to determine the City's adherence to the LoS tier it has selected and that LoS tier's effectiveness in reducing flooding issues and maintaining high water quality in the City's services areas. **Appendix G** presents the template for developing the LoS tiers for each asset class, triple-bottom-line LoS and KPIs, watershed preliminary priority designations based on watershed flooding characteristics, water quality permitting requirements and Adaptation Action Area (AAA) location.

SECTION 5 – ASSET INVENTORY UPDATING PROCEDURES

5.1 Asset Inventory Access

The City of Fort Lauderdale operates and maintains an Enterprise GIS system for the use of City Departments. The Enterprise GIS operates in an on-premises datacenter computing environment. Access control for internal resources is maintained via federation with the City's IT Department and Employee Roster. In essence, users authenticate with the GIS using the same credentials used to log into their workstations. Permissions are assigned to users on an individual basis. Permissions are also specific to individual databases, such that users can receive read/write permissions to water, sewer, and/or stormwater Geodatabases based upon their job duties. An overview of the architecture of the GIS is presented in **Figure 5.1.**

Figure 5.1: Overview of ArcGIS Enterprise GIS Data Flows



The Enterprise GIS is implemented with the ArcGIS Enterprise suite of software applications, provided by the Environmental Systems Research Institute (ESRI) of Redlands, CA. On-premises servers within the City's datacenter provide all functionality required by the software applications. The storage systems are redundant and single-fault-tolerant for reliability. Data storage is within an Enterprise Geodatabase in Structured Query Language (SQL) database subsystems.

Web applications are used to retrieve data stored within the Enterprise GIS to users within the Public Works Department. For STW OPS, the web application is called "Storm Viewer" The web application operates within and retrieves data from the virtualized SQL subsystem in real-time. Thus, updates and modifications made to the SQL subsystem are presented to all users immediately. A user-friendly graphical interface is provided to users in order to navigate to any area of the City and select layers to view. Users are also able to view all attribute data related to each feature class. The feature classes available to users within the stormwater geodatabase via a web application are listed in **Section 2, Table 2.3**. **Appendix H** provides the full stormwater data dictionary used to store this data.

The main GIS access goal is to ensure that operations and engineering personnel have the information needed to perform their duties in an effective and efficient manner and are able to make decisions based on current and reliable asset information.

5.2 Existing Assets Updates

Stormwater System modifications occur due to private development or redevelopment within the City of Fort Lauderdale, City Public Works Department (PWD) Projects, and City Operations and Maintenance Activities. Furthermore, surveys performed by the Public Works Department Engineering Division's Survey Section (Survey Section) or by contracted surveyors may find discrepancies between field conditions and data within the GIS. In all cases, it is necessary to rapidly and efficiently update the GIS asset information to reflect the most recent field conditions. Maintaining an updated GIS is essential to support operations and maintenance activities performed by the STW OPS. A regularly updated GIS is also necessary for the implementation and functioning of asset management, maintenance management, and work order management systems. Currently, the City is implementing a Cityworks Enterprise Asset Management System (EAMS). This EAMS will utilize the GIS geodatabase as its asset registry. It is anticipated that once the Cityworks EAMS is placed into service, it may be used as a tool to streamline the workflow for certain updates to GIS data from City field personnel. However, GIS analysts will continue to update the bulk of the GIS asset data based on GIS workorder requests coming from the EAMS or from new or updated asset information from As-built and/or survey drawings as described in the sections that follow.

5.2.1 Updates to Existing Assets Included in the Existing Stormwater Geodatabase

One key activity for the update of the existing stormwater assets is to understand, to the greatest extent practicable, the extent to which the stormwater system assets are included in GIS and the completeness of the asset inventory information. Some of the questions that need to be evaluated to get this understanding are:

- What data exists?

- What is the completeness and accuracy of the data?
- What data is missing?
- What missing data is the City currently collecting and what data needs to be collected and how it will be collected?
- How is the data going to be accessed?
- How is the data going to be updated?

This section provides an overview of how the assets are updated using data from several different sources. As mentioned in the previous section, the City's mapping data is maintained in a geodatabase format and is populated and updated from several data sources. Most of the data is imported into GIS from as-built drawings. However, there are other document types used to update the GIS as described below:

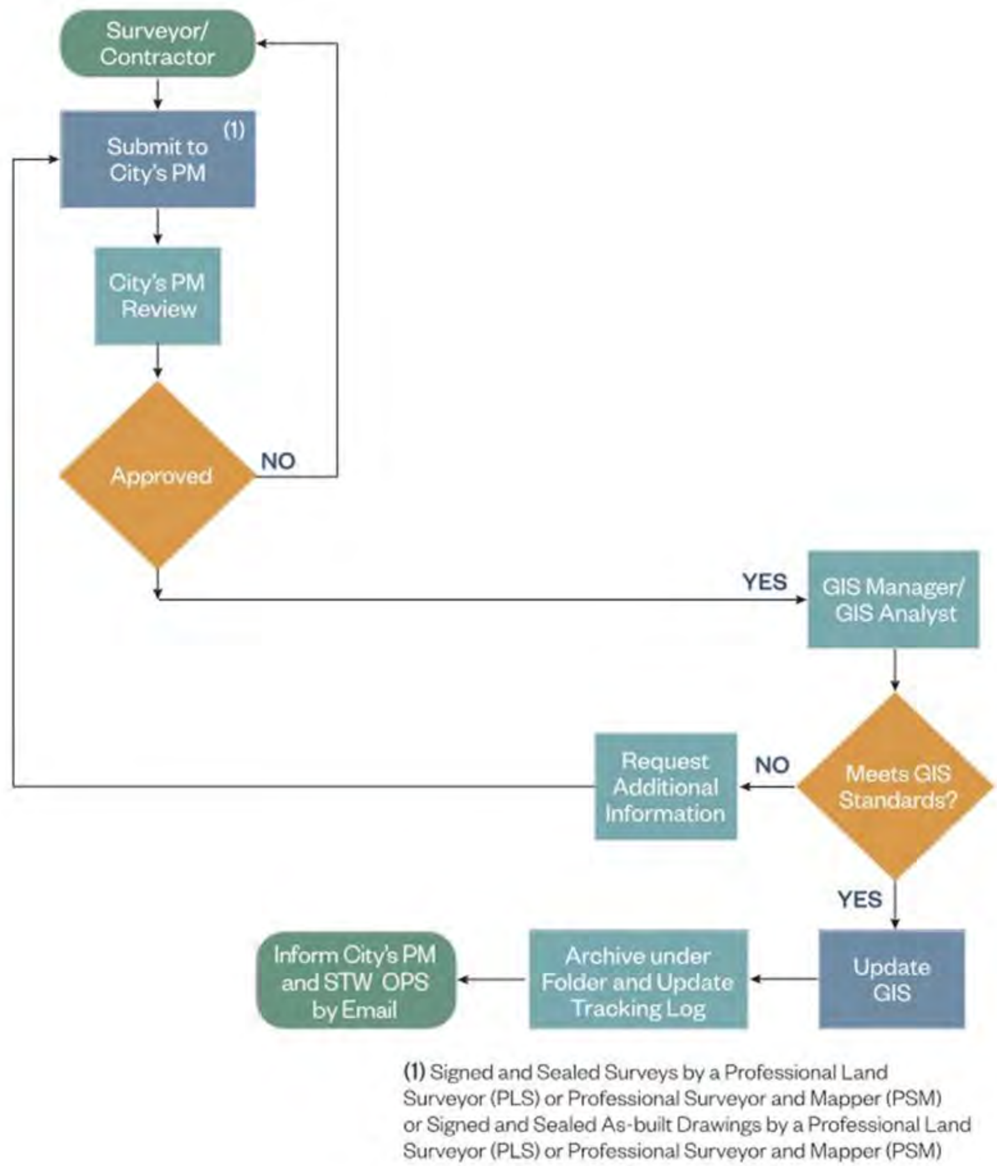
- As-Built Drawings from projects managed by the City's PWD Engineering Division – Refer to Figure 5.2
- Surveys from the Survey Section – Refer to Figure 5.2
- As-Built Drawings from City's PWD Engineering Division contracted projects – Refer to Figure 5.3
- Surveys from external surveyors – Refer to Figure 5.3
- Field notes from the City's PWD Utilities Divisions for asset information that does not require surveying such as asset condition assessments or status of asset (e.g. inactive, removed, replaced). These updates will be addressed via Cityworks workorder system
- As-Built Drawings from the City's Department of Sustainable Development (Building Department) – The City is in the process of establishing standards and procedures for As-built drawings received from the DSD.
- Survey and attribute data submitted as part of ongoing system characterization. These updates will be managed by the City's GIS team.

Updates to the GIS Data (spatial and tabular) rely in some fashion o three units of the City: the IT Department's GIS Division (GIS Division), the Survey Section, and the PWD Engineering Division. Documents that contain updated georelational or attribute data are routed to either the GIS Division, or the PWD Engineering Division, or the Survey Section when they arrive. This routing is decided based upon the document type and source, and is shown in **Figures 5.2 and 5.3.**

5.2.1.1 PWD Signed and Sealed Surveys and As-built Drawings Workflow – In-house Work / Projects

Figure 5.2 presents the suggested workflow to update the stormwater geodatabase with asset data from signed and sealed surveys and/or as-built drawings from inhouse PWD projects/work. The workflow applies to projects managed by the City and/or surveys performed by the City's Survey Section. The updates may be triggered by topographical asset data gathered on new or existing stormwater assets by City surveyors, updates to existing stormwater assets by the STW OPS, and/or installation of new stormwater assets listed in **Section 2**, **Table 2.3**. The GIS analysist will require signed and sealed as-built/ survey drawings in order to perform updates to the stormwater geodatabase. New additions from as-built drawings will be input to the GIS by extracting asset information. There are several options to import the as-built data into GIS. The City is currently evaluating these options.

Figure 5.2: PWD Signed and Sealed Surveys and As-built Drawings Workflow – In-house Work / Projects



5.2.1.2 PWD Signed and Sealed Surveys and As-built Drawings Workflow – Contracted Projects

Figure 5.3 presents the suggested workflow to update the stormwater geodatabase with asset data from signed and sealed surveys and/or as-built drawings from contracted projects. The workflow applies to engineers, surveyors, or contractors performing work under contract that involves and addition to, or modifications of, the City's stormwater system. This type of work may include the design and installation of new inlets, manholes, exfiltration trenches, or work on assets represented in any of the feature classes in the stormwater geodatabase (listed in **Section 2**, **Table 2.3**). Engineers will be required to submit signed and sealed as-built and/or survey drawings as detailed in the contract and/or contract documents. The City plans to formalize Standard Operating Procedures (SOPs) for submitting signed and sealed surveys and/or as-built drawings for all contracted (and inhouse) work. At that time, all contracted work will be required to follow the established SOPs, which will facilitate the integration of asset data into the stormwater geodatabase.

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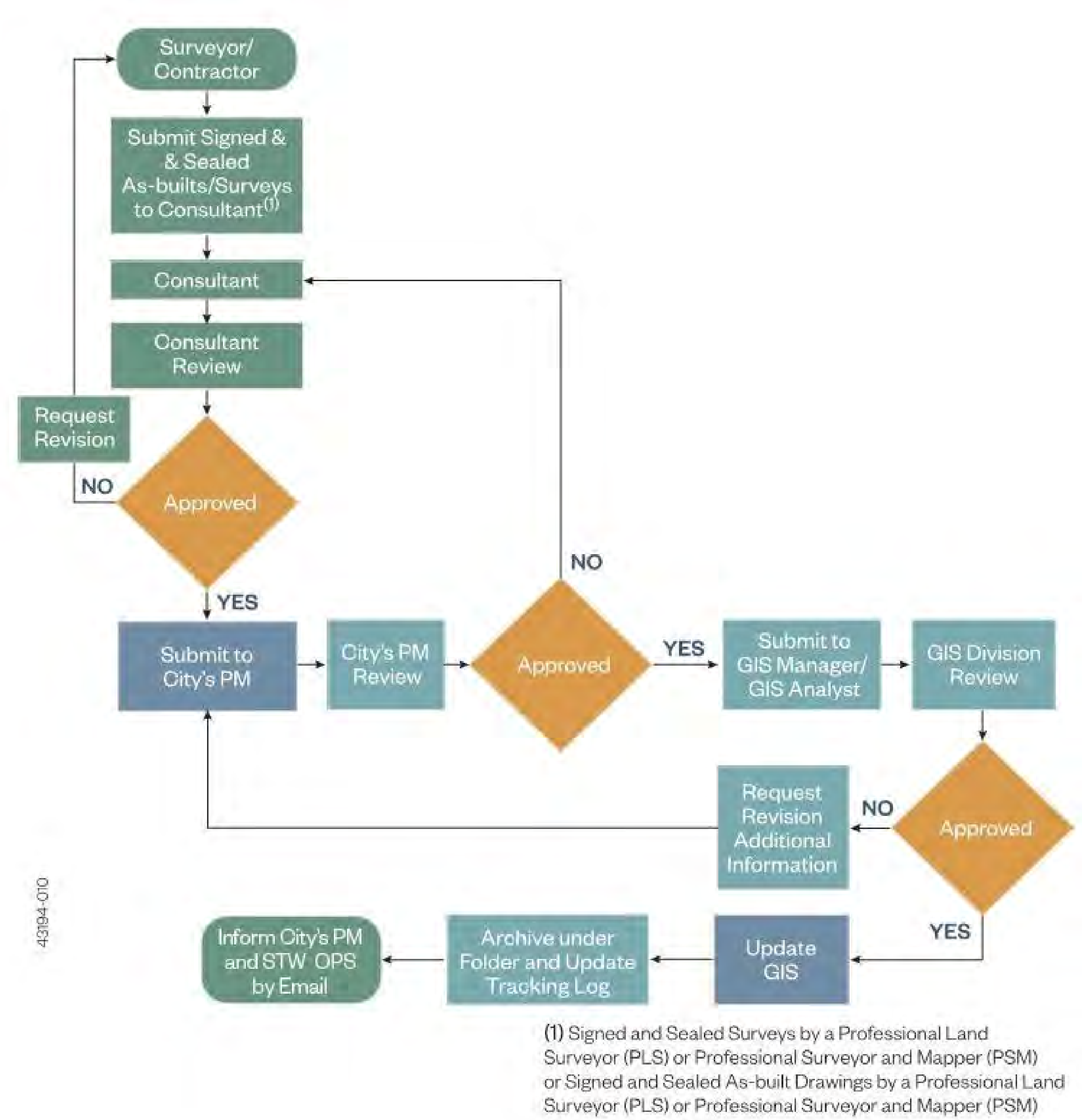
Figure 5.3: Signed and Sealed Surveys and As-built Drawings Workflow – Contracted Projects



5.2.2 Updates to Existing Assets not included in the Existing Stormwater Geodatabase and GIS Schema Development

The City is in the process of adding the following feature classes (hard asset classes) to the stormwater geodatabase:

- Seawalls
- Swales
- Drainage Easements
- Drain Trenches/Ditches
- Drainage Canals

Once the above listed asset classes are added to the stormwater geodatabase the asset data will be updated as described in **Sections 5.2.2** and **5.2.3**.

5.3 New Assets Inventory

5.3.1 City Projects

New assets inventory will be added to the stormwater geodatabase as described in **Sections 5.2.1.1** and **5.2.1.2**.

5.3.2 Private Development Projects Transferred to the City

The Department of Sustainable Development (DSD) issues and reviews permits for stormwater assets within the City's Right-of-Way (ROW) for single family and commercial buildings. City engineering staff inspects the stormwater asset(s). After the warranty period expires, the assets are transferred to PW STW OPS for asset maintenance. As part of the transfer process, as-built drawings are submitted by DSD to the PW Engineering Division for integration of the asset data into the stormwater geodatabase.

5.3.3 Public Assets Transferred Across Jurisdictions

The City seldom obtains ROW assets transferred across jurisdiction. However, there have been several instances where roads or other stormwater assets have been transferred to the City. An example of an asset transferred across jurisdictions is Las Olas Blvd. This major street was transferred to the City from the Florida Department of Transportation (FDOT). This road is part of the Southeast Isles Neighborhood. Another example of an asset transferred to the City was Riverland Road at State Rd 441, previously a FDOT ROW.

The Departments responsible for the transfer of assets across jurisdiction includes: Transportation and Mobility (TAM) Division, the Legal Department and City Management.

Moving forward, it is recommended that the City be intentional about coordinating and communicating with adjacent municipalities, Broward County, FDOT, SFWMD and other jurisdictions in order to create mutually beneficial opportunities. Resiliency and optimization of asset performance will be best achieved through collaborative efforts and joint partnerships. Opportunities for joint funding and project execution exist in many locations where assets from different stakeholders' interface. The execution of these committed partnerships will be needed and are very important in the face of a changing climate and environment.

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SECTION 6 – HOW MUCH WILL THE WAMP COST?

6.1 Budgetary Forecast of WAMP Level of Effort and Savings Impact on Stormwater Operations Fund, Fiscal Years 2019 through 2023

In order to determine the level of effort (LOE) and associated budget requirements for the City to develop and implement a multi-phase, multi-year WAMP that supports the City's sustainability and environmental programs for Fiscal Years 2019 through 2023, the City needs to assess the following four components for each of the 10 watersheds:

- Forecasted operations and maintenance expenses, which includes both in-house and contracted work.
- Forecasted capital renewal and replacement costs
- Estimated impact of SWMP assets on forecasted operations and maintenance expenses.
- Forecasted WAMP investment costs, both for external (i.e., consultant) support and within STW OPS.
- Forecasted WAMP savings achieved through improved efficiencies.

Each of these components is described in further detail in Sections 6.2 through 6.5. Section 6.6 then presents graphical and tabular summaries of how all four of these components comprise the WAMP's forecasted LOE and associated Stormwater Operating Fund budget for Fiscal Years 2019 through 2023.

6.2 Forecasted Operations and Maintenance Expenses

STW OPS has operated as its own enterprise fund since Fiscal Year 2014. Prior to 2014, stormwater assets were somewhat ancillary to other Public Works assets, such as those for water and wastewater operations, and as such have endured many years of deferred maintenance. STW OPS has since undertaken aggressive, proactive maintenance to make up for these lost years of deferred maintenance.

Based upon the current situation, the most realistic basis for forecasting future stormwater fund operations and maintenance expenditures for Fiscal Years 2019 through 2023 is a linear projection of historical budget data for Fiscal Years 2014 through 2017, for which complete annual budgetary data currently exist. Detailed estimates are presented graphically and in tabular format in **Figure 6.1** and **Table 6.1** below:

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Figure 6.1: LOE for WAMP, Forecasted WAMP Savings and Stormwater Operations Fund Budget Overview

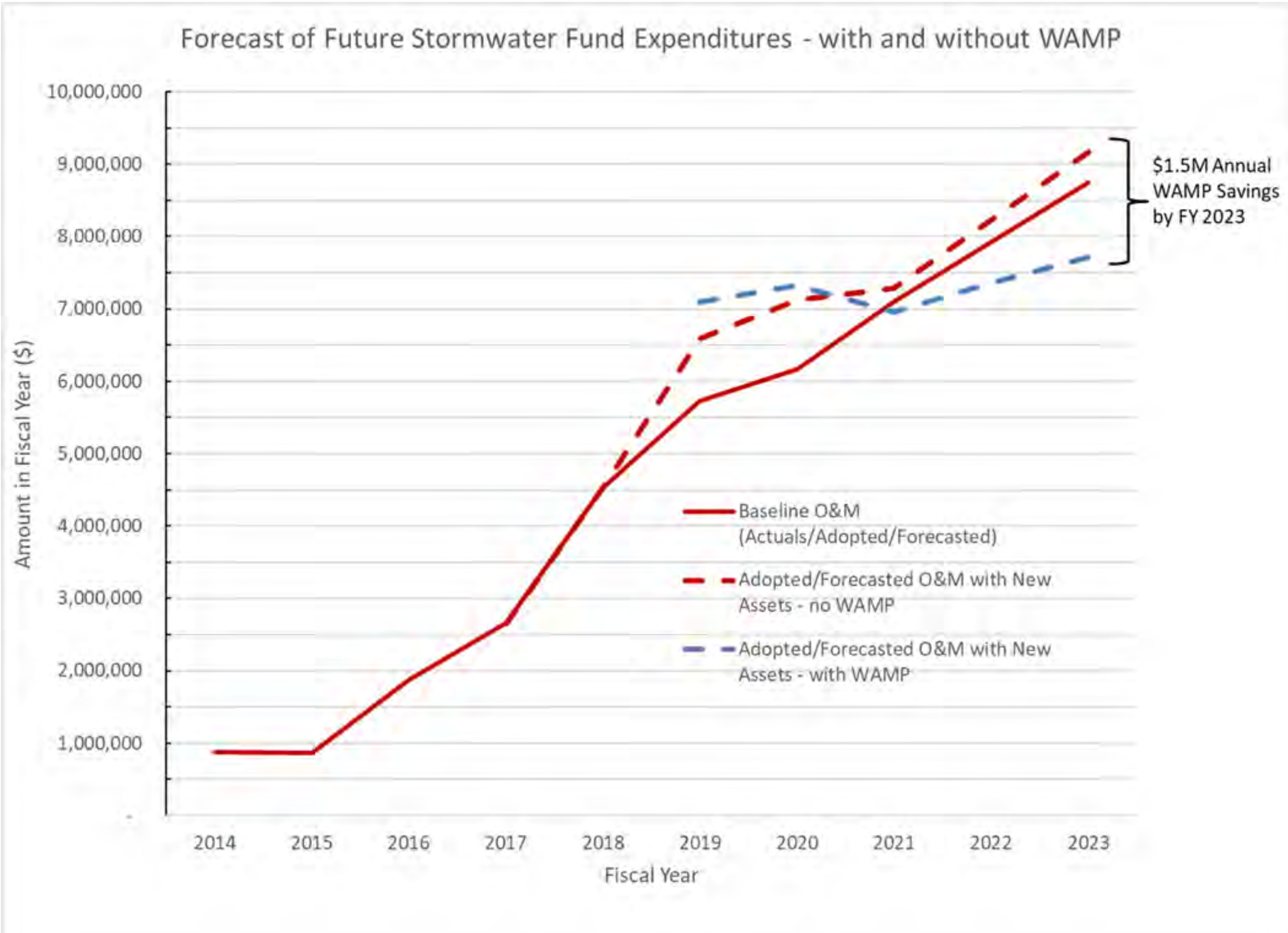

Table 6.1: LOE for WAMP, Forecasted WAMP Savings and Stormwater Operations Fund Budget Estimate Fiscal Years 2019 through 2023

Fiscal Year	2019	2020	2021	2022	2023
	Adopted	*Adopted*	*Forecasted*	*Forecasted*	*Forecasted*
Baseline O&M - No WAMP	$5,729,346	$6,161,471	$7,100,000	$7,920,000	$8,740,000
Total Estimated O&M New Assets	$856,000	$957,000	$181,000	$309,000	$419,000
O&M with New Assets - No WAMP	$6,585,346	$7,118,471	$7,281,000	$8,229,000	$9,159,000
WAMP Investment: Consultant	$771,000	$210,000	$180,000	$180,000	$190,000
WAMP Investment: STW OPS	$231,000	$238,000	$245,000	$253,000	$260,000
Gross WAMP Investment	$1,002,000	$448,000	$425,000	$433,000	$450,000
Gross WAMP Savings	$-	$250,000	$750,000	$1,300,000	$1,900,000
Net WAMP Investment (-) Savings (+)	$ (510,000)	$(200,000)	$330,000	$870,000	$1,450,000
O&M with New Assets - with WAMP	$7,587,346	$7,316,471	$6,956,000	$7,362,000	$7,709,000

As it can be seen in **Table 6.1**, the WAMP implementation is forecasted to require net investments, as shown by the blue dashed line, in Fiscal Years 2019 and 2020 with net savings realized in Fiscal Year 2021. Following an estimated net investment of $510,000 in Fiscal Year 2019 and $200,000 in Fiscal Year 2020, net annual savings of forecasted operations and maintenance costs are estimated to be $330,000 in Fiscal Year 2021, reaching approximately $1.5M by Fiscal Year 2023. This reduces the forecasted Stormwater Operations Fund Budget from $9.16M to $7.71M by Fiscal Year 2023.

6.3 Forecasted Capital Renewal and Replacement Costs

Capital Investment for the City of Fort Lauderdale for fiscal years 2020 through 2024 is identified through the Community Investment Plan (CIP), which provides a total investment required including stormwater infrastructure.

The Stormwater Management Program faces several infrastructure challenges in order to successfully achieve the City's stated goal: 'to be a sustainable and resilient community'. The key objective of this goal is to reduce flooding and adapt to sea level rise. The City has already developed a stormwater master plan and plans to invest $196 million into making hard assets more resilient to flooding and sea-level rise. Hazen and Sawyer currently leads this initiative and is supported by four local engineering firms who will design and oversee the rehabilitation, replacement, or addition of new infrastructure within each of the five focus watersheds.

Stormwater capital investment planned for FY 2020 is $11.6 million, or 1.6% of the total budget. The City intends to issue a $200 million bond in FY 2021 in order to fund the critical infrastructure needed to reduce flooding in at least five of the ten watersheds and their respective seven neighborhoods, which make up half of the City's stormwater system of ten watersheds, recognizing that each watershed has its own unique requirements.

During the Discovery phase of the current WAMP, a percentage of hard assets have been identified for each watershed, as referenced in Section 9 of this document. Representative samples of each asset class have been assigned a CoF based upon their physical location, elevation, and risk exposure to extreme environmental conditions.

During the Implementation Phase of this project, asset condition will need to be assessed to determine the LoF. Combined, these assessments will determine respective Criticality scores and Business Risk Exposure (BRE) case studies that will aid in future projection of additional capital to refurbish, replace or add new assets in order to meet the City's strategic goal and objective, as stated above.

This will inform the current effectiveness of capital investment on meeting resilience requirements and establish, more accurately, the degree at which future capital expenditures will be required for FY 2020-2024 and eventually over the long-term (i.e., 50 year) horizon.

6.4 Estimated Impact of SWMP Assets on Forecasted Operations and Maintenance Costs

6.4.1 New Assets

Using existing asset data from STW OPS's geographic information system (GIS) and Stormwater Master Plan SWMP cost data, the quantity and type of new assets that will be constructed per the SWMP was able to be proportionally determined. Average proportional growth by each asset class was then used to forecast operations and maintenance expenditures. For example, there are currently 14,116 storm inlets and the SWMP will introduce 257 new storm inlets, representing a 1.8 percent growth in this class of assets. This was then repeated across all other asset classes (e.g., manholes, tidal vales, etc.) to obtain an approximate six percent growth in stormwater assets excluding pump stations, pipes, and exfiltration trenches. This six percent growth was then applied to STW OPS's historical operations and maintenance expenditures to obtain a forecasted annual cost of approximately $100,000 annually (**Table 6.2**) to operate and maintain these new assets.

Table 6.2: New (SWMP) Assets Impact on Future Operational and Maintenance Costs

Fiscal Year	2019	2020	2021	2022	2023
New Assets	$100,000	$103,000	$106,000	$109,000	$112,000
Pump Station Maintenance	$297,000	$306,000	$315,000	$324,000	$334,000
Pump Station Energy	$19,000	$20,000	$21,000	$22,000	$23,000
O&M Impact Profile of SWMP	0%	24%	41%	68%	89%
Subtotal Non-Pipe & Trench Assets	$ -	$101,000	$181,000	$309,000	$419,000
New Equipment for Pipe & Trench Operations	$783,000	$783,000	$ -	$ -	$ -
Pipe & Trench CCTV and Cleaning Activities	$ 73,000	$73,000	$ -	$ -	$ -
Subtotal Pipe & Trench Assets	$856,000	$856,000	$ -	$ -	$ -
Total Estimated O&M New (SWMP) Assets	$856,000	$957,000	$ 181,000	$309,000	$419,000

6.4.2 New Pipe and Exfiltration Trenches

To provide a more accurate estimate of forecasted operations and maintenance costs of new pipe and exfiltration trench assets, STW OPS estimated cleaning and closed circuit television (CCTV) costs at $73,000 annually, in addition to associated trucks and equipment at $783,000 annually for Fiscal Years 2019 and 2020 only.

6.4.3 New Pump Stations

STW OPS spends $36,000 per quarter for maintenance on its current four (4) pump stations. According to the SWMP, eight (8) new pump stations are anticipated, which correlates to $288,000 annually to maintain these new stations. Based on pump horsepower and runtime estimates from the SWMP, in addition to an estimated 11.9 cents per kWh energy cost, it is estimated that annual energy costs for these pump stations will be approximately $18,000.

6.5 Forecasted WAMP Investment Costs

6.5.1 Forecasted Consultant Costs

Consultant fees are estimated based on a workup of the three phases of WAMP implementation tasks. While most of these tasks can be established (e.g., asset register, risk analysis, WAMP document, etc.) by the beginning of Fiscal Year 2020, additional modification, enhancement, and updating of work within those tasks will need to be undertaken in the subsequent four years. For instance, a foundational level of maintenance process maps, can be established in the first fiscal year that will inform and drive improved O&M efficiencies but as STW OPS embraces the principles of condition based maintenance, it will require support in revising these process maps. Thus, the following consultant support costs are estimated by fiscal year:

- Fiscal Year 2019 Actual: $771,000 ($519,000 for WAMP development, $217,000 for drainage easements geodatabase development, and $35,000 for ESRI-CUES software integration)
- Fiscal Year 2020 Forecast: $210,000
- Fiscal Years 2021 through 2022 Forecast: $180,000

When accounting for a 3 percent assumed annual cost escalation, the $180,000 projected costs in Fiscal Year 2023 increase to $190,000.

6.5.2 Forecasted STW OPS Internal Costs

Given the strain the various WAMP implementation tasks will place on existing staff, it is anticipated that STW OPS will need to increase staffing by at least one permanent Maintenance Planner and two GIS Technicians to improve the team’s ability to effectively plan maintenance and repair work using GIS data, inclusive of both administrative and field functions. The GIS Technicians will work with the City’s Cityworks Administrator. They will provide dedicated GIS support to STW OPS and process all GIS data update requests from Cityworks™. These two additional GIS technician positions will facilitate the asset data integration into the stormwater geodatabase and ensure that GIS data is maintained up to date. The Maintenance Planner position will allow the two STW OPS Chiefs to free up their time to focus on more efficient scheduling and oversight of maintenance and repair work.

A salary of approximately $95,000 is estimated for the Planner, based on similar positions in the marketplace and STW OPS’s salary levels for this type of position (midway between the Stormwater Operations Manager and Stormwater Chief). An additional 38 percent is added to this salary to account for benefits and other overhead expenses, resulting in an anticipated operations budget impact of $131,000.

It is estimated that the salary for a GIS Technician / Cityworks™ Administrator will be approximately $72,000 (or $100,000 fully burdened with the 38 percent benefits and overhead escalation), based on a review of similar positions in the marketplace.

6.6 Forecasted WAMP Savings

Good asset management practices have been proven to yield annual savings of up to 30 percent. As shown in **Table 6.3**, the benefits of the WAMP will accrue gradually over the five-year implementation period, reflecting new knowledge and practices adopted by STW OPS and City staff, and will achieve maturity by 2023... This is expressed as a percentage savings of the forecasted Stormwater Operations Fund budget for Fiscal Years 2019 through 2023, which includes SWMP asset operations and maintenance costs.

Table 6.3: Estimated WAMP Savings as Percent of Forecasted Stormwater Operations Fund Budget, Fiscal Years 2019 through 2023

Fiscal Year	2019	2020	2021	2022	2023
Estimated Savings	0%	4%	10%	16%	21%

As shown in **Table 6.3**, annual savings are not anticipated until Fiscal Year 2020, when improved asset management practices are expected to be fully underway.

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SECTION 7 – HOW CAN THE CITY PAY FOR IT?

The City has identified the boundary of this WAMP effort to be comprised of ten (10) watersheds, which are managed by STW OPS. The following five (5) watersheds are part of the Stormwater Master Plan (SWMP) modeling and design implementation project, which includes significant improvements to existing assets and additions of new assets: Middle River, North Fork New River, South Fork New River, New River, and ICW South. Collectively, these five (5) watersheds support the following seven (7) neighborhoods: Dorsey, Progresso, Victoria Park, Southeast Isles, Edgewood, River Oaks, and Dorsey Riverbend.

New River, and ICW South watershed will represent the two watersheds that will be used for comparative analysis of financial requirements and to validate methods that will then be replicated for the remaining eight watersheds.

Although the remaining five watersheds (ICW North, Prospect Recharge, S 36, S 37A and Cypress Creek) are not included in the SWMP, they are within the scope of this WAMP budget evaluation.

7.1 Funding Strategies

Stormwater funding, as stated in the City's Revenue Manual (Page 104), is derived from stormwater fees assessed and approved by the City Council for services provided to the City to the community ratepayers. This rate is projected to increase by 5% annually through 2023 as per Stantec 2019 Report.

The WAMP funding strategy outlines the suggested financial approach to adequately funding the required standard of care, LoS and KPIs needed to achieve the City's stormwater objectives outlined in Section 4. The financing strategy forecast was prepared in alignment with the City's 2018 Stormwater Management Financing Study, so that it can be used to measure ratepayer impacts relative to what was identified in that study, and includes:

- Annual expenditure forecasts broken down by:
  - Capital renewal rehabilitation, and replacement activities
  - Significant operating costs
- A breakdown of annual funding/revenue by source
- Identification of any funding shortfalls, if applicable
- Documentation of all key assumptions

The City developed a hybrid stormwater rate structure to support the $200 million revenue bond planned in FY 2021 to fund Phase II of the Stormwater Master Plan. The rate increases depicted in **Table 7.1** were implemented on October 1, 2019. These rate increases are critical to the continued success of the Stormwater Management program.

Table 7.1: Stormwater Fee Increase

Stormwater Charge	Previous Rate	New Rate (10/1/19)	$ Change
Residential <= 3 Units	$12.00/unit	$14.00/unit	$2.00/unit
Commercial, Industrial, and Residential >3 Units	$120.96/acre	$141.12/acre	$20.16/acre
Vacant Land, Parks, and Well Fields	$38.34/acre	$44.73/acre	$6.39/acre

For the recommended asset management strategy, a detailed five-year plan was generated. The plan identifies specific maintenance, renewal and rehabilitation, replacement, and expansion activities required over the forecast period as described in preceding sections of this WAMP.

Funding strategies consider both Operational (OPEX) and Capital (CAPEX) expenditures and are based upon the Levels of Service STW OPS is striving to achieve today and how STW OPS expects demand for these services to change over the next five years and beyond. It also considers how reliable the City's stormwater infrastructure (and ancillary equipment such as fleet vehicles) is today with respect to meeting existing demand, and whether the infrastructure has the capacity to meet expected future demand. These considerations inform a financial plan that supports meeting service levels by providing:

- Recurrent Operational Expenditure Profile – What STW OPS needs for day-to-day management of the assets
- Investment Profile – Capital expenditures needed for both replacement of existing assets and for growth in the system
- Revenue Profile – What STW OPS is being paid for the services it provides
- The Revenue-Cost Gap (or surplus) – Including associated implications and recommendations

Figure 7.1 presents a projection of stormwater funding needs through fiscal year 2023. These funding needs include stormwater OPEX budget, including the addition of operations and maintenance for anticipated new stormwater assets, a projection of stormwater CAPEX needs, and the overall potential revenue requirements that will need to be funded through stormwater revenues.

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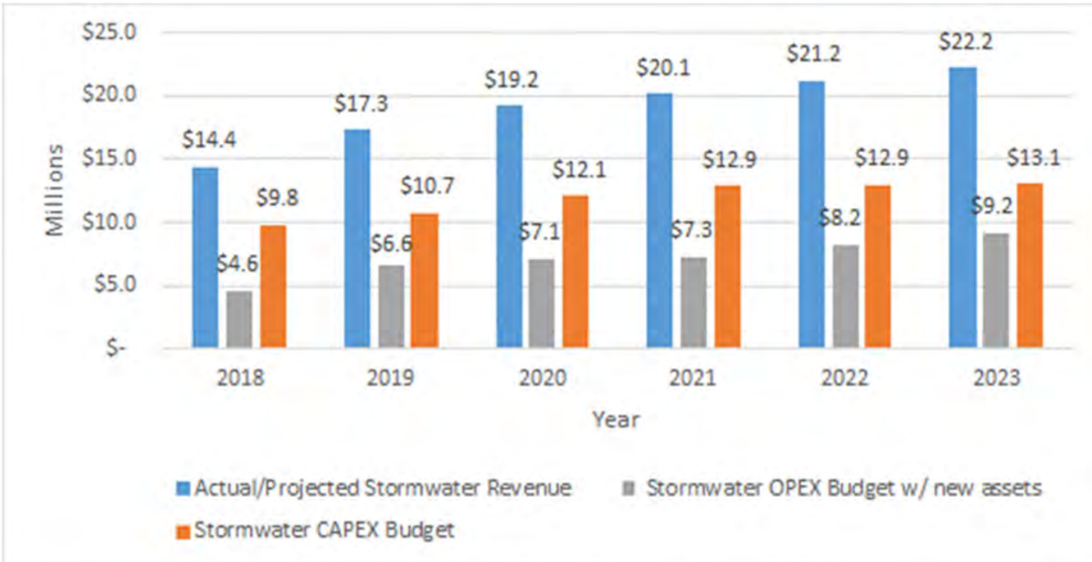
Figure 7.1: Stormwater Funding Projections



7.2 Historical Funding Levels and Cycles

Figures 7.2 and **7.3** illustrate historical revenue and expenditure trends from Fiscal Years 2014 through 2017, which represent the four years that STW OPS has been in existence as its own enterprise fund. City budget categories are organized into higher level WAMP budget categories as illustrated in **Figure 7.3.**

Figure 7.2: Historical Stormwater Operations Revenues and Expenditures Fiscal Years 2014 to 2017

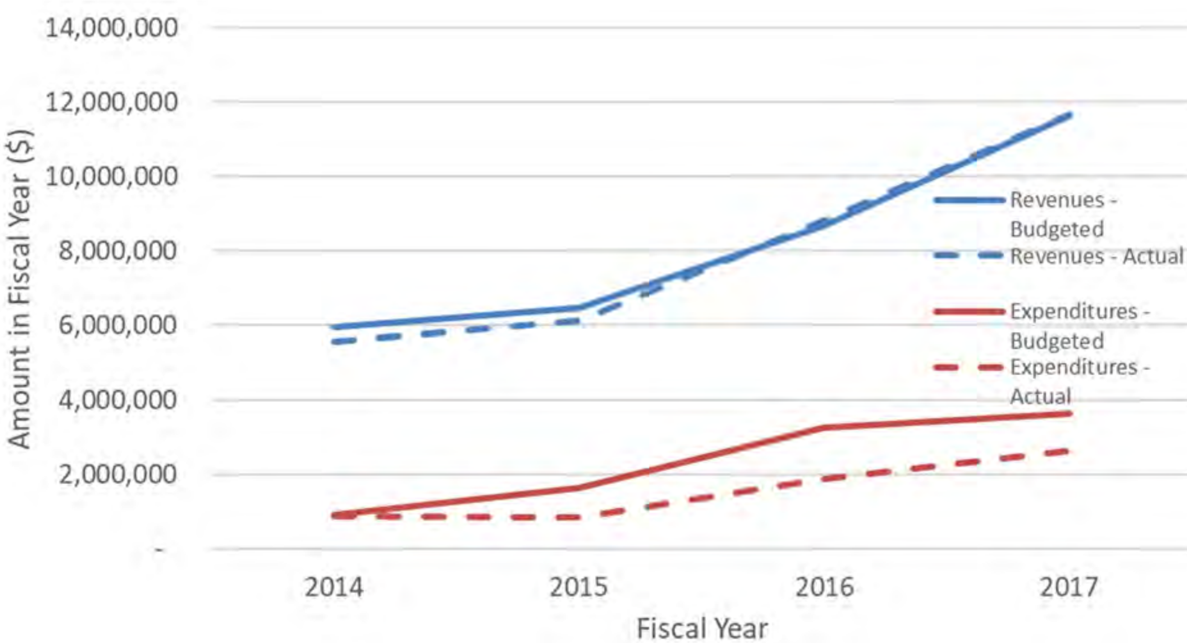
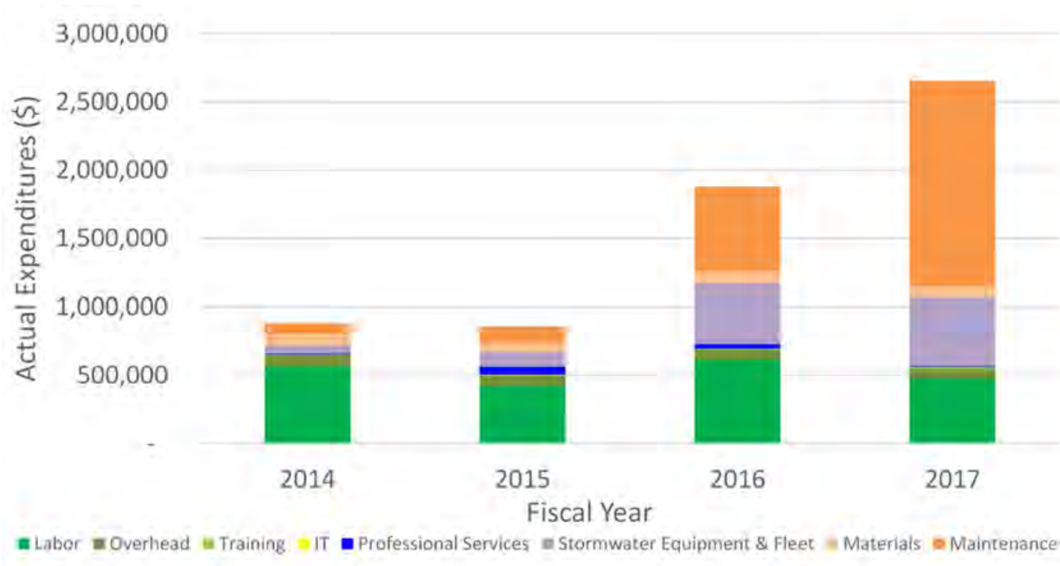


Figure 7.3: Historical Stormwater Operations Budget Expenditures by WAMP Budget Category



Figures 7.2 and 7.3 demonstrate that STW OPS has made substantial investments in asset maintenance, stormwater equipment and fleet, and overall department growth, from less than $2M in 2014 to nearly $4M in 2017. Stormwater fees account for the majority (>97%) of the revenues required to fund these budgets, which have increased from approximately $6M in 2014 to nearly $12M in 2017.

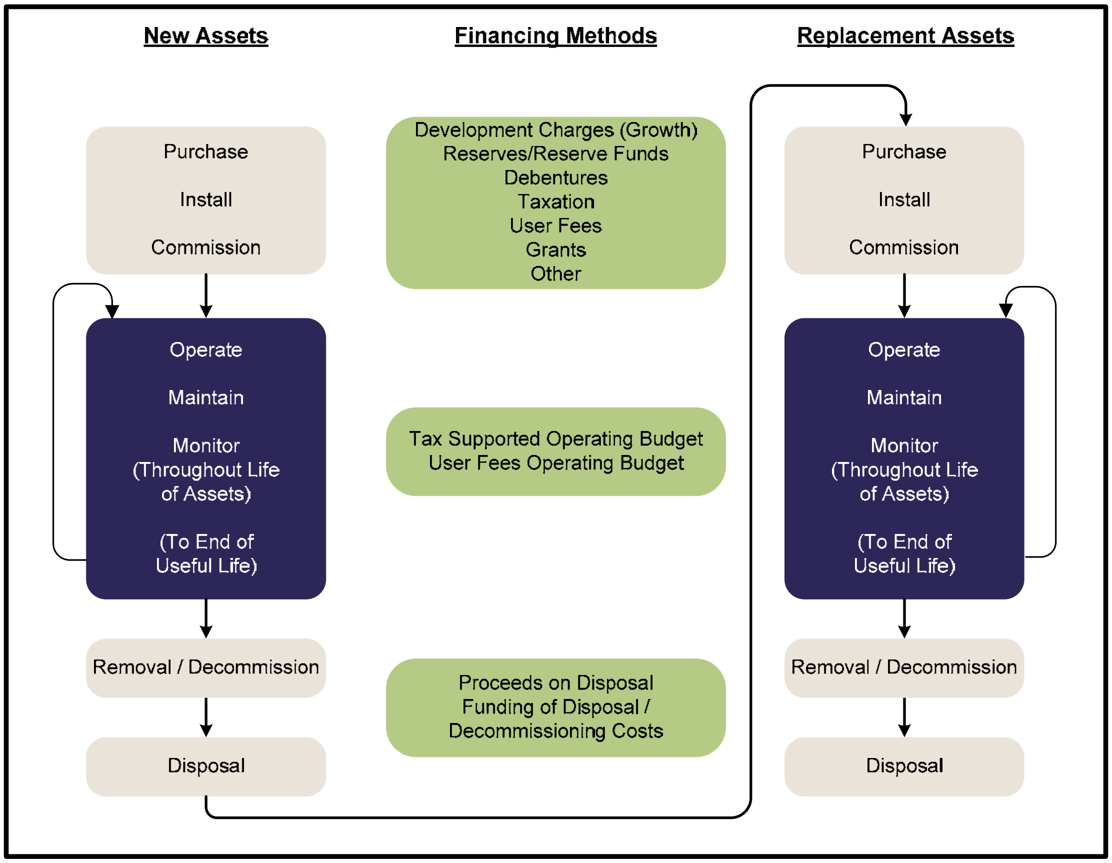
7.3 Potential Funding Sources

The five-year Operations and Maintenance budget presented in **Figure 7.1** was forecasted based upon historical records and trends, as shown in **Figures 7.2 and 7.3.** The total projected revenue expected to be recovered through stormwater fees exceeds $35 million in FY 2023, according to the City's Revenue Manual. These estimates suggest that STW OPS has an adequate revenue source for implementing the WAMP. In addition, any potential surplus funds could also be applied to unplanned capital improvements/repairs.

The stormwater maintenance, equipment and fleet, and material expenditures increased substantially in FY 2016 and FY 2017. However, due to the relatively brief existence of the STW OPS, it is difficult to assess the future projected stormwater expenditures necessary to achieve and sustain the Levels of Service categories (C, B, A) for each asset class, as detailed in Section 4. During the WAMP Implementation Phase, the CoF and LoF for each asset class in each of the 10 watersheds will be determined, which will provide greater clarity as to the condition and level of effort required to operate, maintain, restore or replace the collective stormwater assets. This information, once complete, will more accurately inform the City as to the total funding requirements for both capital improvements and operations and maintenance.

Once a more accurate picture of funding requirements is known, the City may need to consider other additional funding sources such as grants and bonds to support their objectives. **Figure 7.4** illustrates funding options (in green) the City may choose to consider.

Figure 7.4: Financing Methods



In order to fund the recommended Levels of Service and asset requirements over the forecast period, the City will need to consider potential increases in funding for stormwater services from its current level through FY 2023, as presented in the City's Revenue Manual. The magnitude and validity of these potential increases will require a more detailed examination of the City's stormwater assets and their lifecycle needs based on associated LoF, CoF, and overall BRE. While the annual funding requirements may fluctuate, it is important for the City to implement a consistent, yet increasing annual investment in asset lifecycle activities so that any excess annual funds can accrue in the stormwater reserve fund.

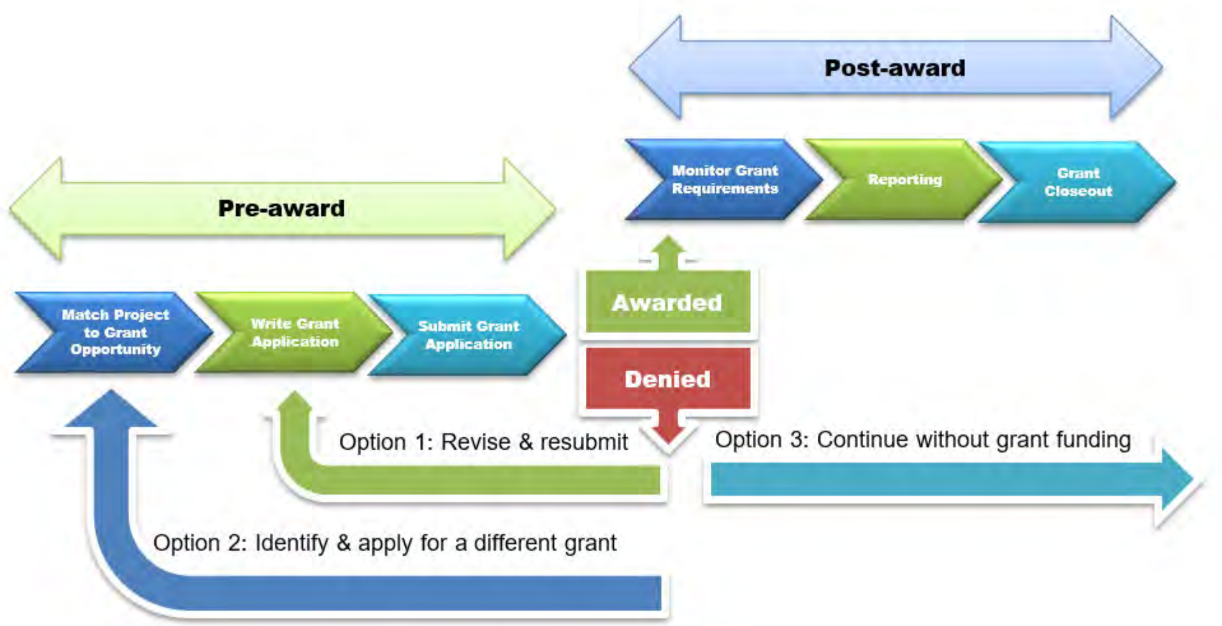
The revenues collected for the City's Stormwater Management Program are used for operating expenses and capital improvements directly related to the management of stormwater, including improvements designed to improve water quality in the City's waterways. Any potential shortfalls between the annual adopted budget and the proposed operating budget and transfers for the Stormwater Fund may need to be addressed through other financing methods, including grants and low-interest loans.

7.3.1 Grant Funding Plan

A preliminary review of potential grant and loan sources that may support the City of Fort Lauderdale's proposed stormwater projects was undertaken as part of this WAMP. The preliminary review included federal, state, and private funding programs. A preliminary list of approximately 50 grant programs was reviewed and currently 10 grant opportunities have been identified that will align with the City's WAMP process. During the WAMP implementation phase, the City will need to continue the grant identification process to find additional grant sources directly applicable to the City's overall project goals for WAMP activities and proposed improvements. A detailed list of initial grant opportunities is included in **Appendix I**.

As proposed projects are identified and prioritized during the WAMP implementation phase, a review of each project's eligibility for grant or low-interest loan funding should be included in the process with the goal of setting schedules, budgets, and project criteria to maximize eligibility. Because the grant process is often competitive, prioritizing and matching projects to grant opportunities early in the WAMP process will be crucial to ensuring that project timelines are flexible enough to accommodate re-application or pursuit of alternative funding, as illustrated below in **Figure 7.5**.

Figure 7.5: Review of Project Grant or Low-Interest Loan Funding



Projects that typically are eligible for local, state, or federal government funding programs include constructed projects such as stormwater treatment trains, filter marshes, retrofitting outfall pipes, installation of baffle boxes, reconstruction of roadside swales, and low-impact development (LID) elements such as underground retention basins and biotreatment systems installed under parking lots. O&M projects that may be funded through government grants and loans include canal maintenance and dredging and culvert inspection and cleaning. Non-constructed projects eligible for funding may include public education and outreach programs for nonpoint source management and flood awareness; developing and updating stormwater, resiliency, and mitigation plans; and in some cases, asset management planning activities.

7.3.2 Grants Process Alignment to WAMP

While many government grant programs allow a 10% rate for administrative costs for grant application and management, the United States Government Accountability Office (USGAO) estimates that the average cost of grant administration is 15-20% of project cost. This means that governments must optimize grant application strategies to minimize administrative and indirect costs and maximize dollars dedicated to project hard costs and project management.

The City has a centralized process for grants procurement led by the Budget CIP & Grants Division. This structure is considered Best Management Practice (BMP) for the oversight of the grants process from application and procurement to project reporting and grants close-out. The Division utilizes a grant tracking and reporting system; provides a yearly review; and develops an Annual Grants Plan of Action. In addition, the Budget/CIP and Grants Division provides extensive training on grants processes for department personnel. During the implementation of the WAMP, the City's Project Manager and Stormwater and Sustainability staff will need to coordinate and align WAMP grants activities with the Budget/CIP & Grants Division processes and integrate WAMP grant opportunities into the Annual Grants Plan of Action.

To further align the WAMP grant process with the City's Budget/CIP and Grants Division procedures, it is suggested that the City adopt a project scoring protocol similar to that used by the City Manager's Office. With the addition of a category for specific grants, this Project Scoring Worksheet can act as a tool for prioritizing projects based on the basic program attributes and the project's impact on strategic goals, as well as the level of effort and cost of grant administration, management, and reporting. An example worksheet is illustrated in **Table 7.2.**

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Table 7.2: Project Scoring Worksheet

Benefit Matrix

		Grant Application requirements & Cost	Asset Class (A, B, C)	Cost and source of funds	Project Feasibility	Project Consistency with existing approved plans	Improves traffic mobility, connectivity, pedestrian - cyclist safety	Environmental Benefits	Addresses aging infrastructure/maintenance	Promotes/Accelerates sustainable economic development	Improves neighbor safety	
		Basic Program Attributes					Impact on Strategic Goals					
	Weighted Score:	0	0	0	0	0	0	0	0	0	0	Total Points
Project Title	Grant Program Title	Project Scores										
												0
												0
												0
												0
												0

Rate each project category for impact using Scoring Criteria 0,1,2 - Scoring Criteria to be determined during WAMP Implementation Phase

7.4 Budget Scenarios

7.4.1 Proactive Versus Reactive O&M Costs

Planned O&M work such as Inspections and Testing (I&T), Preventive Maintenance (PM) and Planned Corrective Maintenance (CM) can and should be scheduled as far ahead as practical based upon the respective risk category, desired LoS, and the LoE necessary to complete each work package. Achieving these objectives will allow STW OPS to determine, project, and track overall planned OPEX using the matrix shown in **Figure 7.6**.

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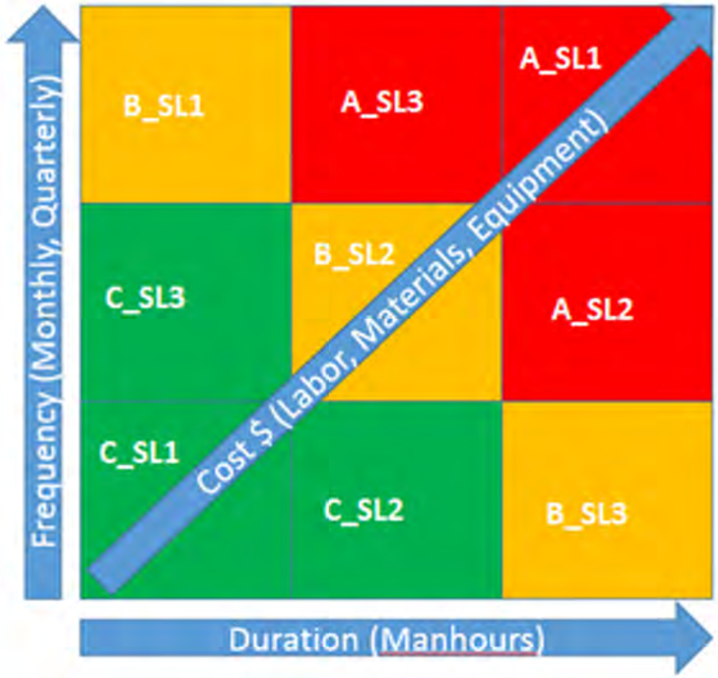
Figure 7.6: OPEX Planning Matrix



Each LOS category (C, B, A) contains attributes such as risk, estimated portion of total assets, estimated consumption of watershed OPEX budget, LoS and maintenance strategy used and corresponding response levels for unplanned work. The following sections establish approximate levels of performance as the bases from which to establish respective budgets.

7.4.2 Five Year Operations Budget Estimate

The five-year operations budget estimate presented in **Table 6.1** forecasts future stormwater asset operations and maintenance expenditures. Operations expenditures also include relevant administrative expenditures, such as salaries and training. In addition to serving as a budget validation tool, it also helps STW OPS to assess whether its asset management program is improving asset performance and lowering lifecycle costs. Finally, the budget estimate provides a forecast of revenues to fund these expenditures. The current O&M costs are projected to be 2% of the estimated CIP. The appropriate OPEX necessary to sustain stormwater assets will initially increase as shown in Section 4 due to discovery and implementation of the WAMP. However, as a more accurate understanding of asset condition is gained and more effective maintenance strategies are applied through better planning, scheduling and more efficient work execution, future O&M costs should decline below current projected levels providing a cost reduction of services to the City.

7.4.3 Current Budget and Baseline Level of Service

The WAMP seeks to identify STW OPS's general business areas and associated strategic objectives, which bring into focus the corresponding LoS that support these objectives. Achieving the appropriate LoS requires STW OPS has the right type and quantity of resources at hand to plan for and respond to both planned and reactive needs.

STW OPS seeks to review its current LoS (LoS P), and re-classify assets by a new LoS (C, B, A) to ensure they support core business objectives. In addition, the City has identified effective performance measures and targets to track progress toward meeting the goals established for each LoS. For instance, providing adequate stormwater drainage, particularly for residential customers who seek protection from tidal flooding, is a key LoS for STW OPS. STW OPS staff measure this LoS by the quantity of swales constructed on a quarterly basis and have specific goals corresponding to this desired quantity.

In order to establish the appropriate LoS as described in Section 4, the City will need to determine the appropriate funding requirements for each asset class and resultant budget for each of the 10 watersheds:

The three LoS categories C, B, A have been identified by the City. Asset classes within each category typically have similar risk levels, response times and maintenance strategies. Maintenance planning and scheduling will be determined during the implementation phase of the WAMP based upon the effectiveness of existing maintenance activities and frequencies (LoS P) and the requirement to modify maintenance activities and frequencies due to a change in the LoS category (C, B or A).

LoS C, B, and A will require increasing levels of effort (LoE). The resources required to meet respective LoS performance standards will determine the Cost of Service (COS) for each asset class: Labor, Materials, Equipment, Duration and Frequency. The cumulative COS for each watershed can then be determined and adjusted, as needed, based upon budget limitations starting with the two watersheds of ICW South and New River as representative samples, as presented in Section 4.

This approach and methodology should be applied to all 10 watersheds to establish a revised annual budget and financial projection.

7.4.4 Budget Example for LoS A, B, C

Table 7.3 presents a maintenance cost comparative analysis for each of the three LoS categories, demonstrating how the various budgets for each asset class (and in turn, each watershed) will need to be derived.

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Table 7.3: LoS Comparative Analysis

LoS	LoS C	LoS B	LoS A
Risk Tolerance	Low	Medium	High
Percentage of Total Assets	50	30	20
Asset Class	Pollution Control Device	Manhole	Tidal Control
# Assets in Class	76	1,192	150
Proactive Inspection Frequency	Annual	Quarterly	Biannual
Duration/Inspection	0.5 Hours	1 Hour	2 Hours
Inspections/Year	1	4	2
Cost/Inspection (assuming avg. labor rate/hour = $30)	15	30	60

Reactive work is unplanned work that originates from a request by anyone observing a condition that requires some form of action or response, such as a citizen request for service or repair. During the implementation phase of the WAMP, the City will need to not only develop budgetary estimates for each asset class and watershed for planned maintenance activities, but will also need to accommodate a reasonable level of reactive maintenance based on historical expectations. As the WAMP is implemented over several years, it is anticipated that the reactive work volume will decrease.

7.5 WAMP Financial Summary

As previously discussed, it is estimated that implementing the WAMP could save the City $2M over the next five years, and approximately $1.5M in 2023 alone (which is more than 22 percent of the forecasted operating budget in that year if no WAMP were implemented). Financially, this computes to a return on investment (ROI) of more than 370 percent and an internal rate of return (IRR) of 54 percent.

The City’s financial and rate consultant, Stantec, has proposed projected increases of 5% in stormwater rate charges in each of the next five fiscal years as per 2019 Report. This increase in revenue is projected to support operations costs and provide additional funds for unplanned capital expenditures not supported by grant or bond funding, as shown in Figure 7.1. This demonstrates that the City’s projected revenues recovered through stormwater fees through FY 2023 will adequately support the projected OPEX and CAPEX stormwater needs over the next several years.

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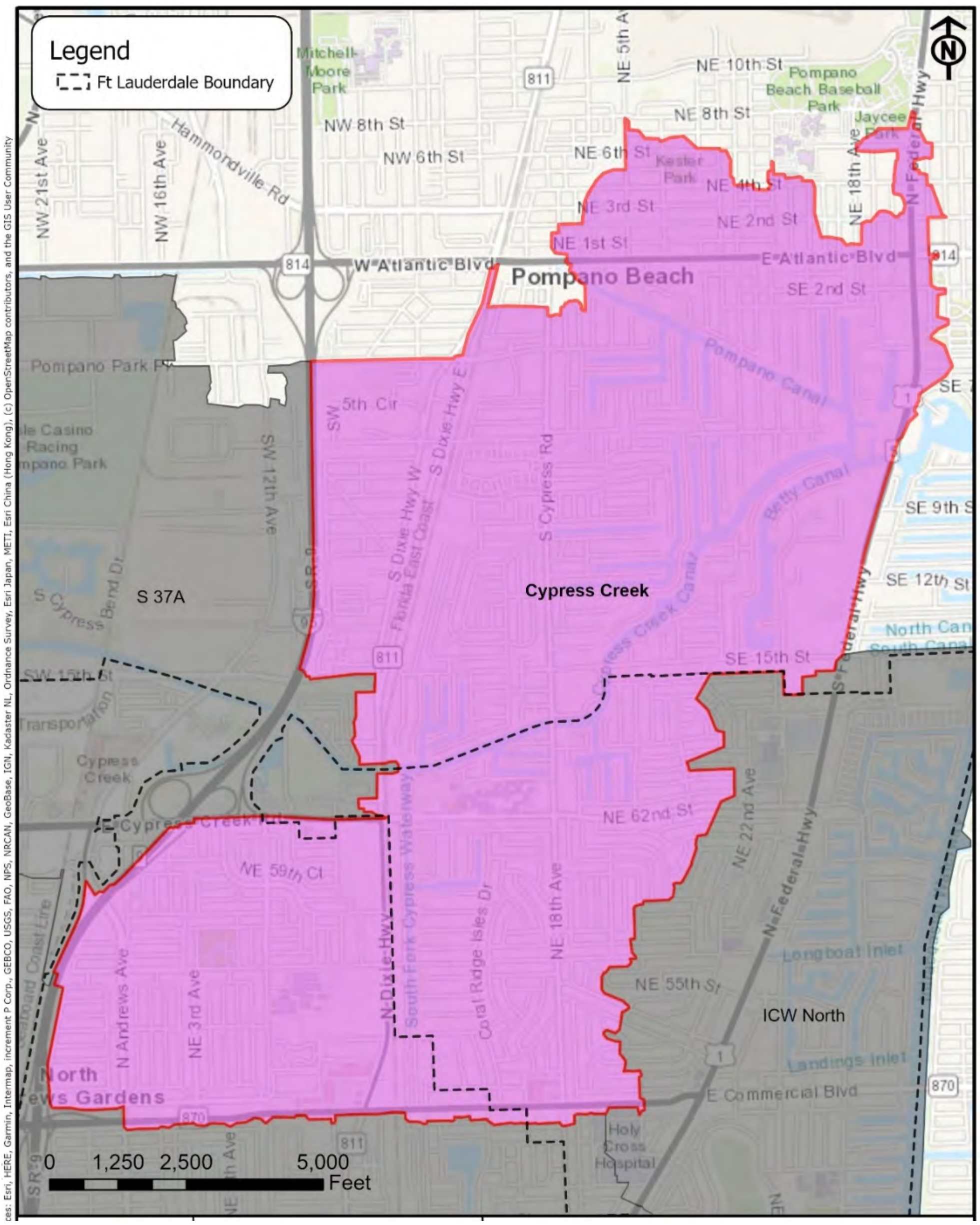
SECTION 8 – WATERSHEDS

8.1 CYPRESS CREEK

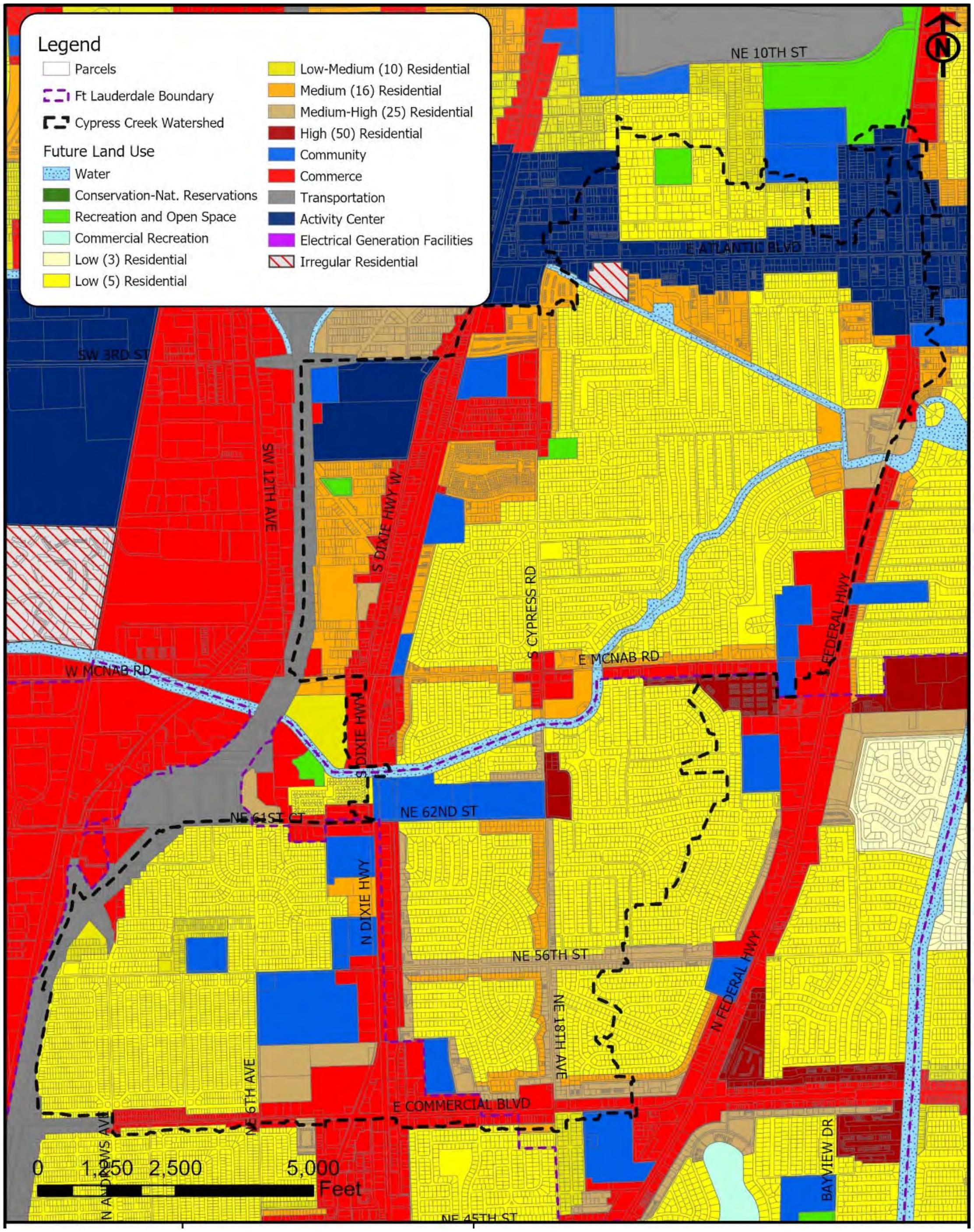
The Cypress Creek watershed is located on the northeast part of the City of Fort Lauderdale, Florida. The watershed is approximately 5.65 square miles out of which 1.25 square miles are within the City boundaries. **Figure 8.1** illustrates the extent of the watershed.

Figure 8.1: Cypress Creek Watershed Boundary



Land use throughout the watershed is primarily residential. The existing land use in this watershed is illustrated in **Figure 8.2**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.2: Cypress Creek Land Use Plan



8.1.1 Asset Summary

8.1.1.1 Hard Assets

A summary of the hard assets within Cypress Creek watershed as included in the stormwater geodatabase is presented in **Table 8.1**.

Table 8.1: Summary of Hard Assets in Cypress Creek Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	0
Pond(1)	0
Discharge Point	59
Drainage Well	0
Exfiltration Trench(1)	
Inlet	370
Manhole	52
Gravity Main	466
Network Structure	83
Pollution Control Structure(1)	
Pollution Control Device	0
Pump Station	0
Weir Structure	0

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) There are 85 unknown assets under the stormwater geodatabase within this watershed.

Figure 8.3 presents the hard assets in Cypress Creek watershed.

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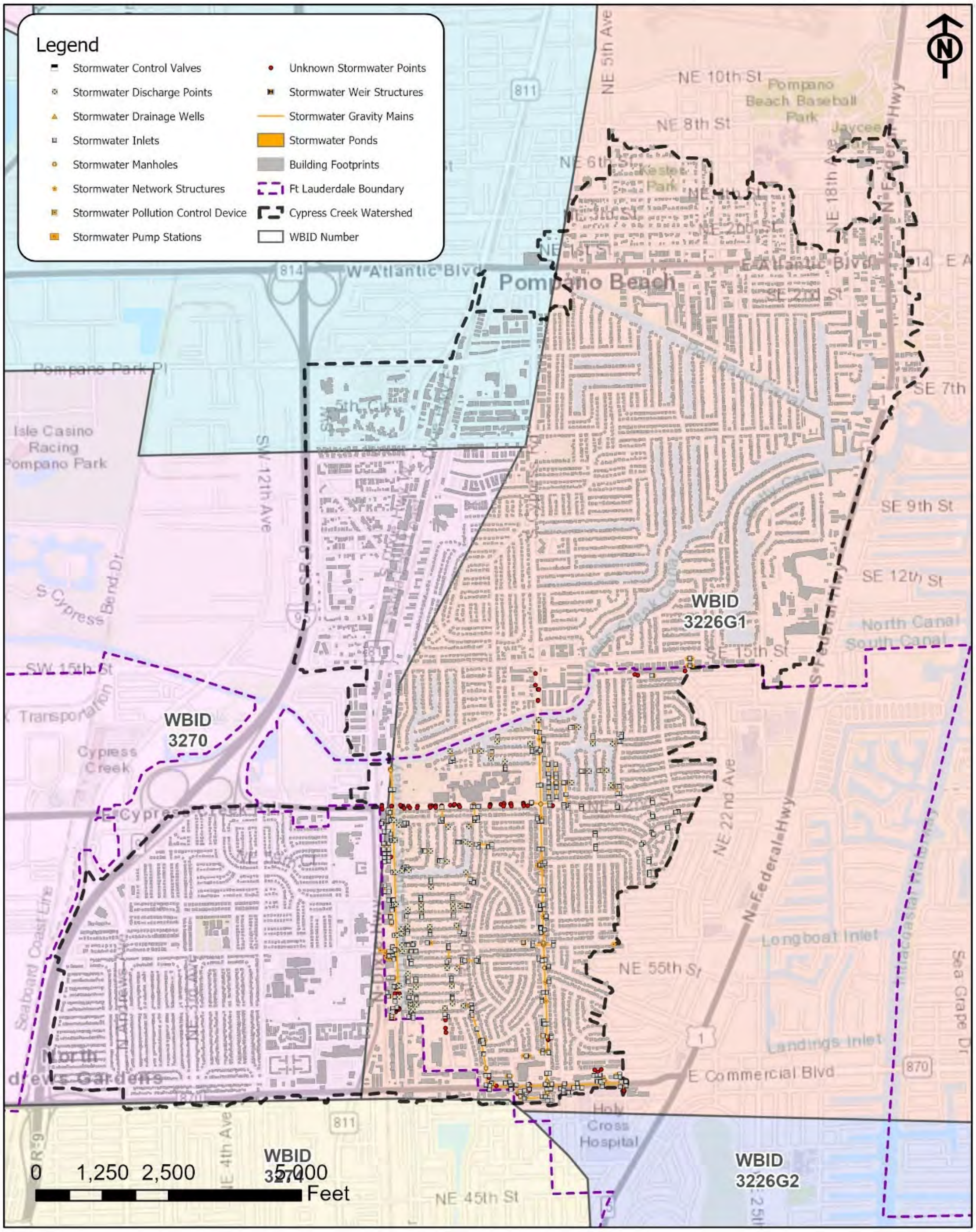
Figure 8.3: Hard Assets in Cypress Creek (2019 Stormwater Geodatabase)



8.1.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1.** Specific soft assets for the Cypress Creek watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.4** illustrates the Cypress Creek Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

City Planning Documents

City planning documents that may have application in the Cypress Creek watershed include the 2020-2024 Proposed Community Investment Plan, all of which include proposed projects that may impact infrastructure in the Cypress Creek Watershed including the Coral Ridge Isles Sewer Basin B-13 Rehabilitation. Performance measures for these documents are included in **Section 2**.

Regulatory Permitting Policies & Non-Structural BMPs

As noted in **Section 1.7.1.2** NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the Cypress Creek watershed are considered impaired as also noted on the TMDL Report in **Appendix C**. The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

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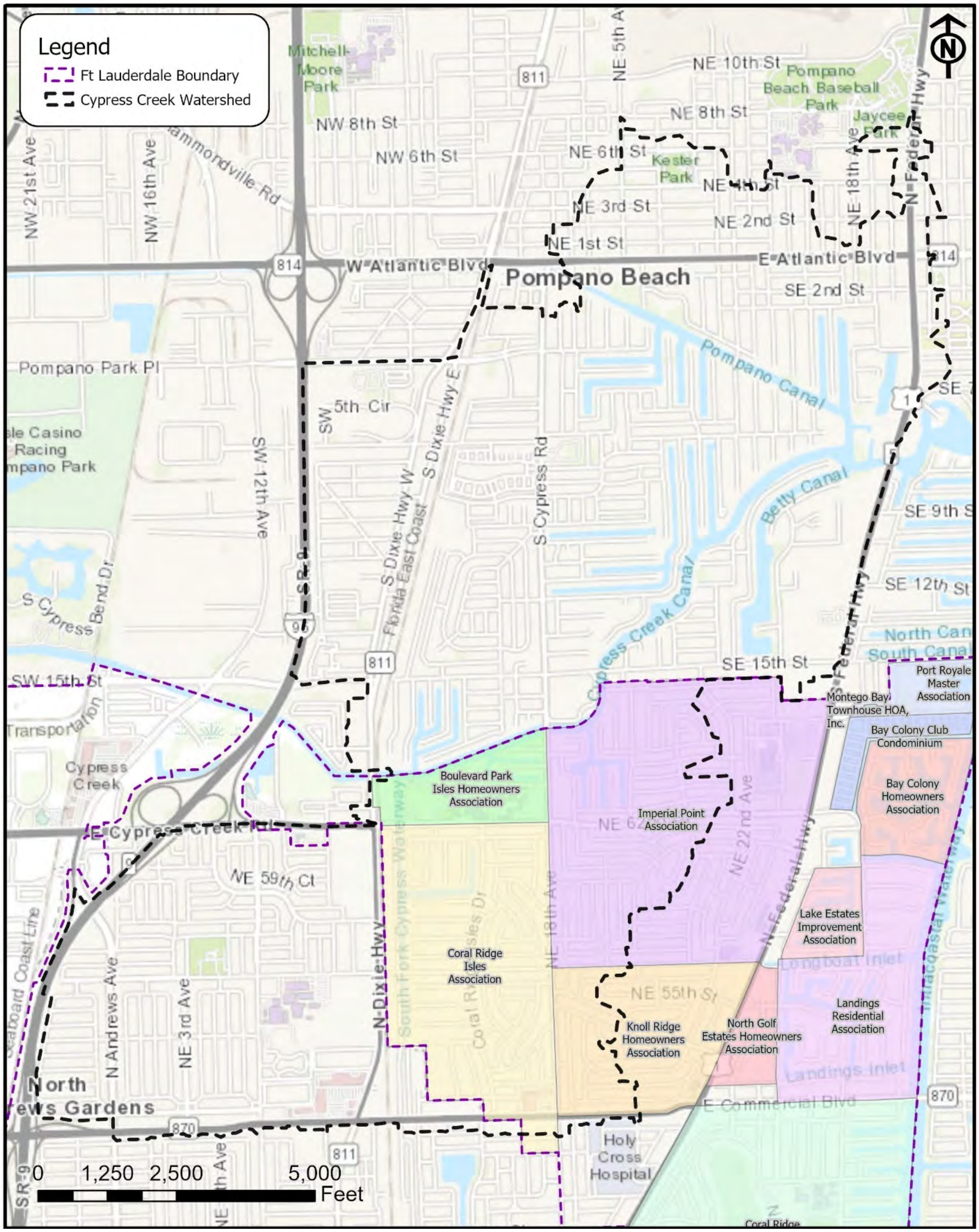
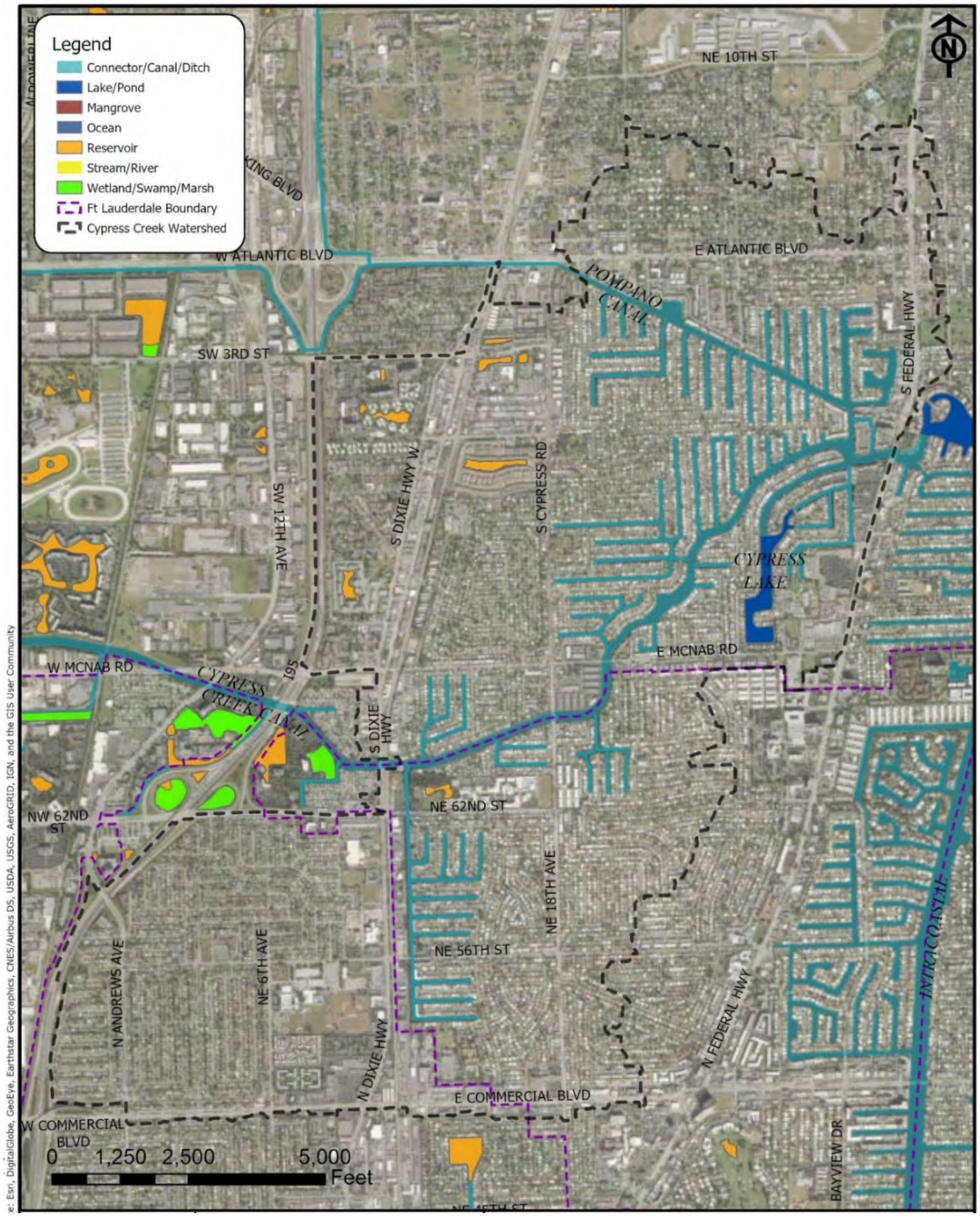
Figure 8.4: Cypress Creek Watershed Neighborhood Associations



8.1.1.3 Natural Assets

The primary natural assets within the Cypress Creek watershed are illustrated in **Figure 8.5**. In general, there are 10 main reservoir, Cypress Lake, and an intricate system of canals. The watershed does not include many open space areas with trees

Figure 8.5: Natural Assets in Cypress Creek Watershed



8.1.2 Watershed Challenges

Each of the ten watersheds face common and specific challenges that impact their respective Levels of Service. Some challenges in this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.2**.

Table 8.2: Cypress Creek Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Seawall	Ownership determination	Complete 2018 Seawall Master Plan to identify all City-owned seawalls.
	Ordinance compliance and enforcement	The City adopted an ordinance (homeowners in the eastern portion of the Middle River Watershed) requiring property owners to elevate the height and ensure the functionality of their seawall.
	Seawall replacement prioritization	Replace/elevate seawalls as per established priority.
Water Pollution Control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Enhancement of the existing swale areas to provide better surface infiltration to reduce stormwater runoff and the number of suspended solids that enter the storm sewer system.
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets of the same channel	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection

8.1.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.1.3 Asset Ownership and Inventory

Table 8.3 summarizes the hard assets in Cypress Creek per asset ownership.

Table 8.3: Asset Inventory and Ownership in Cypress Creek Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	0	0	0	0
Pond(1)	0	0	0	0
Discharge Point	59	51	7	1
Drainage Well	0	0	0	0
Exfiltration Trench(1)				
Inlet	370	237	129	4
Manhole	52	38	14	0
Gravity Main	466	289	165	12
Network Structure	83	36	46	1
Pollution Control Structure(1)				
Pollution Control Device	0	0	0	0
Pump Station	0	0	0	0
Unknown Point	85	0	0	85
Weir Structure	0	0	0	0

(1) *GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.*

8.1.4 What is the Condition and Performance of the Assets?

8.1.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the Cypress Creek Watershed, the Hazen Team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan.

It is recommended that the staging of asset condition assessments be approached and planned as follows:

1. Identify assets with the highest CoF
2. Quantify all assets, by watershed, within the asset class deemed to have the highest CoF
3. Rank each asset class in decreasing order of CoF

4. Quantify the total number of assets by asset class that requires inspection
5. Establish the condition assessment requirements and process for each asset class
6. Estimate the time (including travel) and resources required to conduct each condition assessment
7. Calculate the total time required to complete all condition assessments
8. Calculate the total available time within each calendar year that could realistically be scheduled to complete condition assessments
9. Based upon task 8 above, project the total duration, manpower and cost required to complete all condition assessments
10. Determine best method to complete the condition assessments given personnel, time, and financial constraints
    a. City staff
    b. Consultant
    c. City staff and consultant

This method helps the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.1.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds as a baseline. **Table 8.4** shows the CoF Score by class used in this analysis.

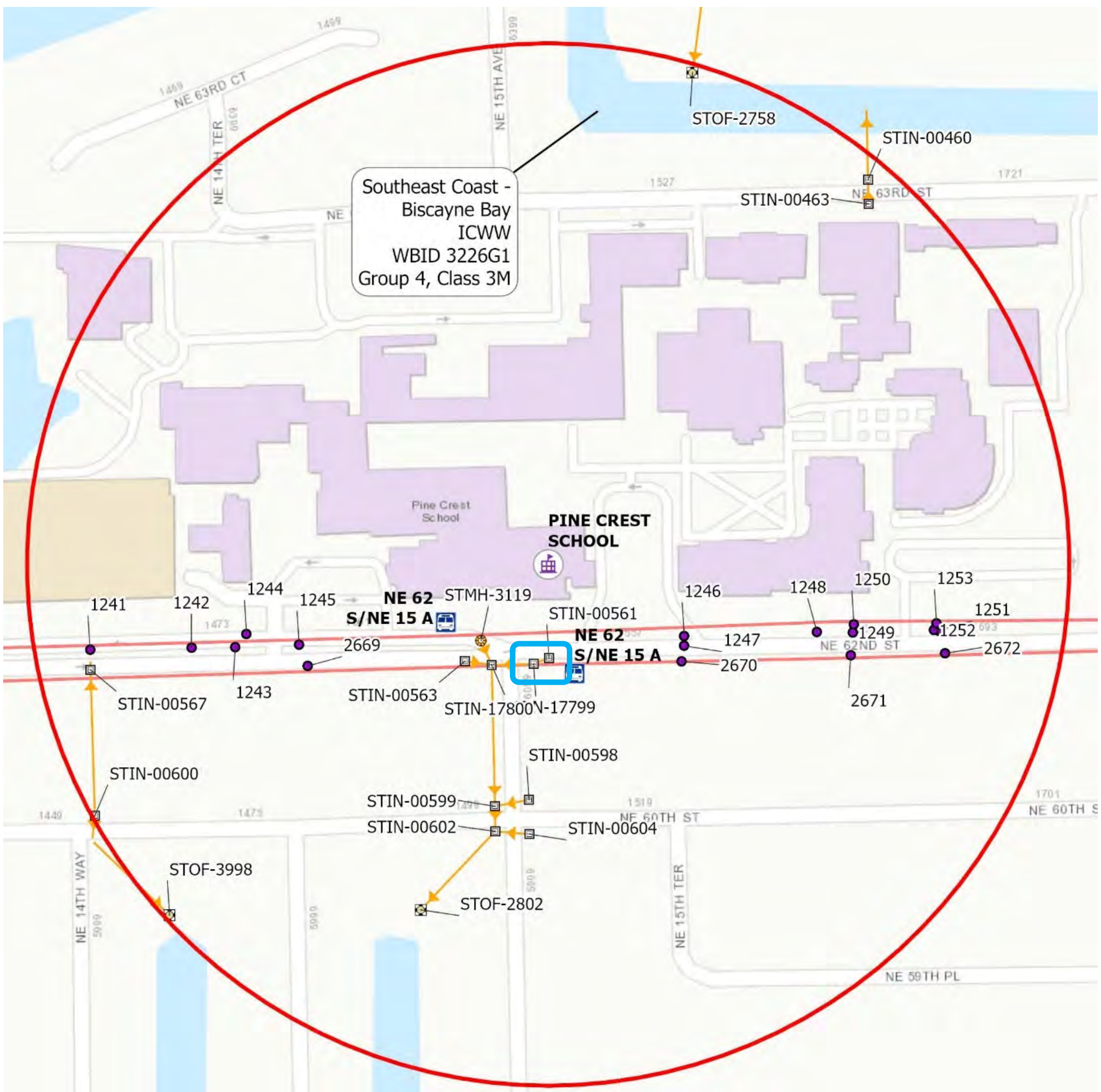
Table 8.4: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4

Asset Class	CoF Score
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the Cypress Creek Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius around the Pine Crest School, as shown in **Figure 8.6**.

Figure 8.6: Cypress Creek Watershed Data Subset Used for CoF Analysis (Example)



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the Cypress Creek Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score.

For the section selected, there are two City-owned stormwater assets next to a bus stop. These two assets are circled in blue in **Figure 8.6** above. For example, the inlet asset class has a CoF score of 4. However, if the inlet device is located next the school, it may be desired to increase that specific asset CoF score to a 5, showing that it is more critical than the general population of the asset.

The assets near critical facilities whose CoF scores were changed due to proximity to a critical facility are identified in **Table 8.5**.

8.1.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of the risk score for each asset. **Table 8.5** provides the overall representation of the Cypress Creek Watershed data subset used for this analysis.

Table 8.5: Cypress Creek Watershed COF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Cypress Creek	Gravity Main	City	STMN-04741	1.0	4.10	4.10		
Cypress Creek	Gravity Main	City	STMN-04742	1.5	4.00	6.00		
Cypress Creek	Gravity Main	City	STMN-04743	2.0	4.18	8.36		
Cypress Creek	Gravity Main	City	STMN-04749	3.0	3.95	11.85		
Cypress Creek	Gravity Main	City	STMN-04750	3.5	4.00	14.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Cypress Creek	Gravity Main	City	STMN-04752	3.0	3.93	11.79		
Cypress Creek	Gravity Main	City	STMN-04753	3.5	3.95	13.83		
Cypress Creek	Gravity Main	City	STMN-04778	3.0	4.00	12.00		
Cypress Creek	Gravity Main	City	STMN-04779	2.5	3.97	9.93		
Cypress Creek	Gravity Main	City	STMN-15732	2.0	4.05	8.10		
Cypress Creek	Gravity Main	City	STMN-27213	2.0	4.00	8.00		
Cypress Creek	Gravity Main	City	STMN-27209	2.0	4.00	8.00		
Cypress Creek	Gravity Main	City	STMN-27211	2.5	4.00	10.00		
Cypress Creek	Gravity Main	City	STMN-27212	1.0	3.95	3.95		
Cypress Creek	Inlet	City	STIN-00563	1.5	4.00	6.00		
Cypress Creek	Inlet	City	STIN-00561	1.0	5	5.00	3.87	By bus stop
Cypress Creek	Inlet	City	STIN-00567	2.5	4.00	10.00		
Cypress Creek	Inlet	City	STIN-00460	2.5	3.89	9.73		
Cypress Creek	Inlet	City	STIN-00463	2.0	4.01	8.02		
Cypress Creek	Inlet	City	STIN-00602	2.0	4.00	8.00		
Cypress Creek	Inlet	City	STIN-00604	3.0	3.98	11.94		
Cypress Creek	Inlet	City	STIN-00598	2.5	4.00	10.00		
Cypress Creek	Inlet	City	STIN-00599	3.5	4.13	14.46		
Cypress Creek	Inlet	City	STIN-17799	3.5	5	17.50	3.81	By bus stop
Cypress Creek	Inlet	City	STIN-17800	5.0	4.18	20.90		
Cypress Creek	Inlet	City	STIN-00600	3.5	3.95	13.83		
Cypress Creek	Discharge Point	City	STOF-2758	3.5	4.00	14.00		
Cypress Creek	Discharge Point	City	STOF-2802	3.0	3.93	11.79		
Cypress Creek	Discharge Point	City	STOF-3998	2.5	3.95	9.88		

A representative BRE plot is shown in **Figure 8.7**.

Figure 8.7: Cypress Creek Watershed Business Risk Exposure by Asset (Example)

8.1.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.6** shows examples of the LoS and strategies for hard assets.

Table 8.6: Cypress Creek Assets Maintenance Strategy (Example)

Classes	LoS	Maintenance Strategy
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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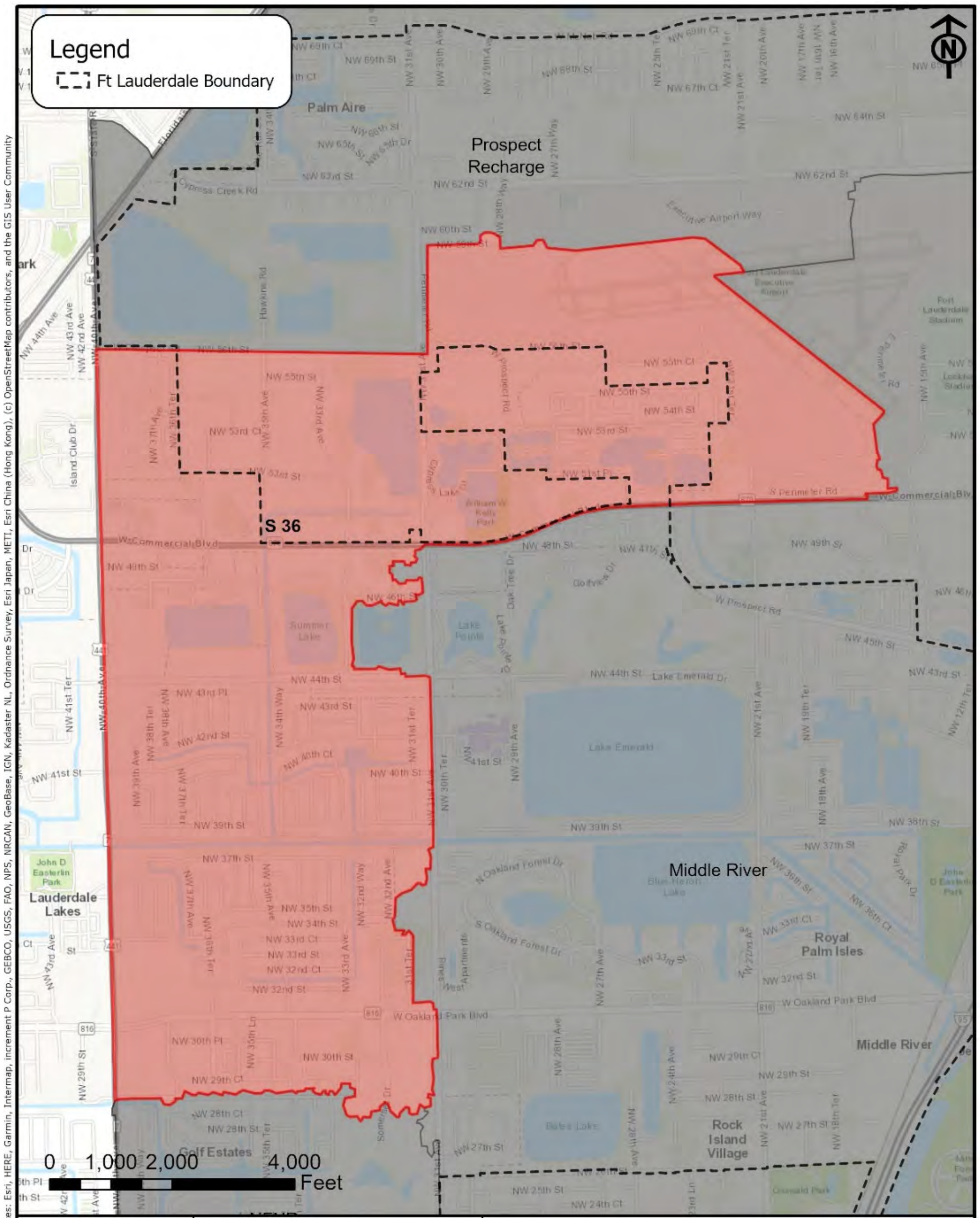
8.2 FORT LAUDERDALE EXECUTIVE AIRPORT (S 36)

8.2.1 Asset Summary

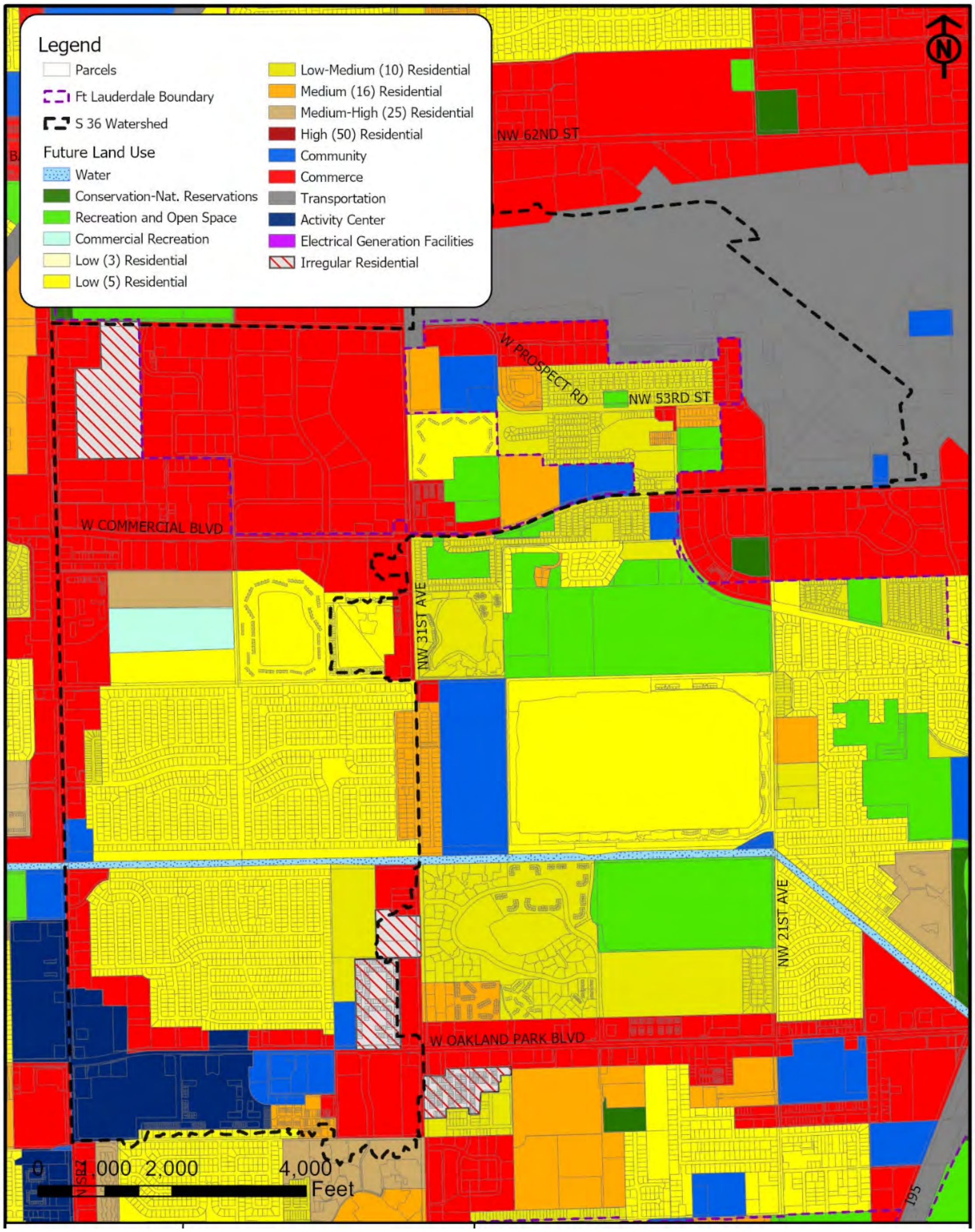
The Fort Lauderdale Executive Airport (S 36) watershed is located on the northwest part of the City of Fort Lauderdale, Florida. The watershed is approximately 3.24 square miles out of which 1.10 square miles are within the City boundaries. **Figure 8.8** illustrates the extent of the watershed.

Figure 8.8: S 36 Watershed Boundary



Land use throughout the watershed is primarily low residential and commercial. This watershed also includes the Fort Lauderdale Executive Airport which is designated in the map as transportation. The existing land use in this watershed is illustrated in **Figure 8.9**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.9: S 36 Land Use Plan



8.2.1.1 Hard Assets

A summary of the hard assets within S 36 watershed as included in the stormwater geodatabase is presented in **Table 8.7**.

Table 8.7: Summary of Hard Assets in S 36 South Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	0
Pond (1)	0
Discharge Point	21
Drainage Well	0
Exfiltration Trench (1)	
Inlet	212
Manhole	25
Gravity Main	162
Network Structure	6
Pollution Control Structure (1)	
Pollution Control Device	0
Pump Station	0
Weir Structure	1

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~80 ft Southward.

(3) There are 64 unknown assets under the stormwater geodatabase within this watershed.

Figure 8.10 presents the hard assets in S 36 watershed.

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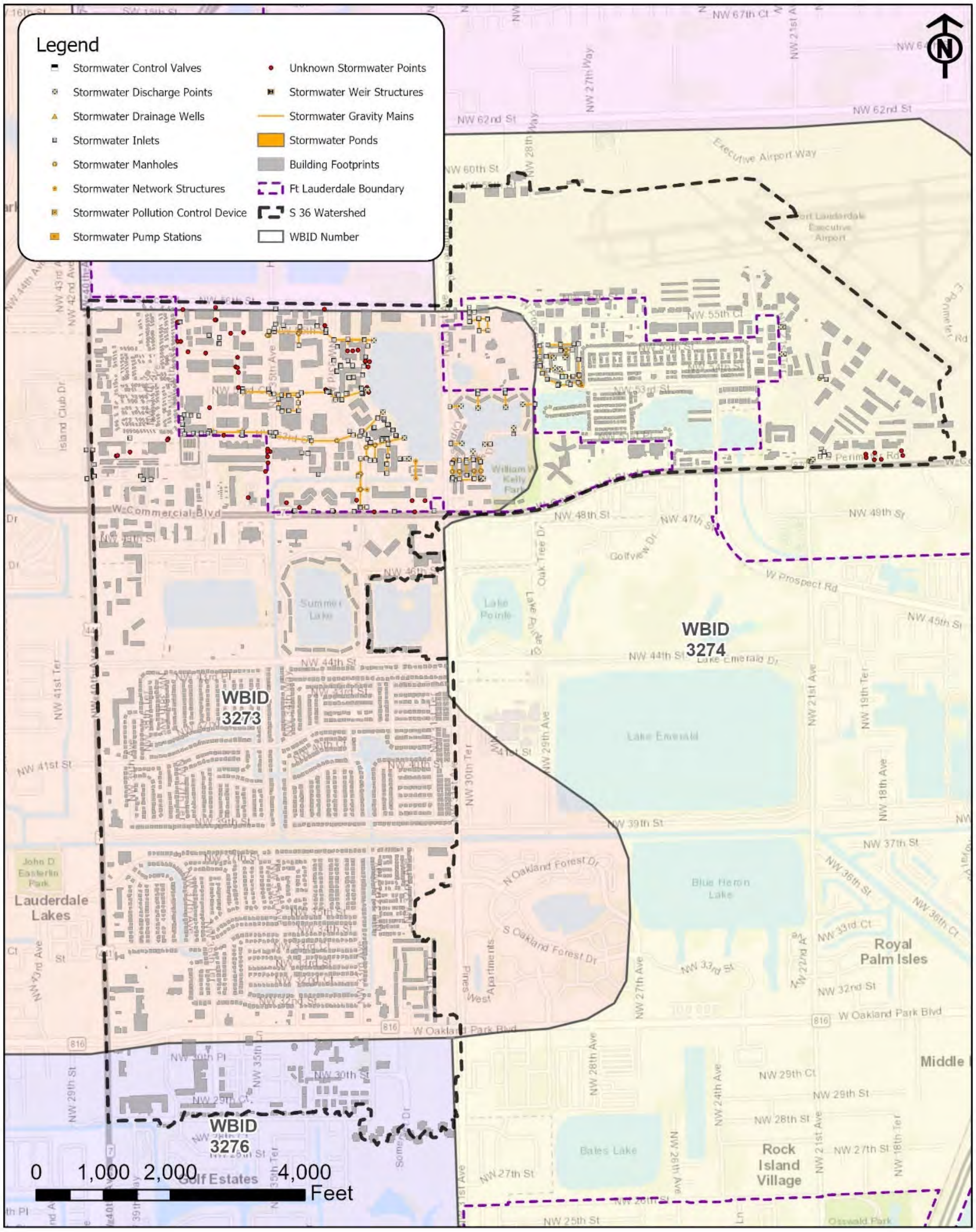
Figure 8.10: Hard Assets in S 36 Watershed (2019 Stormwater Geodatabase)



8.2.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1**. Specific soft assets for the S 36 watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.11** illustrates the S 36 Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

Goodwill Relationships and Cooperation with All City Departments, Staff, and Advisory Boards

This soft asset includes goodwill and cooperation with respect to watershed management activities, flood risk, and water quality from all City levels and departments including the Transportation & Mobility Department that handles administration of the Fort Lauderdale Executive Airport which is located within the S 36 Watershed. The Airport oversees the administration of land leases, development of airport property, as well as operates, maintains, and promotes the Executive Airport, Industrial Airpark, and the City’s Foreign-Trade Zone 241. The Airport staff also maintains, operates, and promotes the Fort Lauderdale Downtown Helistop (DT1), which serves as a multimodal connection to and from the downtown business area.

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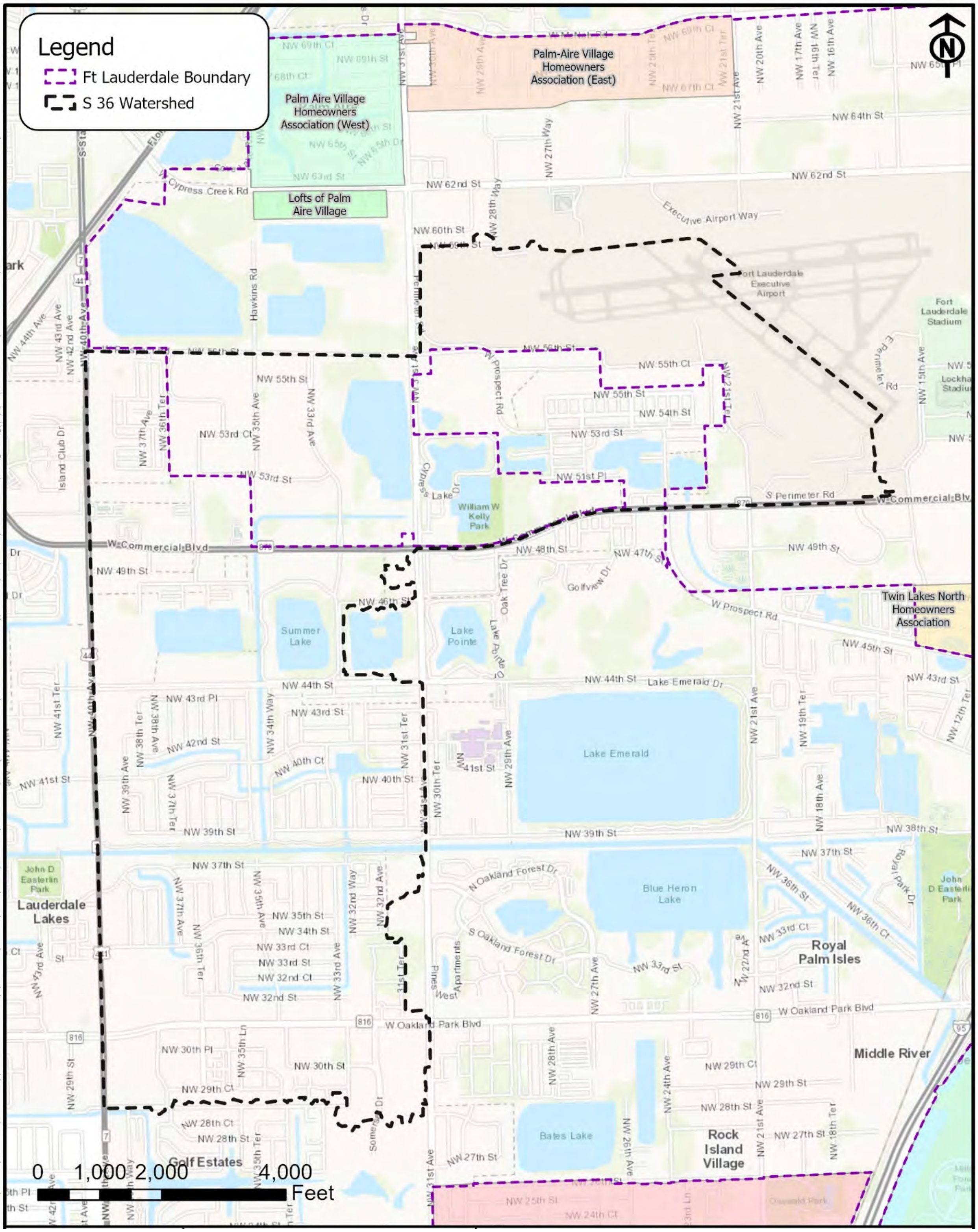
Figure 8.11: S 36 Watershed Neighborhood Associations



8.2.1.3 Natural Assets

The primary natural assets within the S 36 watershed are illustrated in **Figure 8.12**. In general, there are:

- 15 reservoirs, and
- and several open space areas with trees, such as William J. Kelly Park.

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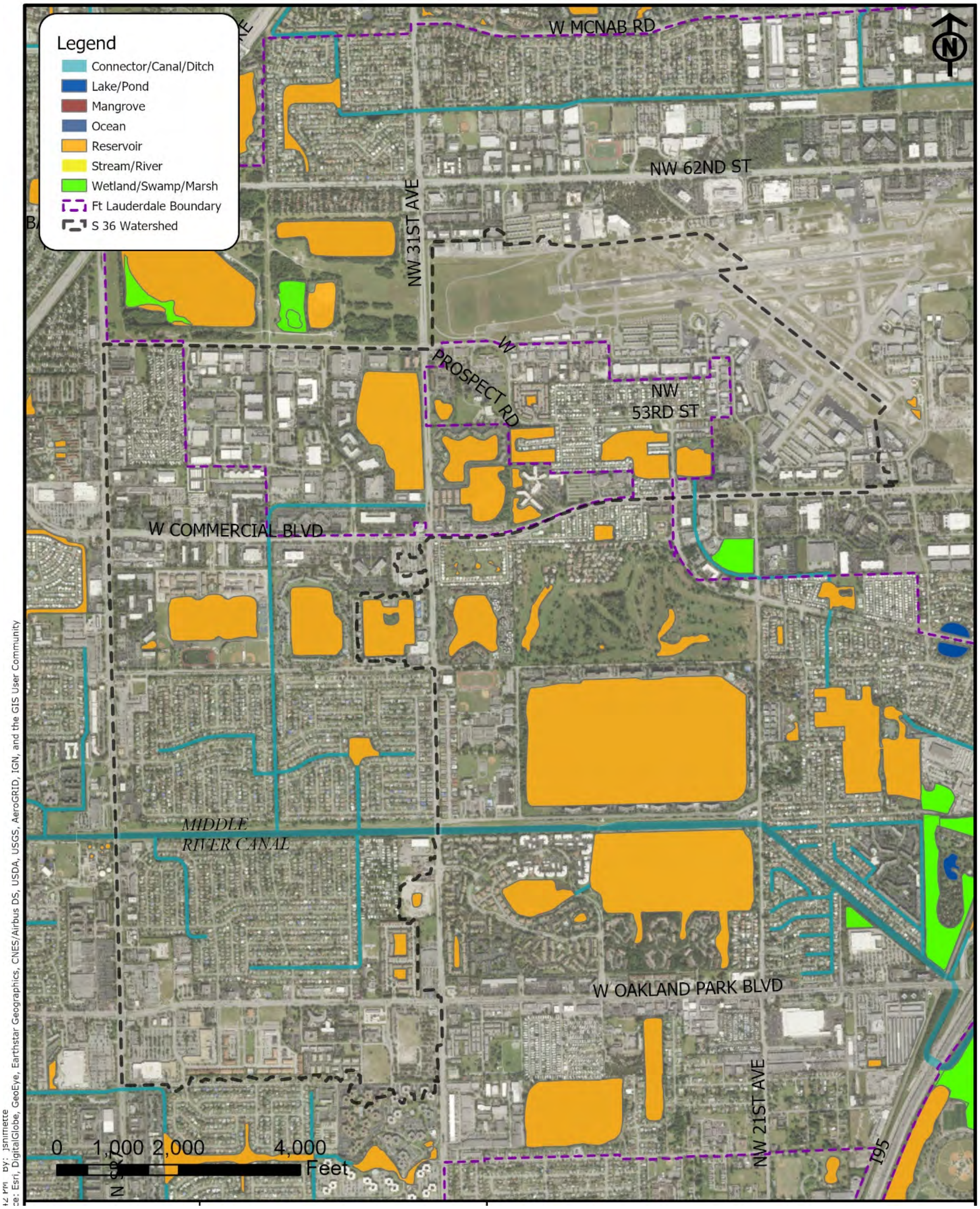
Figure 8.12: Natural Assets in S 36 Watershed



8.2.2 Watershed Challenges

Some challenges in this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.8**.

Table 8.8: Middle River Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Mangrove	Maintenance and Preservation	Perform periodic inspection, testing and dredging of the waterways as well as inspection of the mangroves themselves to ensure they remain healthy.
Reservoir	Saltwater intrusion	Manage wellfield pumpage, monitor saltwater monitoring wells
Seawall	Ownership determination	2018 Seawall Master Plan, which identifies all City-owned seawalls.
	Ordinance compliance and enforcement	The City adopted an ordinance (homeowners in the eastern portion of the Middle River Watershed) requiring property owners to elevate the height and ensure the functionality of their seawall.
	Seawall replacement prioritization	Replace/elevate seawalls as per established priority.
Water Pollution Control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Enhancement of the existing swale areas to provide better surface infiltration to reduce stormwater runoff and the number of suspended solids that enter the storm sewer system.
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from the same channel	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection

8.2.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.2.3 Asset Ownership and Inventory

Table 8.9 summarizes the hard assets in S 36 per asset ownership.

Table 8.9: Asset Inventory and Ownership in Fort Lauderdale Executive Airport (S 36) Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve (1)	0	0	0	0
Pond (1)	0	0	0	0
Discharge Point	21	5	15	1
Drainage Well	0	0	0	0
Exfiltration Trench (1)				
Inlet	212	42	168	2
Manhole	25	11	13	1
Gravity Main	162	53	91	18
Network Structure	6	5	1	0
Pollution Control Structure (1)				
Pollution Control Device	0	0	0	0
Pump Station	0	0	0	0
Unknown Point	64	0	0	64
Weir Structure	1	0	0	1

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~80 ft Westward.

8.2.4 What is the Condition and Performance of the Assets?

8.2.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the S 36 Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is

operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.2.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.10** shows the CoF Score by class used in this analysis.

Table 8.10: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the S 36 Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius north of the Embry-Riddle Aeronautical University, as shown in **Figure 8.13.**

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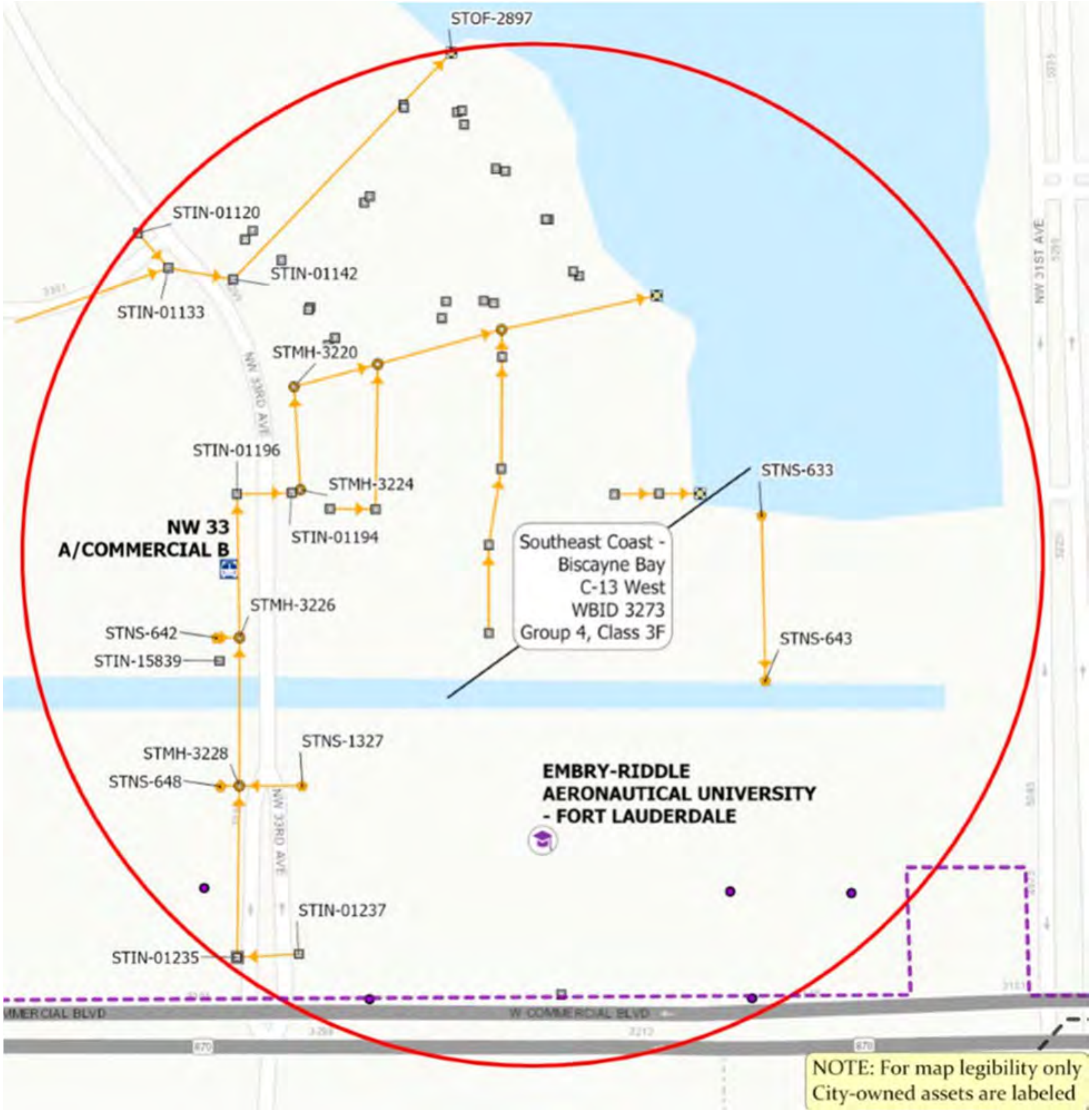
Figure 8.13: S 36 Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the S 36 Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score. For the section selected, there are no City-owned stormwater assets.

8.2.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.11** provides the overall representation of the S 36 Watershed data subset used for this analysis.

Table 8.11: S 36 Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
S 36	Gravity Main	City	STMN-07832	1.5	4.10	6.15		
S 36	Gravity Main	City	STMN-07833	5.0	4.00	20.00		
S 36	Gravity Main	City	STMN-07834	5.0	4.18	20.90		
S 36	Gravity Main	City	STMN-07835	1.5	3.95	5.93		
S 36	Gravity Main	City	STMN-07844	2.0	4.00	8.00		
S 36	Gravity Main	City	STMN-07845	2.0	3.93	7.86		
S 36	Gravity Main	City	STMN-07846	1.5	3.95	5.93		
S 36	Gravity Main	City	STMN-07847	1.5	4.00	6.00		
S 36	Gravity Main	City	STMN-07848	1.0	3.97	3.97		
S 36	Gravity Main	City	STMN-07849	1.0	4.05	4.05		
S 36	Gravity Main	City	STMN-07850	3.0	4.00	12.00		
S 36	Gravity Main	City	STMN-07851	3.5	4.00	14.00		
S 36	Gravity Main	City	STMN-07862	3.0	4.00	12.00		
S 36	Gravity Main	City	STMN-07863	2.5	3.95	9.88		
S 36	Gravity Main	City	STMN-07864	4.43	4.00	17.72		
S 36	Gravity Main	City	STMN-12979	3.75	4.10	15.38		
S 36	Inlet	City	STIN-01133	3.81	4.05	15.43		
S 36	Inlet	City	STIN-01120	4.19	4.10	17.18		
S 36	Inlet	City	STIN-01142	3.98	3.92	15.60		
S 36	Inlet	City	STIN-01235	4.23	3.98	16.84		
S 36	Inlet	City	STIN-01237	3.98	4.00	15.92		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
S 36	Inlet	City	STIN-01196	4.20	4.00	16.80		
S 36	Inlet	City	STIN-01194	4.67	3.89	18.17		
S 36	Inlet	City	STIN-15839	4.44	4.01	17.80		
S 36	Manhole	City	STMH-3220	4.35	4.00	17.40		
S 36	Manhole	City	STMH-3224	2.89	3.98	11.50		
S 36	Manhole	City	STMH-3226	3.56	4.00	14.24		
S 36	Manhole	City	STMH-3228	3.99	4.13	16.48		
S 36	Network Structure	City	STNS-633	2.60	2.20	5.72		
S 36	Network Structure	City	STNS-642	4.62	1.95	9.01		
S 36	Network Structure	City	STNS-643	3.78	2.00	7.56		
S 36	Network Structure	City	STNS-648	3.69	2.05	7.56		
S 36	Network Structure	City	STNS-1327	4.18	1.98	8.28		
S 36	Discharge Point	City	STOF-2897	4.05	4.00	16.20		

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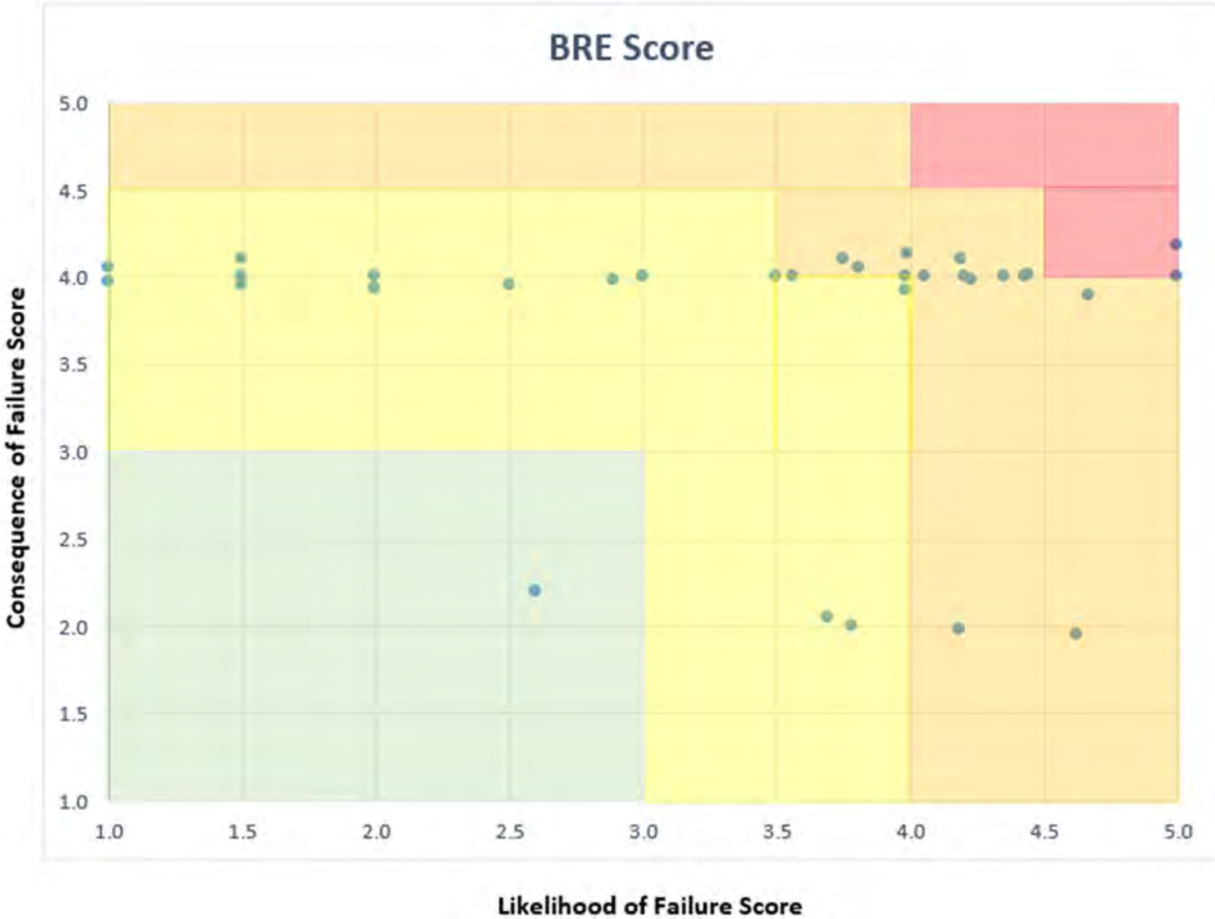
A representative BRE plot is shown in **Figure 8.14**.

Figure 8.14: S 36 Watershed Business Risk Exposure by Asset (Example)



8.2.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.12** shows examples of the LoS and strategies for hard assets.

Table 8.12: S 36 Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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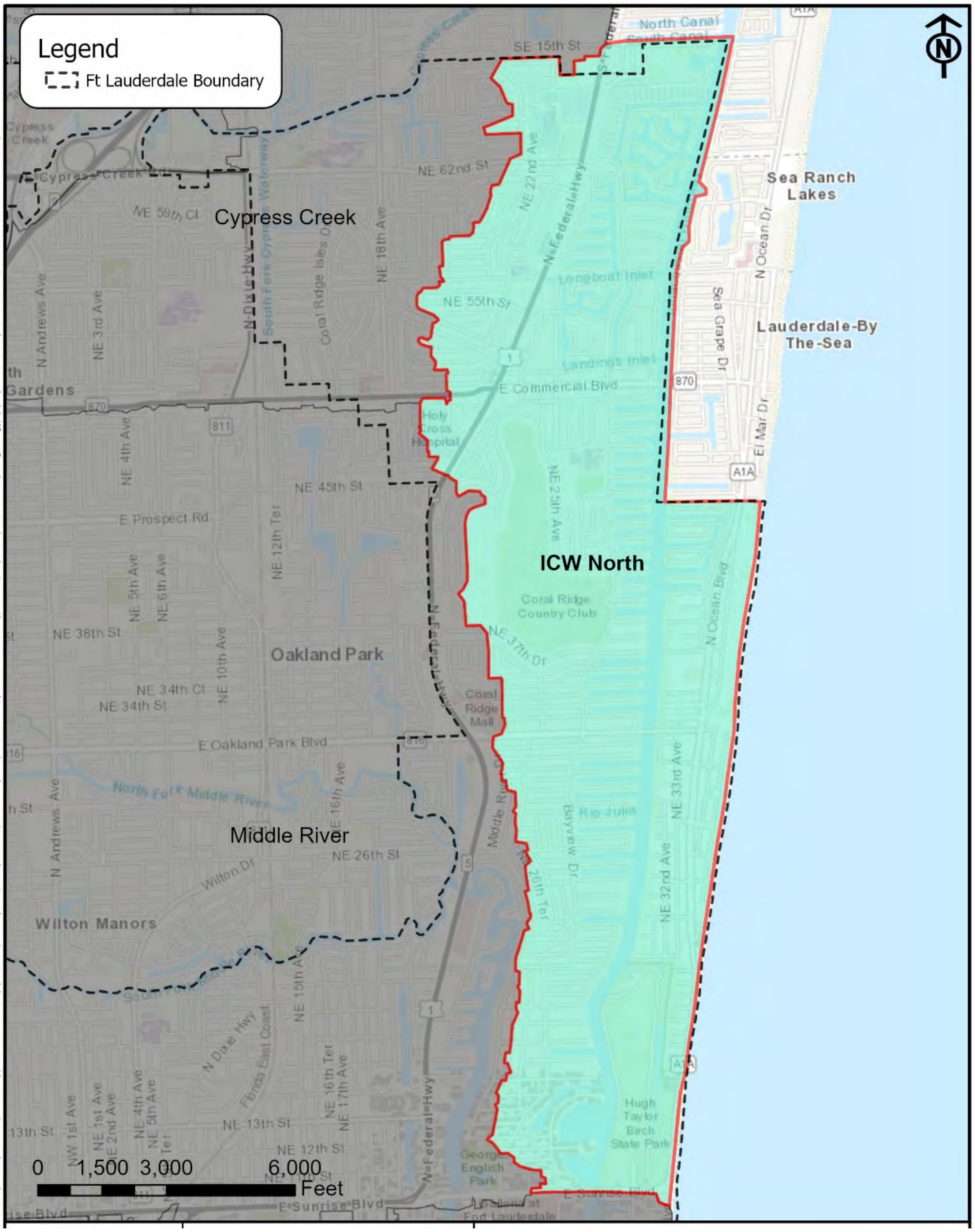
8.3 INTRACOASTAL WATERWAY (ICW) NORTH

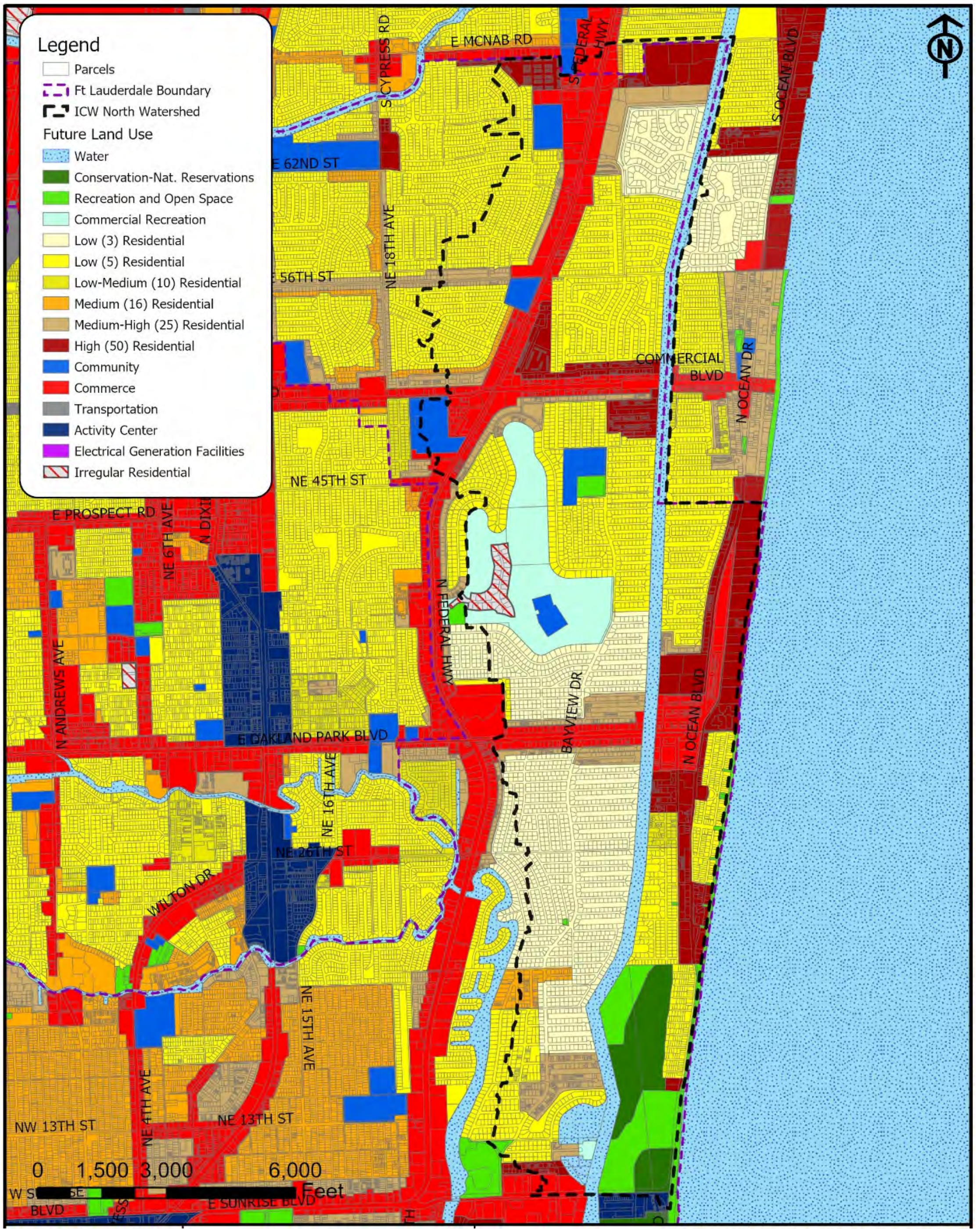
The Intracoastal Waterway (ICW) North watershed is located on the northeast part of the City of Fort Lauderdale, Florida. The watershed is approximately 4.88 square miles out of which 4.78 square miles are within the City boundaries. **Figure 8.15** illustrates the extent of the watershed.

Figure 8.15: ICW North Watershed Boundary



Land use throughout the watershed is primarily residential (a mix of low, medium and high density residential) and commercial along the main highways (North Federal Highway, Oakland Blvd., and Commercial Blvd.). The existing land use in this watershed is illustrated in **Figure 8.16**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.16: ICW North Land Use Plan



8.3.1 Asset Summary

8.3.1.1 Hard Assets

A summary of the hard assets within ICW North watershed as included in the stormwater geodatabase is presented in **Table 8.13**.

Table 8.13: Summary of Hard Assets in ICW North Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	13
Pond (1)	0
Discharge Point	312
Drainage Well	5
Exfiltration Trench (1)	
Inlet	1795
Manhole	325
Gravity Main	2291
Network Structure	211
Pollution Control Structure (1)	
Pollution Control Device	4
Pump Station	0
Weir Structure	27

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~100 ft Eastward along Atlantic Ocean.

(3) There are 354 unknown assets under the stormwater geodatabase within this watershed.

Figure 8.17 presents the hard assets in ICW North watershed.

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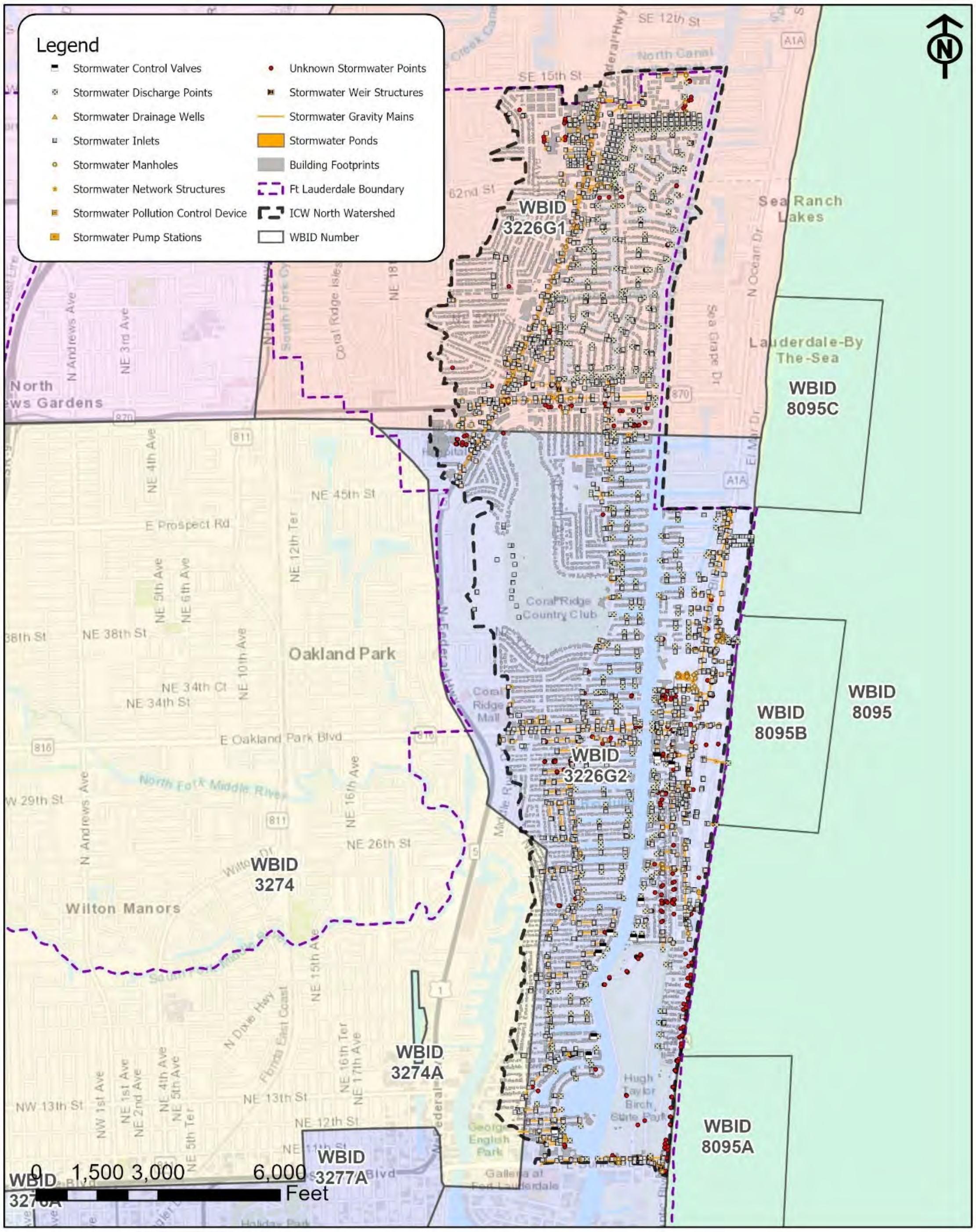
Figure 8.17: Hard Assets in ICW North (2019 Stormwater Geodatabase)



8.3.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1**. Specific soft assets for the ICW North watershed area detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.18** illustrates the ICW North Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

Ordinances

The City updated its seawall ordinance to establish construction and maintenance standards to mitigate tidal flooding and sea level rise impacts. On February 17, 2017, the City issued an ordinance update to amend the unified land development regulation, section 47-19.3. The ordinance sets the minimum seawall elevation at 3.9 feet NAVD 88 and recommends design of new seawall elevation at up to 5.0 feet NAVD88. In general, under the revised ordinance, property owners must meet the City's minimum seawall requirements when:

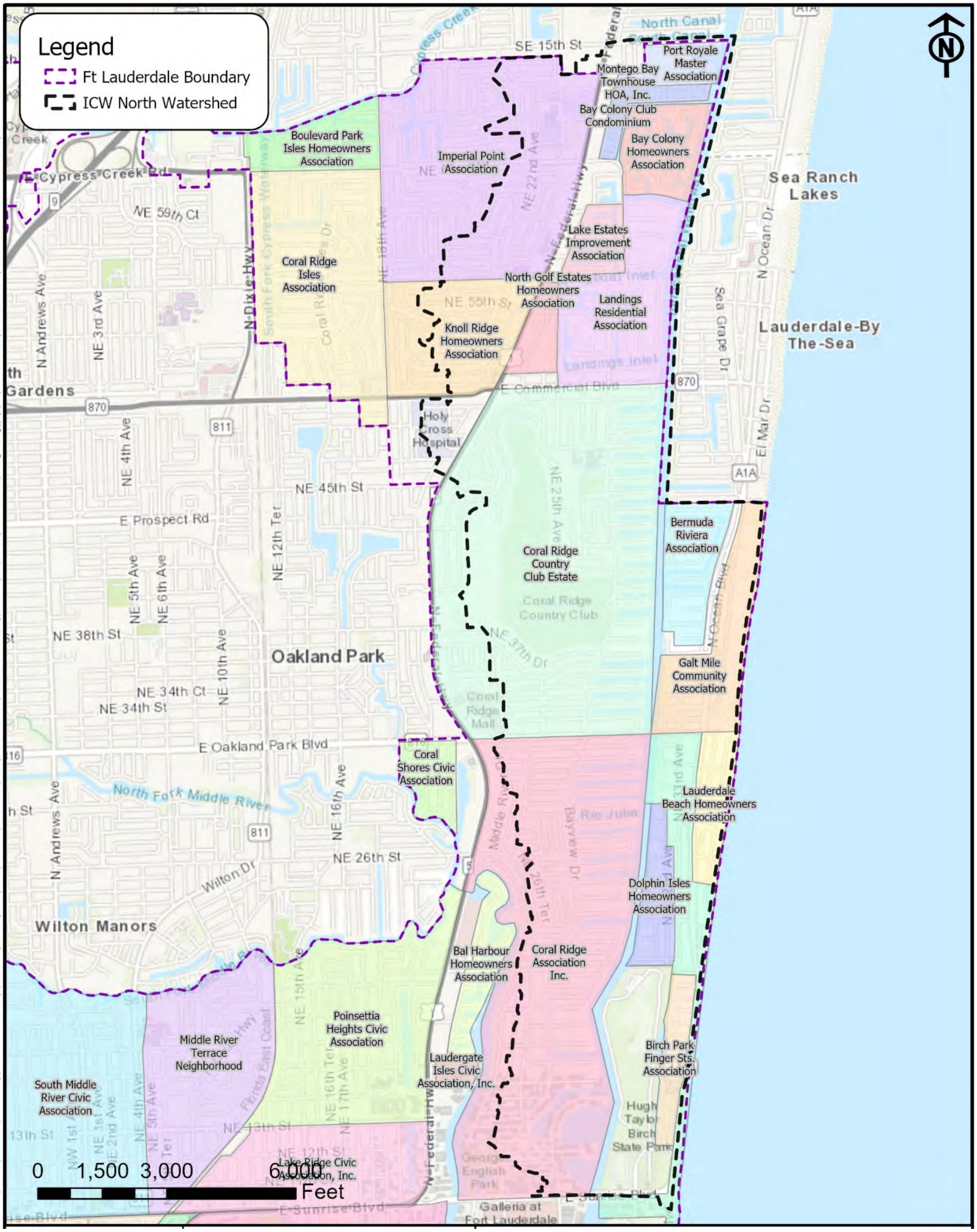
- Owner is installing a new seawall
- Owner comes in for a repair permit and it is determined that repair will cost at least 50% of the value of the structure
- Citation issued for seawall in disrepair
- Allowing tidal waters to enter property which impact adjacent properties or the right-of-way

This ordinance applies to homeowners within the ICW North Watershed.

City Planning Documents

City planning documents that may have application in the ICW North watershed include the 2015 Canal Dredging Plan, the 2018 Seawall Master Plan and the 2020-2024 Proposed Community Investment Plan, all of which include proposed projects that may impact infrastructure in the ICW North watershed. Proposed projects include over $1.5M in canal dredging and replacement and maintenance of City-owned seawalls.

Figure 8.18: ICW North Neighborhood Associations



The primary natural assets within the ICW North watershed are illustrated in **Figure 8.19**. In general, there are:

- 7 reservoirs,
- 3 lakes - Lake Seneca, Lake Cayuga, and Seminole Lake,
- intricate system of canals,
- 2 bays – Sunrise Bay and Coral Bay,
- Hugh Taylor Birch State Park - 175 acres with a variety of waterways (beach, canals), vegetation, and wildlife,
- Intracoastal Waterway, and
- the Atlantic Ocean

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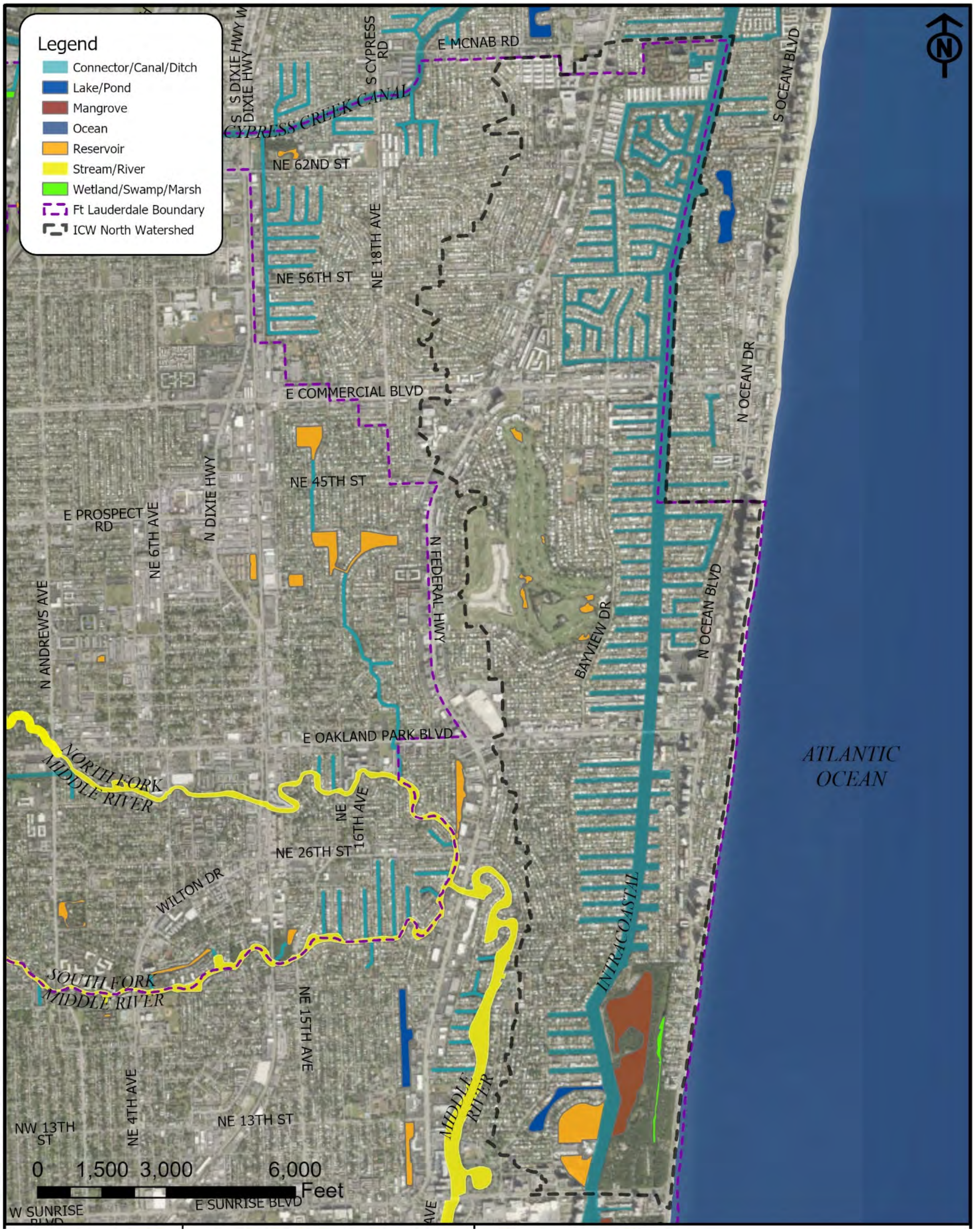
Figure 8.19: Natural Assets in ICW North Watershed



8.3.2 Watershed Challenges

The challenges faced by this tidally influenced watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.14**.

Table 8.14: ICW North Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Waterways pollution control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Install exfiltration trenches, restored swales, permeable pavement and specifically designed water quality structures.
High Groundwater Levels	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station (e.g. proposed stormwater pump station in Progresso Village neighborhood).
Reservoir	Saltwater intrusion	Manage wellfield pumpage, monitor saltwater monitoring wells
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from same channel.	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection
Seawall	Ownership determination	2018 Seawall Master Plan, which identifies all City-owned seawalls.
	Ordinance compliance and enforcement	The City adopted an ordinance (homeowners in the eastern portion of the Middle River Watershed) requiring property owners to elevate the height and ensure the functionality of their seawall.
	Seawall replacement prioritization	Replace/elevate seawalls as per established priority.

8.3.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

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8.3.3 Asset Ownership and Inventory

Table 8.15 summarizes the hard assets in ICW North per asset ownership.

Table 8.15: Asset Inventory and Ownership in ICW North Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	13	13	0	3
Pond (1)	0	0	0	0
Discharge Point	312	263	46	3
Drainage Well	5	0	5	0
Exfiltration Trench (1)				
Inlet	1795	992	781	22
Manhole	325	95	214	16
Gravity Main	2291	1100	1119	72
Network Structure	211	49	160	2
Pollution Control Structure (1)				
Pollution Control Device	4	1	0	3
Pump Station	0	0	0	0
Unknown Point	354	0	0	354
Weir Structure	27	3	19	5

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~100 ft Eastward along Atlantic Ocean.

8.3.4 What is the Condition and Performance of the Assets?

8.3.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the ICW North Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is

operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.3.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds as a baseline. **Table 8.16** shows the CoF Score by class used in this analysis.

Table 8.16: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the ICW North Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius around the E Oakland Park Blvd / NE 3rd Avenue Intersection, as shown in **Figure 8.20.**

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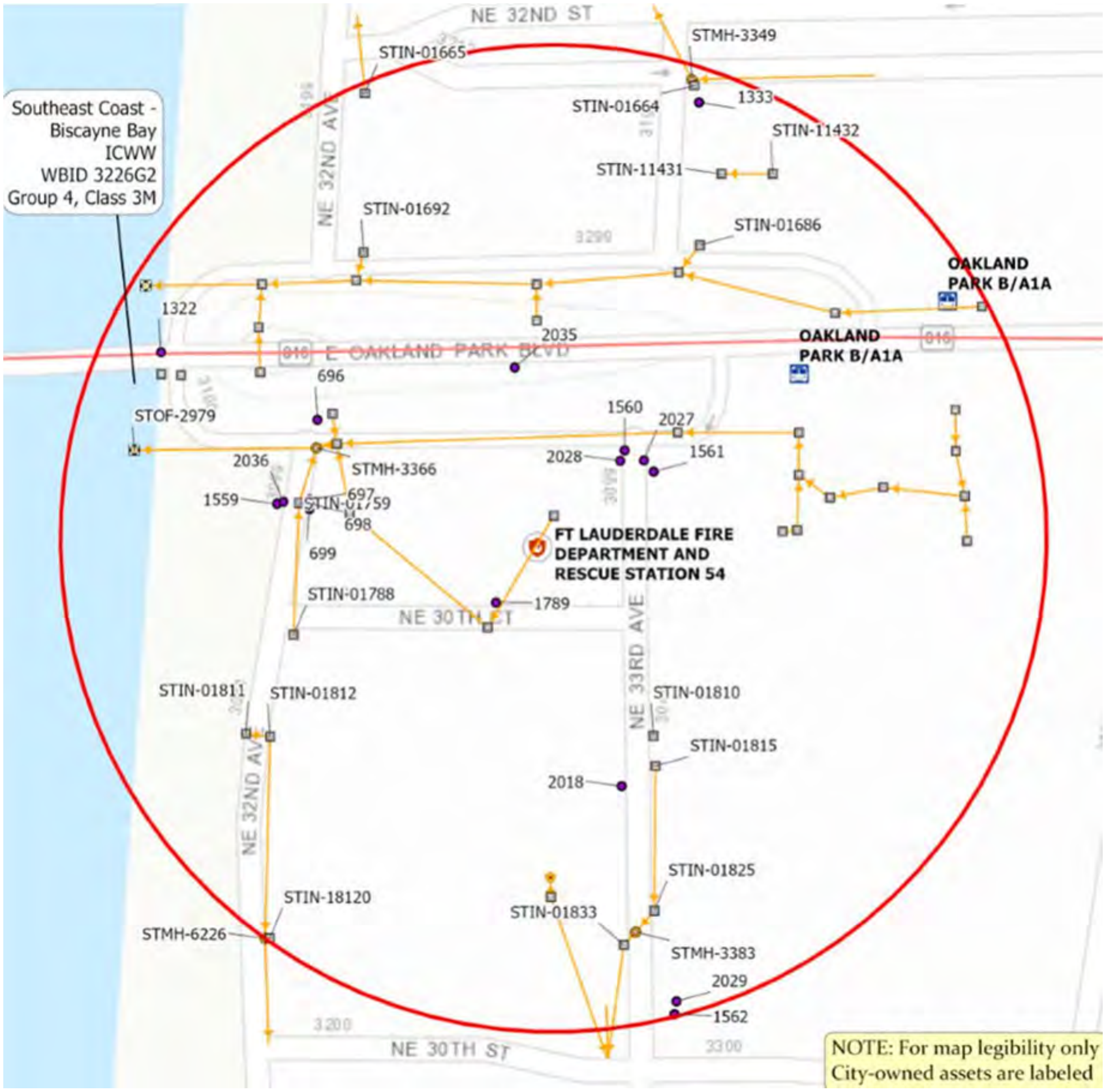
Figure 8.20: ICW North Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the ICW North Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score. For the section selected, there are no City-owned stormwater assets.

8.3.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.17** provides the overall representation of the ICW North Watershed data subset used for this analysis.

Table 8.17: ICW North Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
ICW North	Gravity Main	City	STMN-07927	2.0	4.02	8.04		
ICW North	Gravity Main	City	STMN-07931	3.5	3.98	13.93		
ICW North	Gravity Main	City	STMN-07976	3.5	3.88	13.58		
ICW North	Gravity Main	City	STMN-07977	4.5	4.00	18.00		
ICW North	Gravity Main	City	STMN-07978	1.0	4.10	4.10		
ICW North	Gravity Main	City	STMN-07981	4.0	4.00	16.00		
ICW North	Gravity Main	City	STMN-09405	5.0	4.18	20.90		
ICW North	Gravity Main	City	STMN-09406	5.0	3.95	19.75		
ICW North	Gravity Main	City	STMN-09450	3.0	4.00	12.00		
ICW North	Gravity Main	City	STMN-09451	3.5	3.93	13.76		
ICW North	Gravity Main	City	STMN-09453	3.0	3.95	11.85		
ICW North	Gravity Main	City	STMN-09477	2.0	4.00	8.00		
ICW North	Gravity Main	City	STMN-14128	2.0	3.97	7.94		
ICW North	Gravity Main	City	STMN-09408	2.5	4.05	10.13		
ICW North	Gravity Main	City	STMN-23333	3.0	4.00	12.00		
ICW North	Gravity Main	City	STMN-27550	3.0	4.00	12.00		
ICW North	Gravity Main	City	STMN-27551	3.5	4.00	14.00		
ICW North	Inlet	City	STIN-01686	3.0	3.95	11.85		
ICW North	Inlet	City	STIN-01692	2.0	4.00	8.00		
ICW North	Inlet	City	STIN-01664	1.5	4.10	6.15		
ICW North	Inlet	City	STIN-01665	5.0	4.05	20.25		
ICW North	Inlet	City	STIN-11431	5.0	4.10	20.50		
ICW North	Inlet	City	STIN-11432	1.5	3.92	5.88		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
ICW North	Inlet	City	STIN-01759	2.0	3.98	7.96		
ICW North	Inlet	City	STIN-01788	2.0	4.00	8.00		
ICW North	Inlet	City	STIN-01812	1.5	4.00	6.00		
ICW North	Inlet	City	STIN-01811	1.5	3.89	5.84		
ICW North	Inlet	City	STIN-01825	1.0	4.01	4.01		
ICW North	Inlet	City	STIN-01833	1.0	4.00	4.00		
ICW North	Inlet	City	STIN-01810	3.0	3.98	11.94		
ICW North	Inlet	City	STIN-01815	3.5	4.00	14.00		
ICW North	Inlet	City	STIN-18120	3.0	4.13	12.39		
ICW North	Manhole	City	STMH-3349	2.5	4.07	10.18		
ICW North	Manhole	City	STMH-3366	3.0	3.86	11.58		
ICW North	Manhole	City	STMH-3383	2.5	3.98	9.95		
ICW North	Manhole	City	STMH-6226	3.0	4.00	12.00		
ICW North	Discharge Point	City	STOF-2979	3.0	4.03	12.09		

A representative BRE plot is shown in **Figure 8.21**.

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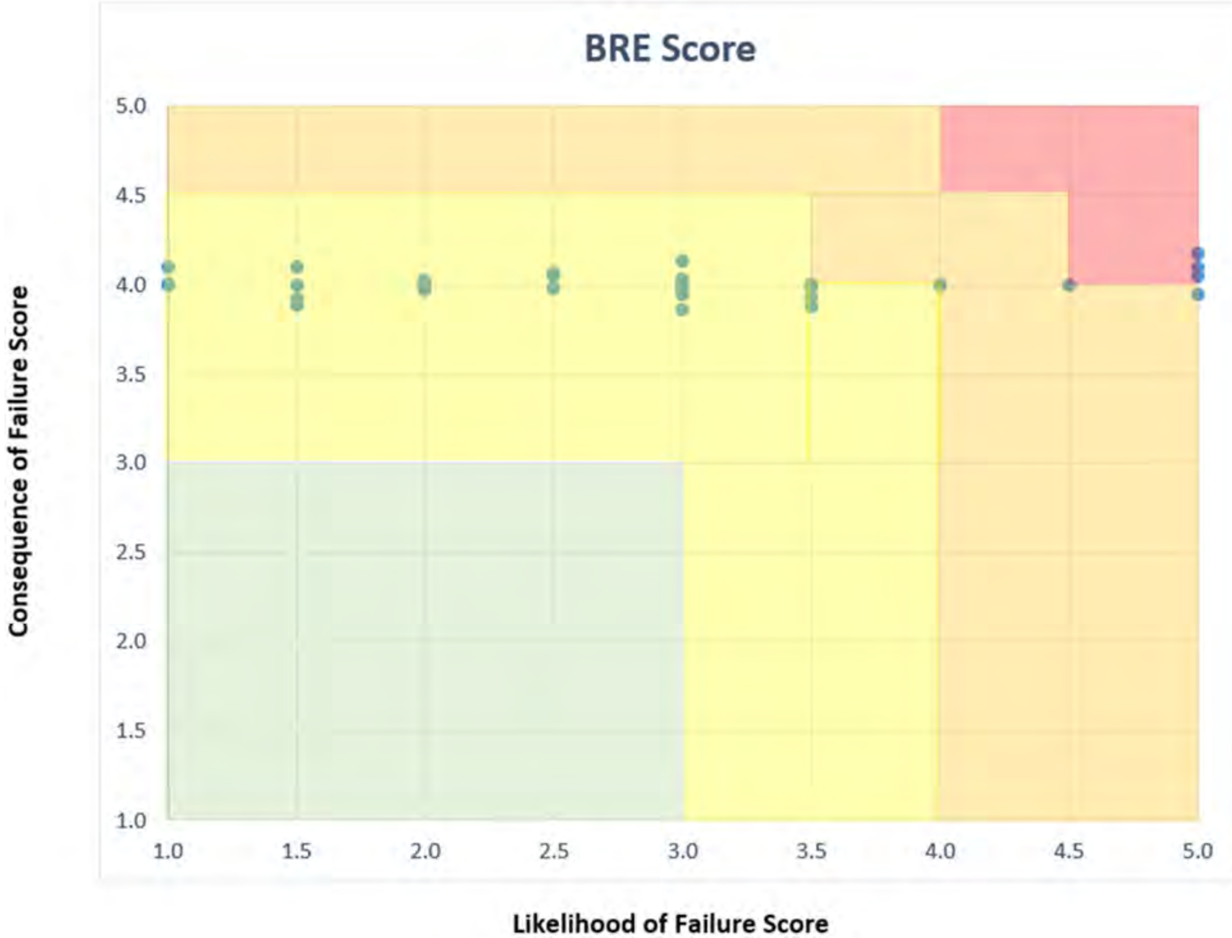
Figure 8.21: ICW North Watershed Business Risk Exposure by Asset (Example)



8.3.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). Table 8.18 shows examples of the LoS and strategies for hard assets.

Table 8.18: ICW North Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Manhole	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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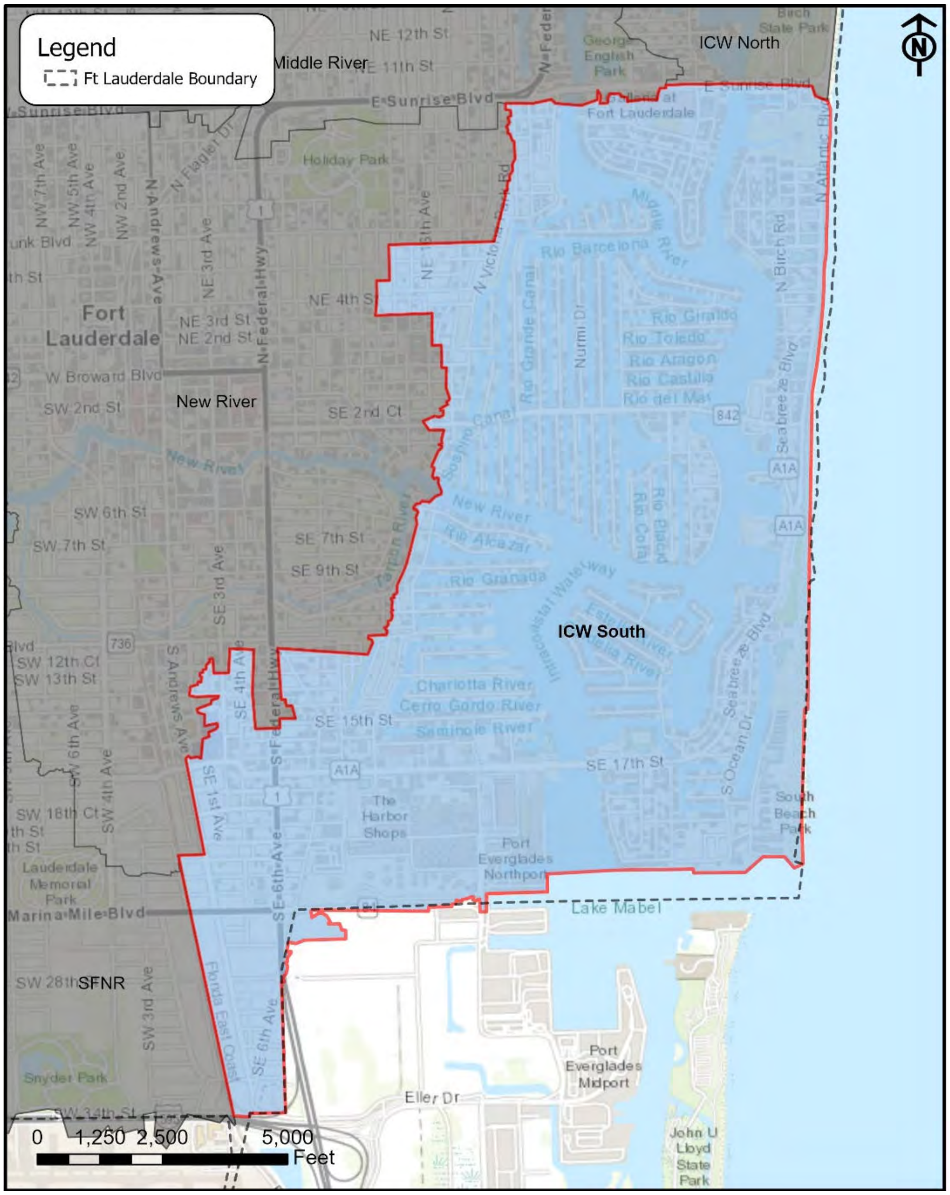
8.4 INTRACOASTAL WATERWAY (ICW) SOUTH

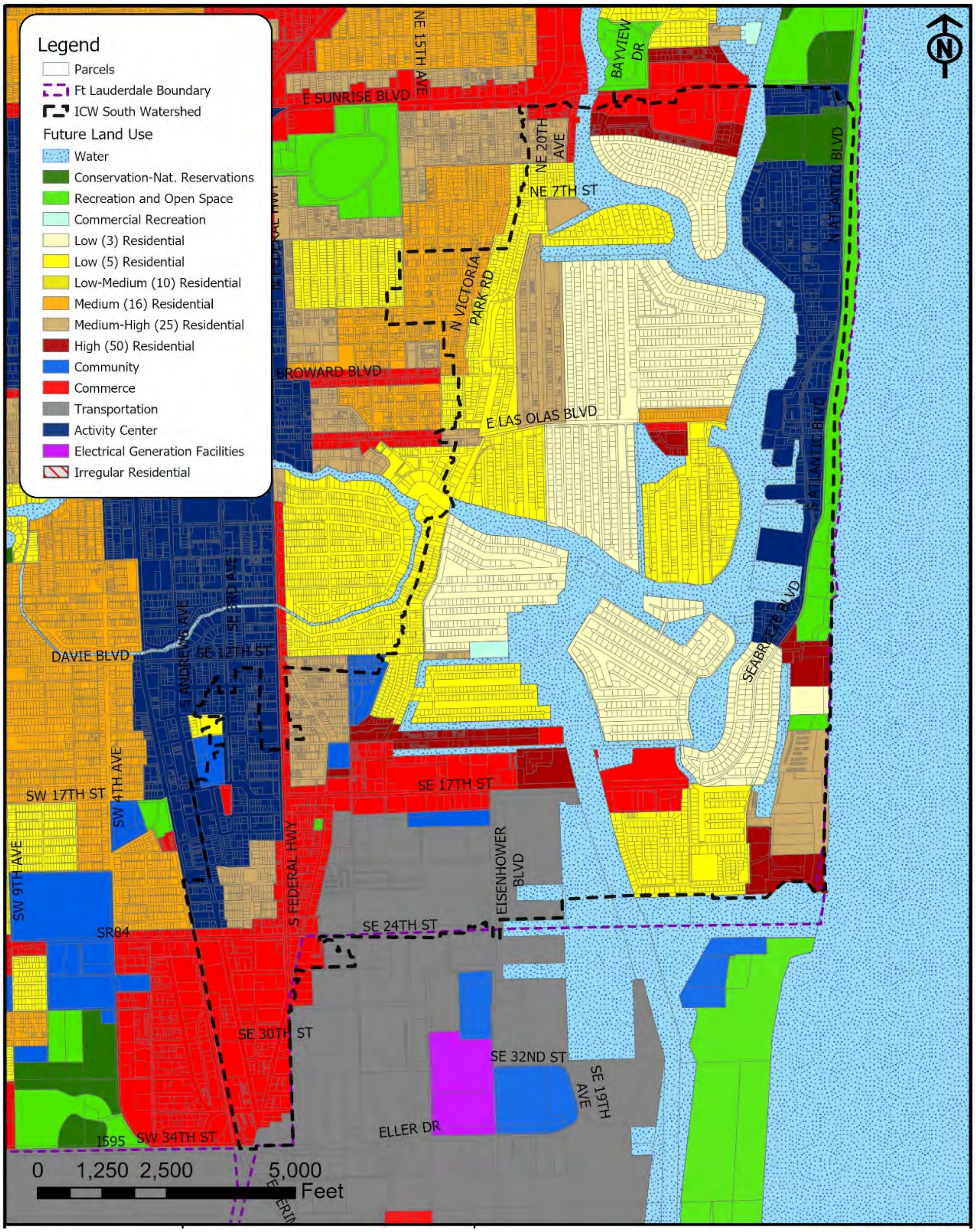
The ICW South watershed is located on the east part of the City of Fort Lauderdale, Florida. The watershed is approximately 5.30 square miles out of which 5.26 square miles are within the City boundaries. This watershed includes the Southeast Isles Neighborhood, one of the seven priority neighborhoods on the Stormwater Master Plan and Design Implementation Program. The watershed discharges to the Intracoastal Waterway. **Figure 8.22** illustrates the extent of the watershed.

Figure 8.22: ICW South Watershed Boundary



The land surface in the ICW South watershed is relatively flat with a range of elevations from below sea level (-2.37 ft) to 11.43 ft. Land use throughout the watershed is primarily residential (low density residential). The existing land use in this watershed is illustrated in **Figure 8.23** Broward County future land use GIS data was used to develop the land use plan.

Figure 8.23: ICW South Land Use Plan



8.4.1 Asset Summary

8.4.1.1 Hard Assets

A summary of the hard assets within ICW South watershed as included in the stormwater geodatabase is presented in **Table 8.19**.

Table 8.19: Summary of Hard Assets in Intracoastal Waterway (ICW) South Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	130
Pond(1)	0
Discharge Point	400
Drainage Well	20
Exfiltration Trench(1)	
Inlet	2255
Manhole	498
Gravity Main	2960
Network Structure	191
Pollution Control Structure(1)	
Pollution Control Device	88
Pump Station	3
Weir Structure	55

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~1,500 ft Southward.

(3) There are 654 unknown assets under the stormwater geodatabase within this watershed.

Figure 8.24 presents the hard assets in ICW South watershed.

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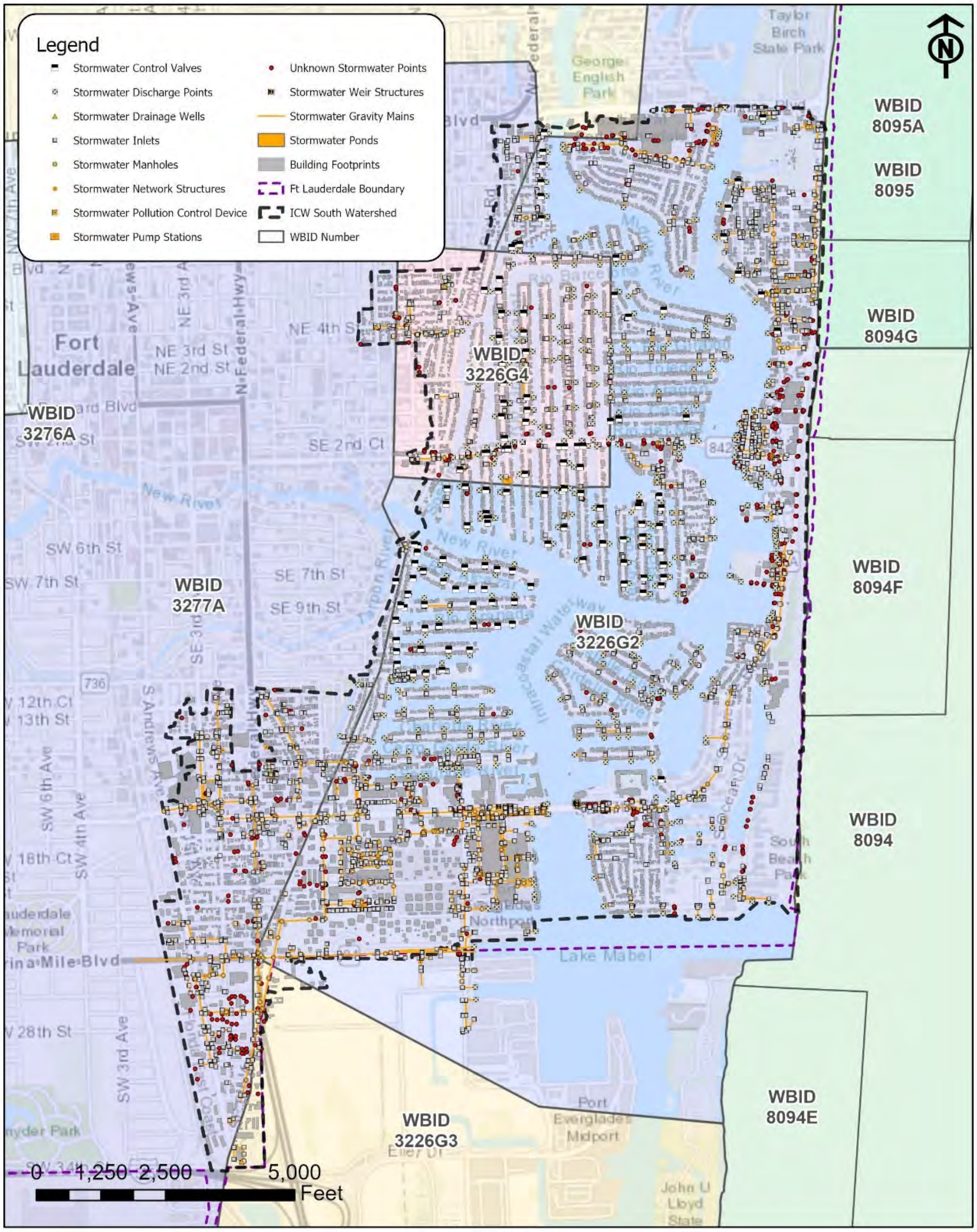
Figure 8.24: Hard Assets in ICW South (2019 Stormwater Geodatabase)



8.4.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in Section 2.1.2.1. Specific soft assets for the ICW South watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

This soft asset includes goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.25** illustrates the ICW South Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

Ordinances

The City updated its seawall ordinance to establish construction and maintenance standards to mitigate tidal flooding and sea level rise impacts. On February 17, 2017, the City issued an ordinance update to amend the unified land development regulation, section 47-19.3. The ordinance sets the minimum seawall elevation at 3.9 feet NAVD 88 and recommends design of new seawall elevation at up to 5.0 feet NAVD88. In general, under the revised ordinance, property owners must meet the City’s minimum seawall requirements when:

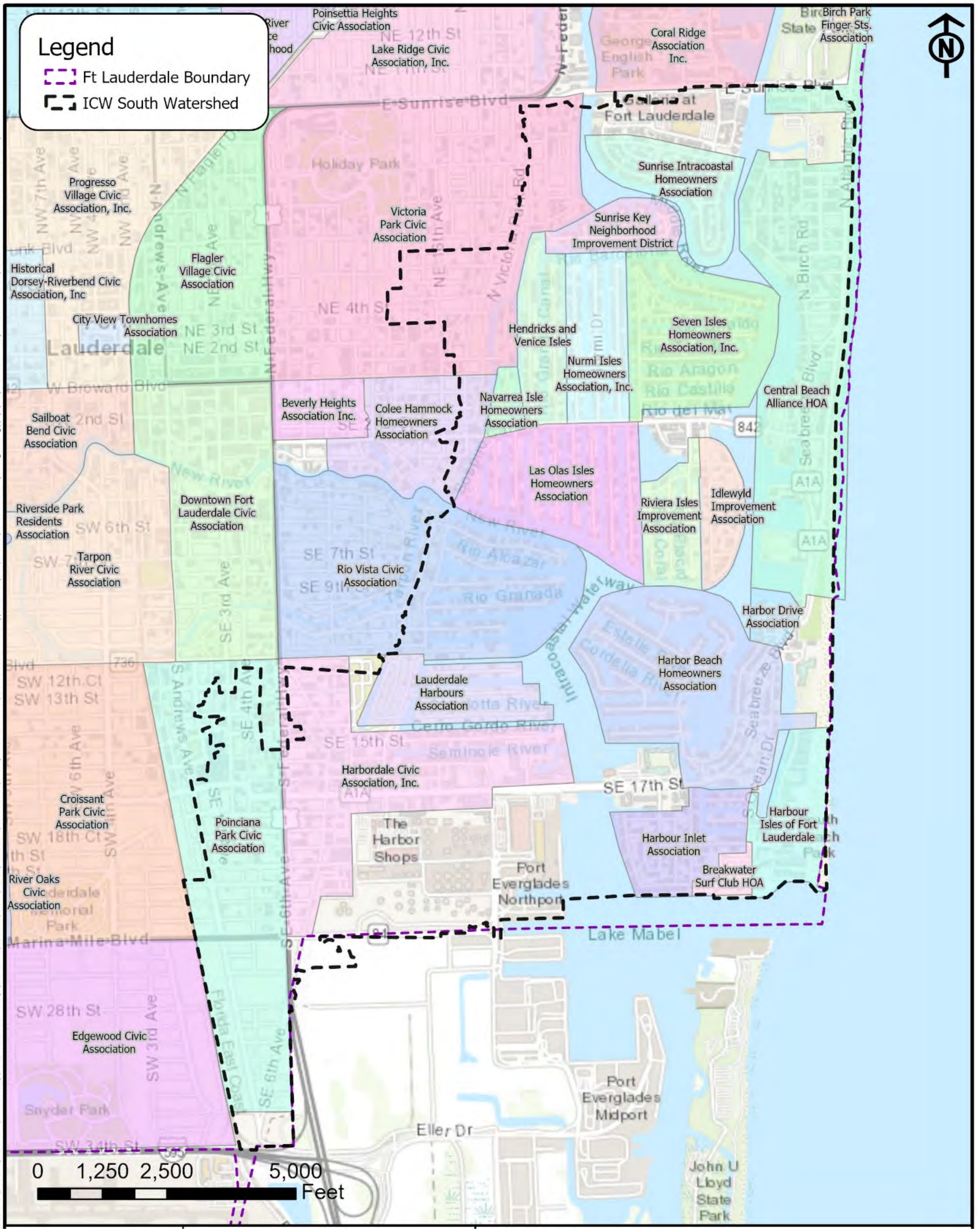
- Owner is installing a new seawall
- Owner comes in for a repair permit and it is determined that repair will cost at least 50% of the value of the structure
- Citation issued for seawall in disrepair
- Allowing tidal waters to enter property which impact adjacent properties or the right-of-way

This ordinance will specifically apply to homeowners within the ICW South Watershed.

City Planning Documents

City planning documents that may have application in the ICW South watershed include the 2015 Canal Dredging Plan, the 2018 Seawall Master Plan and the 2020-2024 Proposed Community Investment Plan, all of which include proposed projects that may impact infrastructure in the ICW South watershed. Proposed projects include over $1.5M in canal dredging and replacement and maintenance of City-owned seawalls.

Figure 8.25: ICW South Neighborhood Associations



Regulatory Permitting Policies & Non-Structural BMPs

As noted in Section 1.7.1.2 NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the ICW South watershed are considered impaired as also noted on the TMDL Report in **Appendix C**. The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

8.4.1.3 Natural Assets

A summary of the primary natural assets within the ICW South watershed are illustrated in **Figure 8.26**. In general, there are:

- 3 main rivers **-** Middle River, Stranahan River, New River Sound,
- the intracoastal
- numerous canal systems,
- 3 lakes – Sunset Lake, Cliff Lake and Lake Sylvia,
- 2 areas identified with mangroves on Bonnet Gardens,
- Several parks **-** Clift Lake park, Victoria Park, Annie Beck Park, Merle Fogg Park, with several trees, and
- the Atlantic Ocean

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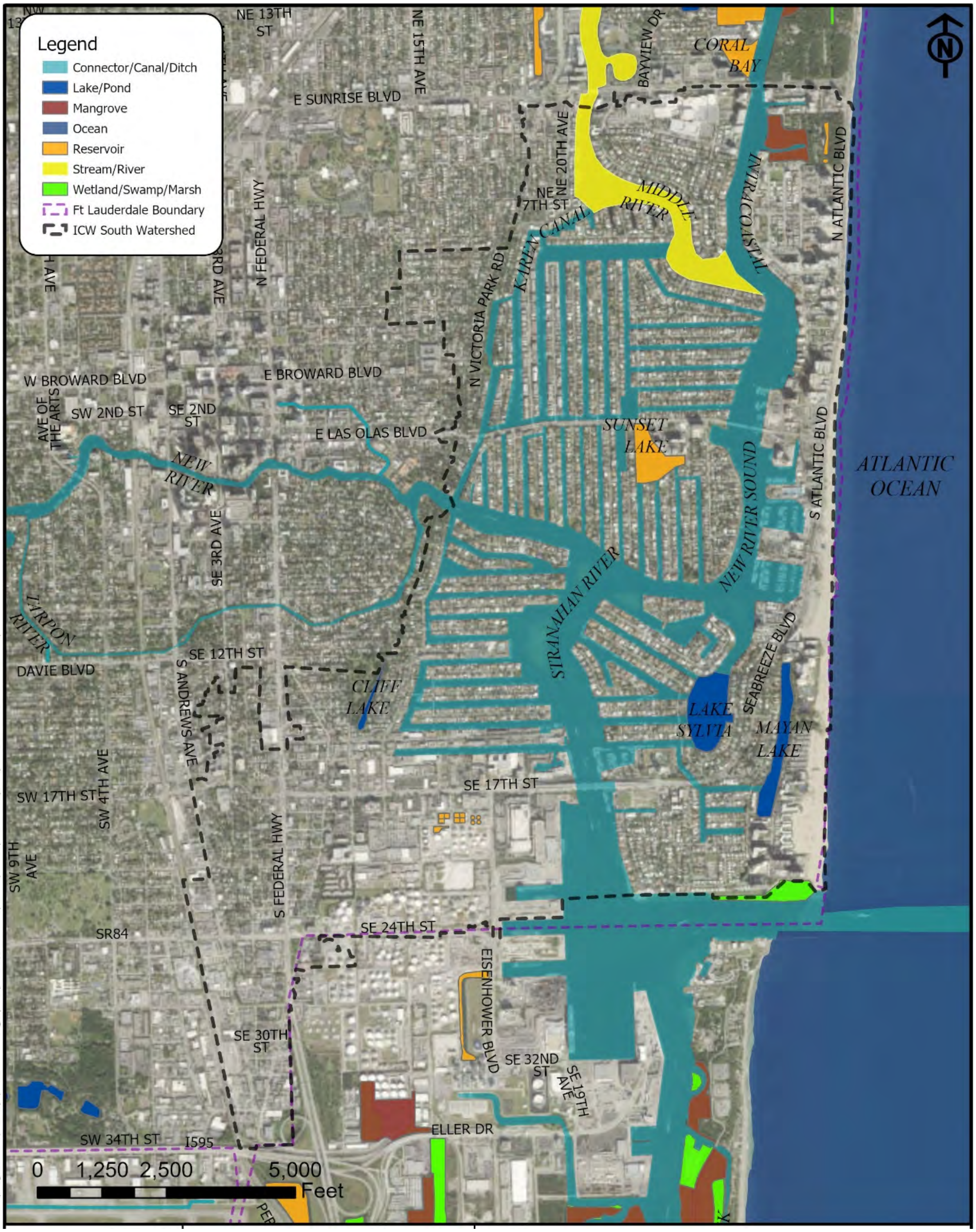
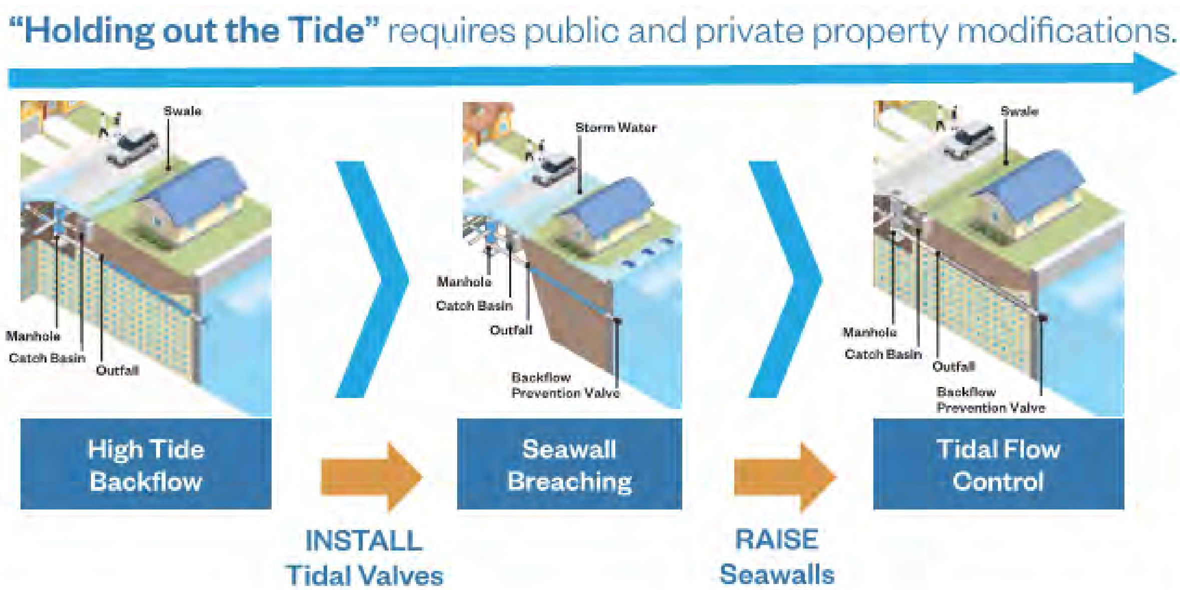
Figure 8.26: Natural Assets in ICW South Watershed



8.4.2 Watershed Challenges

The ICW watershed faces unique challenges based on the existing infrastructure, topography, tidal influences, right-of-way conditions, and community architectural elements. Therefore, the stormwater system requires design and asset operation and maintenance strategies that are specifically tailored to the unique needs of the watershed. For example, in the Southeast Isles neighborhood, the City has started installing tidal valves on stormwater outfalls connected to low lying areas. Remaining areas without tidal valves and with inlet rim elevations below 2.5 ft NAVD 88 were prioritized for installation of tidal valves to protect these areas from backflow during high tides as part of the Southeast Isles neighborhood project. In addition, as part of the design phasing approach, the City-owned seawalls with top of walls below this same elevation and/or with structural deficiencies were selected to be raised to meet the City's Seawall Ordinance maximum top-of-wall elevation of 5 ft. NAVD 88. **Figure 8.27** illustrates the process of holding out the tides in this neighborhood.

Figure 8.27: Phasing Design Approach for Tidally Influenced Locations



In areas such as primary travel routes for neighbors, the backbone of a more robust drainage conveyance system was proposed as part of the Southeast Isles Neighborhood project. One example is Las Olas Boulevard, were the City's stormwater systems are planned to be connected to pumped drainage systems. In addition, the design allows for areas not included in the current design phase to be appropriately incorporated in the future and sequenced to take place after necessary modifications occur on private properties to keep tidal waters from breaching seawalls and reaching public right-of-way. In these specific areas, premature construction of extended stormwater systems would result in repumping tidal flood waters. Proposed improvements in this area were strategically phased and coordinated to account for the timing of modifications on both public and private property and future SLR projections in order to maximize the long-term value of the proposed systems.

Other challenges faced by this tidally influenced watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.20**.

Table 8.20: ICW South Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
High Tides	Backflow during high tides	Install control valves (tidal valves) to prevent backflow; perform critical asset inspection before, during and after hide tides; schedule inspection and/or replacement of flood control assets (e.g. tidal valves) during low tides. **Figure 8.26** presents the high tide flood locations during the months of August and September 2019.
	Seawall breaching (City-owned and privately owned)	Raise City-Owned seawalls based on prioritization plan; implement and enforce City's seawall ordinance; perform hide tide ordinance compliance inspections.
	Roadway degradation, vegetation, private property damage due to sea water	Resurface roadways; replace damaged City-owned asset/equipment
	Seawall Ordinance monitoring and enforcement	Inspect and document seawall that breach during high tides and cite residents.
Seawalls	Ownership determination	Complete Seawall Master Plan to identify all City-owned seawalls.
	Breaching of seawalls owned by other agencies adjacent to City-Owned streets and/or properties	Create strategic joint venture partnerships. JPAs to share cost of seawalls owned by other local and state agencies.
	Structural condition of seawalls	Replace seawalls according to prioritization strategies
	Ordinance compliance and enforcement	Perform seawall ordinance compliance activities; operate and maintain flood control and water quality assets such as tidal valves, catch basins, pollution prevention devices, stormwater pump stations, etc.
	Seawall replacement prioritization	Replace/elevate seawalls as per established priority.
High Groundwater Levels	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
Highly developed neighborhoods with elaborate architectural conditions	Limited right-of way space available for stormwater and runoff water storage	Strategically placed stormwater collection systems.
Unique access condition	Many of the finger isles have only one access road	Prioritize assets on roads that represent the main and/or only access to communities/properties.
Waterways pollution control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Install pollution prevention baffles, water quality structures; implement community awareness plan.

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from same channel.	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection
Other: Beach/Shoreline erosion, preservation of mangroves and natural resources.		

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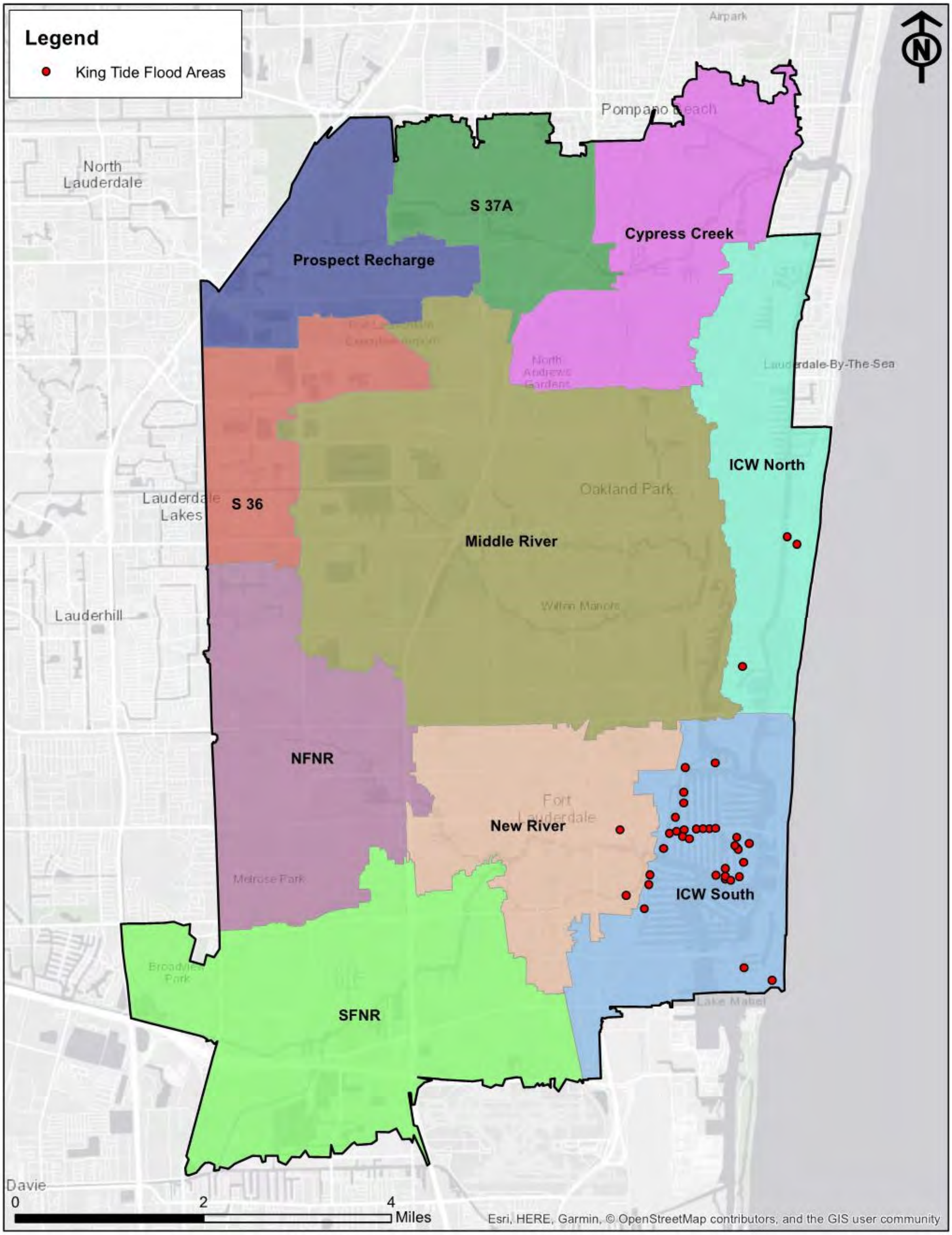
Figure 8.28: Flooding Locations during King Tide Events (August and September 2019)



8.4.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.4.3 Asset Ownership and Inventory

Table 8.21 summarizes the hard assets in ICW South per asset ownership.

Table 8.21: Asset Inventory and Ownership in Intracoastal Waterway (ICW) South Watershed (2019 Stormwater Geodatabase)

Existing Asset Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	130	130	0	0
Pond (1)	0	0	0	0
Discharge Point	400	334	55	11
Drainage Well	20	5	15	0
Exfiltration Trench (1)				
Inlet	2255	1408	792	55
Manhole	498	229	173	96
Gravity Main	2960	1654	918	388
Network Structure	191	86	103	2
Pollution Control Structure (1)				
Pollution Control Device	88	73	0	15
Pump Station	3	0	0	3
Unknown Point	654	0	0	654
Weir Structure	55	12	35	8

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~1,500 ft Southward.

8.4.4 What is the Condition and Performance of the Assets?

8.4.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the ICW South Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.4.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.22** shows the CoF Score by class used in this analysis.

Table 8.22: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen Team reviewed the ICW South watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was the hurricane evacuation route on East Las Olas Boulevard. from the park on the beach to the hospital located at West Las Olas Boulevard and SE 16th Avenue, as shown **in Figure 8.29**.

Figure 8.29: ICW South Watershed Data Subset Used for CoF Analysis

The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on the map. Note that this analysis included only City-owned assets; no state or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the ICW South Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score.

For the section selected, there are ten City-owned stormwater assets next to a hospital or bus stop. These ten assets are circled in blue in **Figure 8.30**. For example, the inlet asset class has a CoF score of 4. However, if the inlet device is located next the hospital, it may be desired to increase that specific asset CoF score to a 5, showing that it is more critical than the general population of the asset.

The assets near critical facilities whose CoF scores were changed due to proximity to a critical facility are identified in **Table 8.22**.

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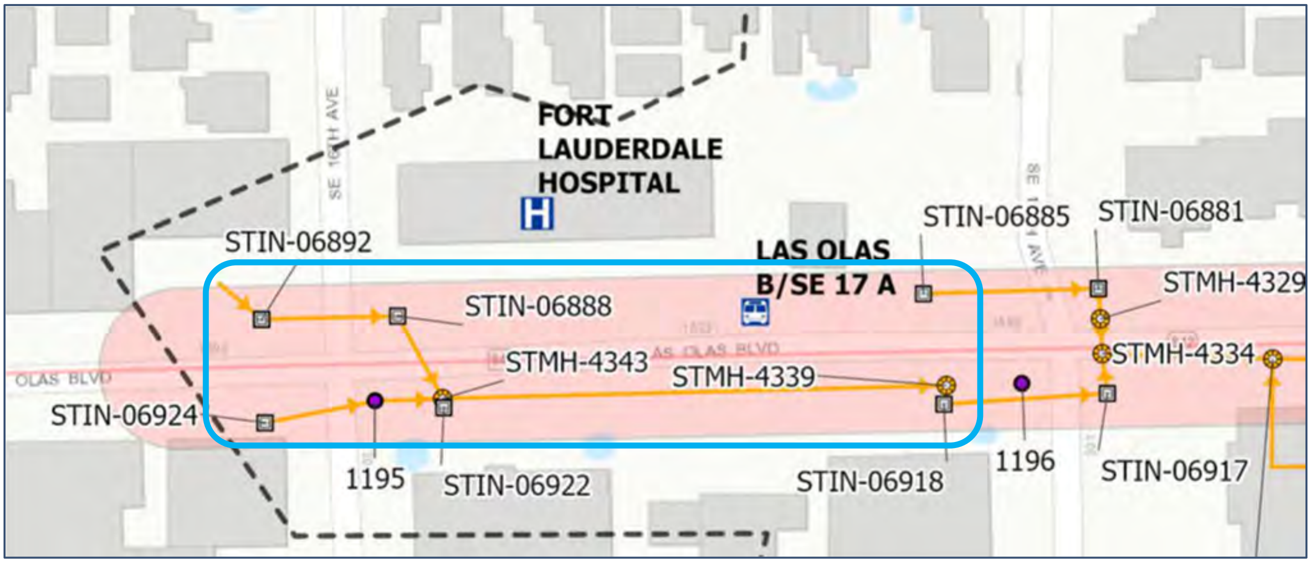
Figure 8.30: ICW South Watershed Identification of Critical Facilities and Assets Map



8.4.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.23** provides the overall representation of the ICW South Watershed data subset used for this analysis.

Table 8.23: ICW South Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for Change
ICM South	Gravity Main	City	STMN-05060	2.0	4.00	8.00		
ICM South	Gravity Main	City	STMN-05061	3.5	4.00	14.00		
ICM South	Gravity Main	City	STMN-05062	3.5	4.00	14.00		
ICM South	Gravity Main	City	STMN-05063	4.5	4.00	18.00		
ICM South	Gravity Main	City	STMN-05064	1.0	4.00	4.00		
ICM South	Gravity Main	City	STMN-05065	4.0	4.00	16.00		
ICM South	Gravity Main	City	STMN-05066	5.0	4.00	20.00		
ICM South	Gravity Main	City	STMN-05067	5.0	4.00	20.00		
ICM South	Gravity Main	City	STMN-05068	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05069	3.5	4.00	14.00		
ICM South	Gravity Main	City	STMN-05070	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05071	2.0	4.00	8.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for Change
ICM South	Gravity Main	City	STMN-05072	2.0	4.00	8.00		
ICM South	Gravity Main	City	STMN-05073	2.5	4.00	10.00		
ICM South	Gravity Main	City	STMN-25798	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05584	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05585	3.5	4.00	14.00		
ICM South	Gravity Main	City	STMN-05806	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05807	2.0	4.00	8.00		
ICM South	Gravity Main	City	STMN-05808	1.5	4.00	6.00		
ICM South	Gravity Main	City	STMN-05809	5.0	4.00	20.00		
ICM South	Gravity Main	City	STMN-05810	5.0	4.00	20.00		
ICM South	Gravity Main	City	STMN-05811	1.5	4.00	6.00		
ICM South	Gravity Main	City	STMN-05812	2.0	4.00	8.00		
ICM South	Gravity Main	City	STMN-05844	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05845	3.5	4.00	14.00		
ICM South	Gravity Main	City	STMN-05846	3.5	4.00	14.00		
ICM South	Gravity Main	City	STMN-05875	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05876	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-05877	2.5	4.00	10.00		
ICM South	Gravity Main	City	STMN-05878	2.0	4.00	8.00		
ICM South	Gravity Main	City	STMN-05879	1.5	4.00	6.00		
ICM South	Gravity Main	City	STMN-05880	1.5	4.00	6.00		
ICM South	Gravity Main	City	STMN-05881	1.0	4.00	4.00		
ICM South	Gravity Main	City	STMN-05882	1.0	4.00	4.00		
ICM South	Gravity Main	City	STMN-05883	3.0	4.00	12.00		
ICM South	Gravity Main	City	STMN-11553	3.5	4.43	15.51		
ICM South	Gravity Main	City	STMN-11554	3.0	3.75	11.25		
ICM South	Gravity Main	City	STMN-11555	2.5	3.81	9.53		
ICM South	Gravity Main	City	STMN-27462	3.0	4.19	12.57		
ICM South	Gravity Main	City	STMN-27463	2.5	3.98	9.95		
ICM South	Gravity Main	City	STMN-27459	3.0	4.04	12.12		
ICM South	Gravity Main	City	STMN-27460	3.0	4.11	12.33		
ICM South	Gravity Main	City	STMN-27248	3.0	3.78	11.34		
ICM South	Gravity Main	City	STMN-27399	3.5	3.75	13.13		
ICM South	Gravity Main	City	STMN-27400	3.0	4.46	13.38		
ICM South	Control Valve	City	STCV-1960	4.0	4.90	19.60		
ICM South	Control Valve	City	STCV-1962	3.5	4.95	17.33		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for Change
ICM South	Discharge Point	City	STOF-3336	3.0	4.21	12.63		
ICM South	Inlet	City	STIN-06892	3.0	5.00	15.00	4	Near hospital
ICM South	Inlet	City	STIN-06888	2.5	5.00	12.50	4	Near hospital
ICM South	Inlet	City	STIN-06922	2.5	4.19	10.48		
ICM South	Inlet	City	STIN-06924	3.5	5.00	17.50	4	Near hospital
ICM South	Inlet	City	STIN-06881	4.5	4.19	18.86		
ICM South	Inlet	City	STIN-06885	4.0	5.00	20.00	4	Near hospital
ICM South	Inlet	City	STIN-06917	4.0	4.00	16.00		
ICM South	Inlet	City	STIN-06918	3.5	5.00	17.50	4	Near hospital
ICM South	Inlet	City	STIN-16081	3.0	4.10	12.00		
ICM South	Inlet	City	STIN-16080	3.0	4.05	12.00		
ICM South	Inlet	City	STIN-06788	1.0	4.10	4.00		
ICM South	Inlet	City	STIN-06789	1.5	4.00	6.00		
ICM South	Inlet	City	STIN-06844	2.0	3.93	8.00		
ICM South	Inlet	City	STIN-06906	3.0	3.95	12.00		
ICM South	Inlet	City	STIN-06911	3.5	4.00	14.00		
ICM South	Inlet	City	STIN-06859	3.0	4.00	12.00		
ICM South	Inlet	City	STIN-06915	3.5	4.00	14.00		
ICM South	Inlet	City	STIN-06842	3.0	5.00	15.00	4	Near park
ICM South	Inlet	City	STIN-06840	2.5	5.00	12.50	4	Near park
ICM South	Inlet	City	STIN-06853	2.0	4.05	8.00		
ICM South	Inlet	City	STIN-06858	2.0	4.10	8.00		
ICM South	Inlet	City	STIN-17805	2.0	4.00	8.00		
ICM South	Inlet	City	STIN-17806	2.5	3.93	10.00		
ICM South	Manhole	City	STMH-4301	1.0	3.95	4.00		
ICM South	Manhole	City	STMH-4305	1.5	5.00	7.50	4	Near park
ICM South	Manhole	City	STMH-4308	1.0	4.05	4.00		
ICM South	Manhole	City	STMH-4319	2.5	4.10	10.00		
ICM South	Manhole	City	STMH-4323	2.5	4.00	10.00		
ICM South	Manhole	City	STMH-4326	2.0	3.93	8.00		
ICM South	Manhole	City	STMH-4329	2.0	3.95	8.00		
ICM South	Manhole	City	STMH-4332	3.0	4.00	12.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for Change
ICM South	Manhole	City	STMH-4333	2.5	4.00	10.00		
ICM South	Manhole	City	STMH-4334	3.5	4.00	14.00		
ICM South	Manhole	City	STMH-4337	3.5	4.00	14.00		
ICM South	Manhole	City	STMH-4339	5.0	5.00	25.00	4	Near hospital
ICM South	Manhole	City	STMH-4340	3.5	4.00	14.00		
ICM South	Manhole	City	STMH-4341	3.5	4.00	14.00		
ICM South	Manhole	City	STMH-4343	3.0	5.00	15.00	4	Near hospital
ICM South	Network Structure	City	STNS-1028	2.5	2.00	5.00		

A representative BRE plot is shown in **Figure 8.31**.

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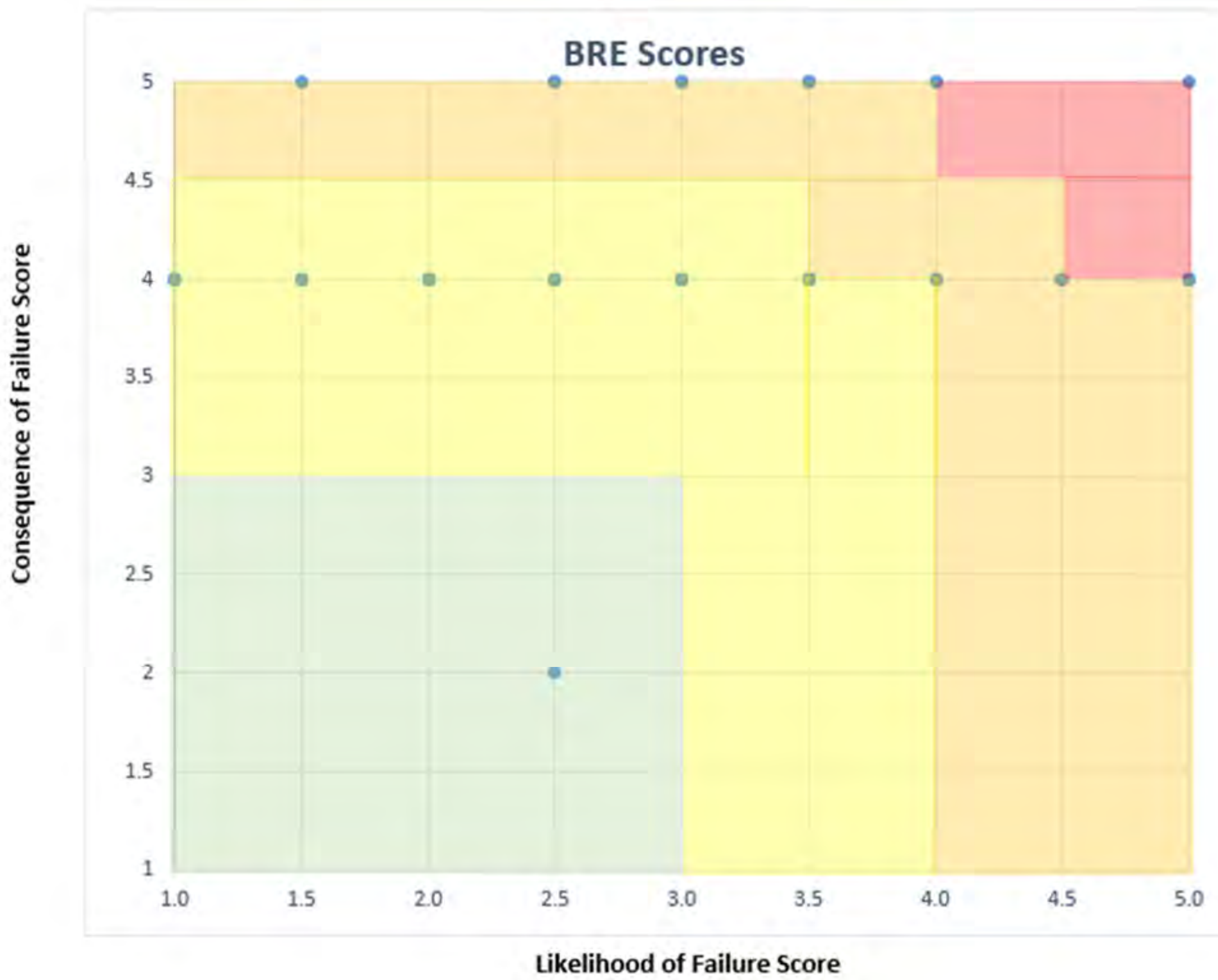
Figure 8.31: ICW South Watershed Business Risk Exposure by Asset (Example)



8.4.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.24** shows examples of the LoS and strategies for hard assets.

Table 8.24: ICW South Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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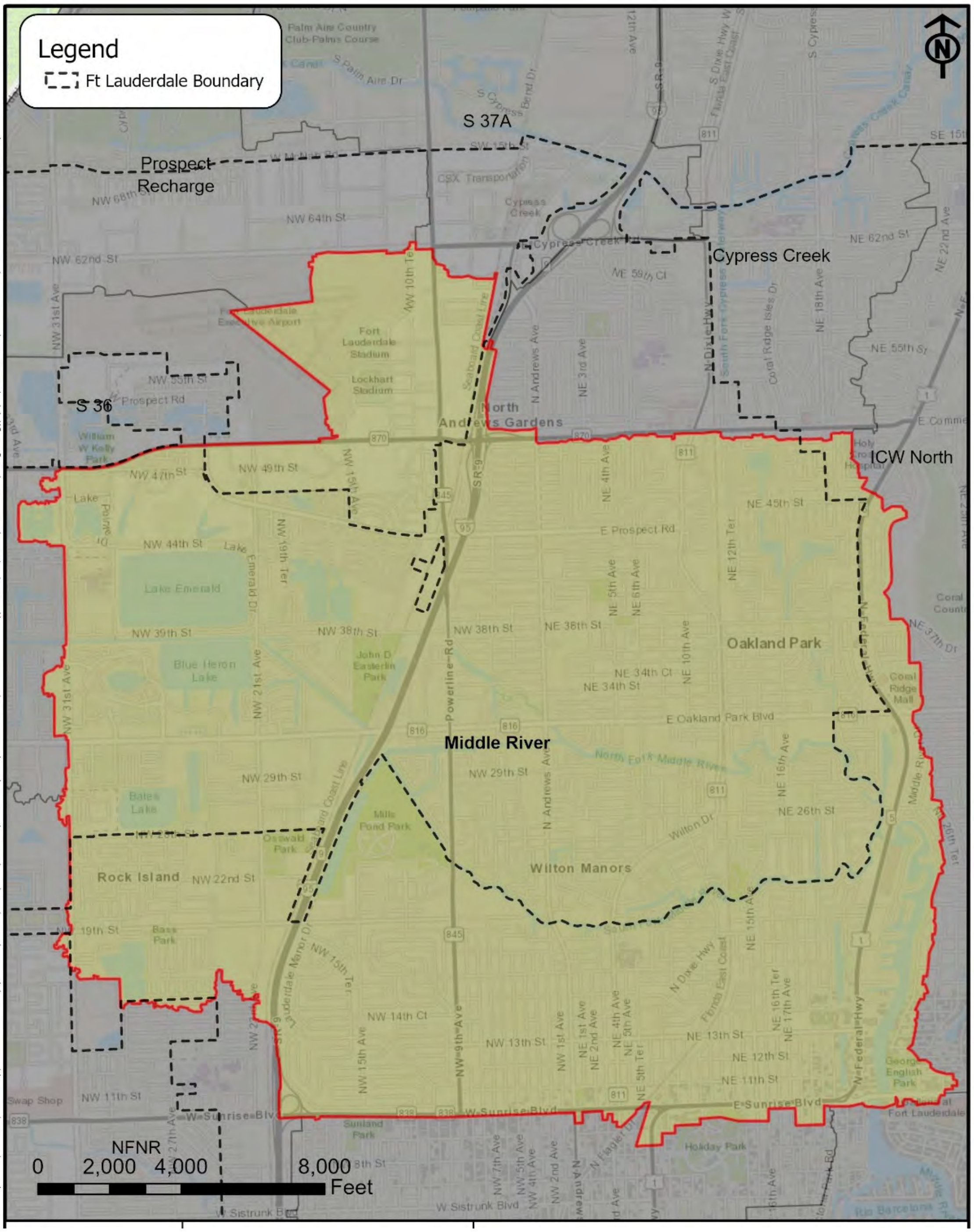
8.5 MIDDLE RIVER

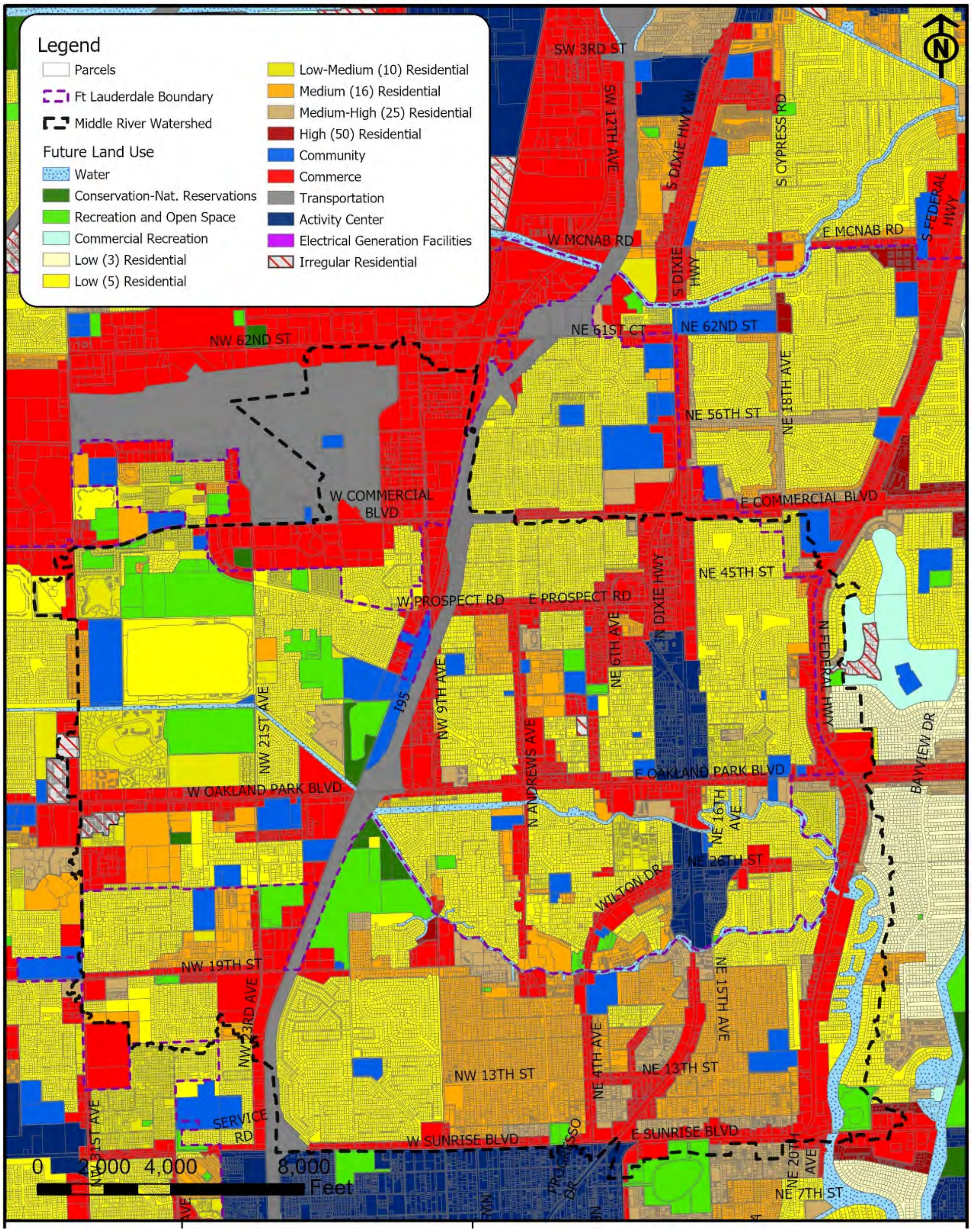
The Middle River watershed is located on the middle of the City of Fort Lauderdale, Florida. The watershed is approximately 16.34 square miles out of which 7.30 square miles are within the City boundaries. **Figure 8.32** illustrates the extent of the watershed.

Figure 8.32: Middle River Watershed Boundary



Land use throughout the watershed is primarily low- medium and medium -high density residential (low density residential) with the areas along the main highways (Oakland Park Blvd., Commercial Blvd., I-95 and Federal Highway) as commercial. The existing land use in this watershed is illustrated in **Figure 8.33**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.33: Middle River Land Use Plan



8.5.1 Asset Summary

8.5.1.1 Hard Assets

A summary of the hard assets within Middle River watershed as included in the stormwater geodatabase is presented in **Table 8.25**.

Table 8.25: Summary of Hard Assets in Middle River Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	2
Pond (1)	0
Discharge Point	127
Drainage Well	8
Exfiltration Trench (1)	
Inlet	2966
Manhole	626
Gravity Main	3798
Network Structure	310
Pollution Control Structure (1)	
Pollution Control Device	43
Pump Station	0
Weir Structure	36

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population

(2) There are 447 unknown assets under the Stormwater geodatabase with this watershed.

Figure 8.34 presents the hard assets in Middle River watershed.

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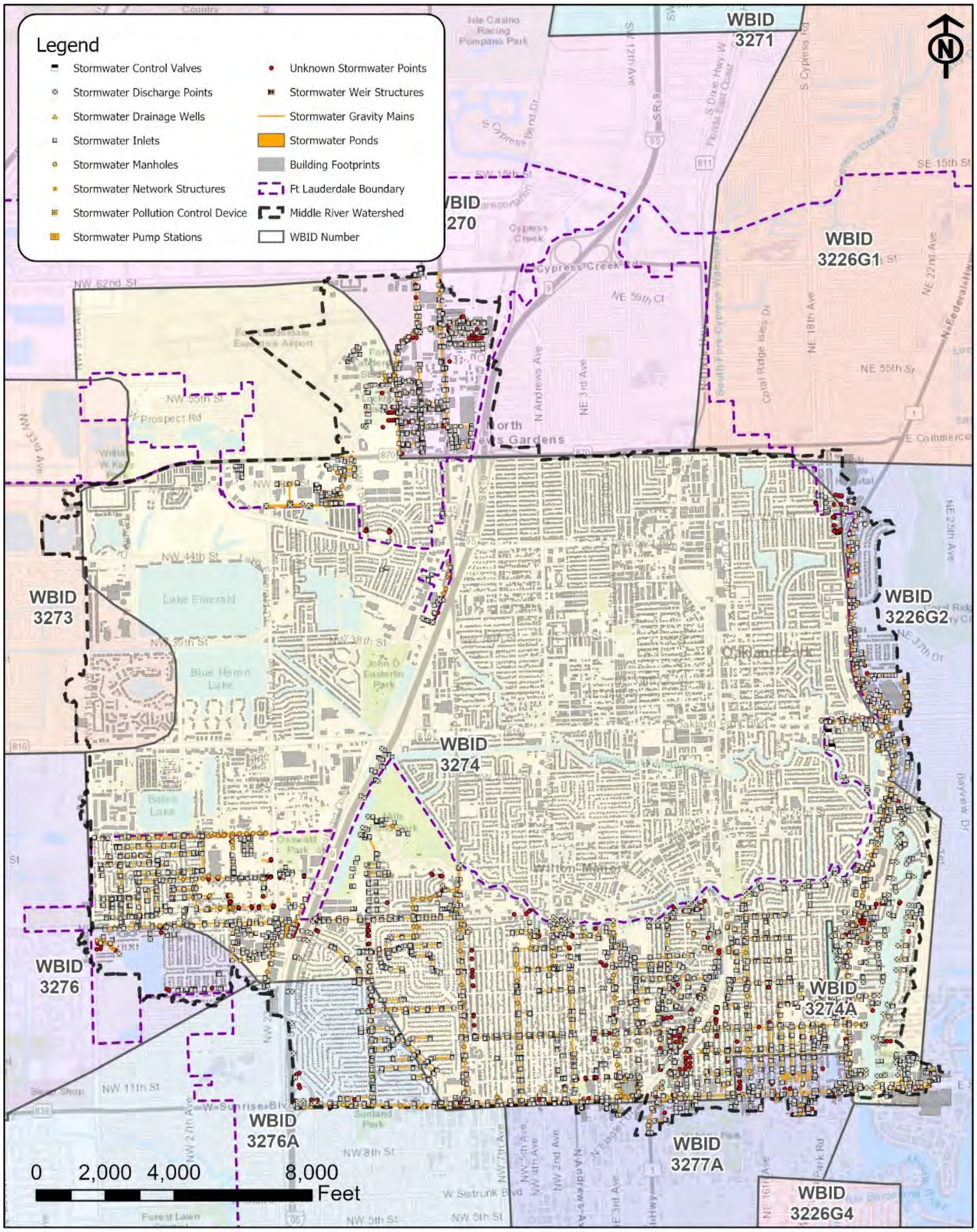
Figure 8.34: Hard Assets in Middle River (2019 Stormwater Geodatabase)



8.5.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1**. Specific soft assets for the Middle River watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.35** illustrates the Middle River Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

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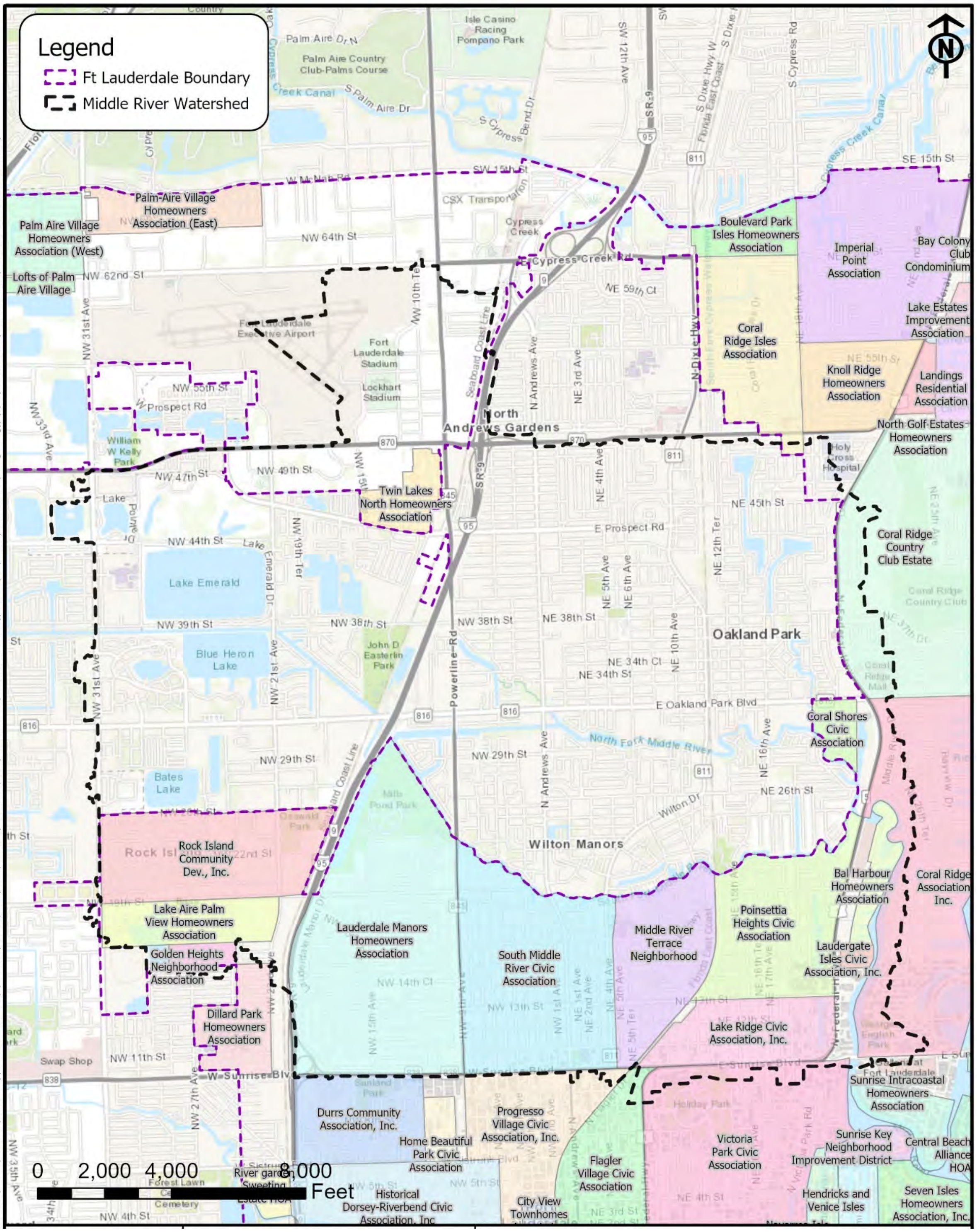
Figure 8.35: Middle River Neighborhood Associations



Ordinances

The City updated its seawall ordinance to establish construction and maintenance standards to mitigate tidal flooding and sea level rise impacts. On February 17, 2017, the City issued an ordinance update to amend the unified land development regulation, section 47-19.3. The ordinance sets the minimum seawall elevation at 3.9 feet NAVD 88 and recommends design of new seawall elevation at up to 5.0 feet NAVD88. In general, under the revised ordinance, property owners must meet the City's minimum seawall requirements when:

- Owner is installing a new seawall
- Owner comes in for a repair permit and it is determined that repair will cost at least 50% of the value of the structure
- Citation issued for seawall in disrepair
- Allowing tidal waters to enter property which impact adjacent properties or the right-of-way

This ordinance will specifically apply to homeowners in the eastern portion of the Middle River Watershed.

City Planning Documents

City planning documents that may have application in the Middle River watershed include the 2015 Canal Dredging Plan, the 2018 Seawall Master Plan and the 2020-2024 Proposed Community Investment Plan, all of which include proposed projects that may impact infrastructure in the Middle River watershed. Proposed projects include the Middle River Terrace A-27 Sewer System rehabilitation, as well as canal dredging and replacement and maintenance of City-owned seawalls.

Regulatory Permitting Policies & Non-Structural BMPs

As noted in **Section 1.7.1.2** NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the Middle River watershed are considered impaired as also noted on the TMDL Report in **Appendix C**. The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

8.5.1.3 Natural Assets

A summary of the primary natural assets within the Middle River watershed are illustrated in **Figure 8.36**. In general, there are:

- approximately 36 reservoirs,
- 6 lakes – Lake Melva, Rock Pit Lake, North Lake, South Lake, Esterlin Park Lake, and East Coral Lake,

- 6 wetlands,
- several parks including the Esterlin Park with a diverse variety of trees and vegetation
- 3 main rivers - the North Fork Middle River, the South Fork Middle River, and the Middle River, and
- A multitude of canals along the three rivers.

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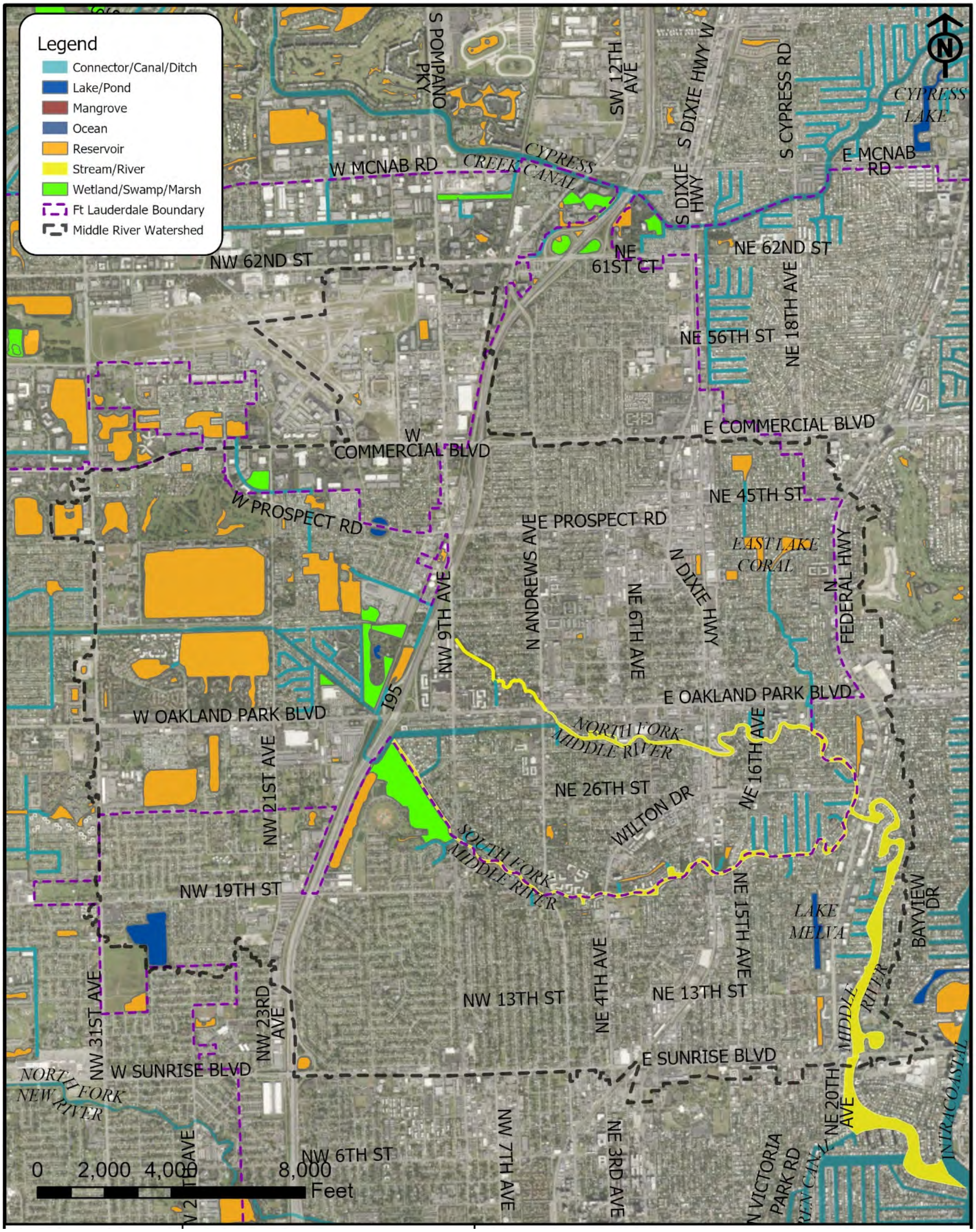
Figure 8.36: Summary of Natural Assets in Middle River Watershed



8.5.2 Watershed Challenges

Some challenges in this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.26**.

Table 8.26: Middle River Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Seawall	Ownership determination	Complete 2018 Seawall Master Plan to identify all City-owned seawalls.
	Ordinance compliance and enforcement	The City adopted an ordinance (homeowners in the eastern portion of the Middle River Watershed) requiring property owners to elevate the height and ensure the functionality of their seawall.
	Seawall replacement prioritization	Replace/elevate seawalls as per established priority.
Water Pollution Control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Enhancement of the existing swale areas to provide better surface infiltration to reduce stormwater runoff and the number of suspended solids that enter the storm sewer system.
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
Canal Dredging	Maintenance	Perform periodic inspection, testing and dredging of the waterways
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from the same channel	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection
Mangrove	Maintenance and Preservation	Perform periodic inspection of areas with mangroves near City-Owned stormwater assets inspection of the mangroves themselves to ensure they remain healthy.

8.5.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.5.3 Asset Ownership and Inventory

Table 8.27 summarizes the hard assets in Middle River per asset ownership.

Table 8.27: Asset Inventory and Ownership in Middle River Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	2	2	0	0
Pond (1)	0	0	0	0
Discharge Point	127	77	43	7
Drainage Well	8	1	7	0
Exfiltration Trench (1)				
Inlet	2966	1756	1164	46
Manhole	626	219	343	64
Gravity Main	3798	1936	1616	246
Network Structure	310	102	208	0
Pollution Control Structure (1)				
Pollution Control Device	43	0	0	43
Pump Station	0	0	0	0
Unknown Point	447	0	0	447
Weir Structure	36	7	17	12

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

8.5.4 What is the Condition and Performance of the Assets?

8.5.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the Middle River Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is

operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.5.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.28** shows the CoF Score by class used in this analysis.

Table 8.28: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the Middle River Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius around Fort Lauderdale High School, as shown in **Figure 8.37.**

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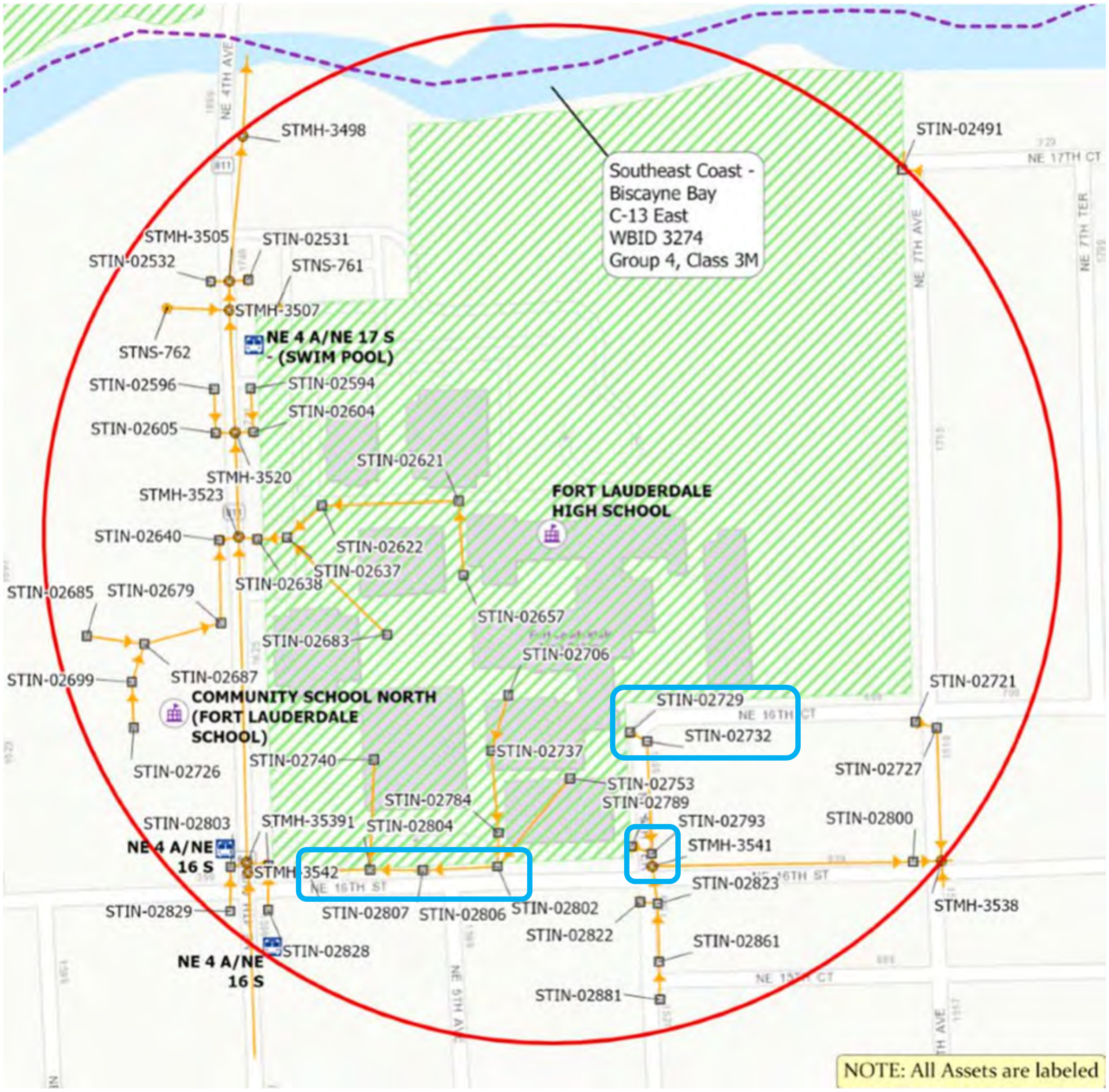
Figure 8.37: Middle River Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the Middle River Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score.

For the section selected, there are eight City-owned stormwater assets next to the park around Fort Lauderdale High School. These eight assets are circled in blue in Figure 8.26 above. For example, the inlet asset class has a CoF score of 4. However, if the inlet device is located next to a park and the high school, it may be desired to increase that specific asset CoF score to a 5, showing that it is more critical than the general population of the asset.

8.5.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.29** provides the overall representation of the Middle River Watershed data subset used for this analysis.

Table 8.29: Middle River Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Middle River	Gravity Main	City	STMN-10114	1.0	3.95	3.95		
Middle River	Gravity Main	City	STMN-10115	1.5	4.00	6.00		
Middle River	Gravity Main	City	STMN-10116	2.0	3.97	7.94		
Middle River	Gravity Main	City	STMN-10117	3.0	4.05	12.15		
Middle River	Gravity Main	City	STMN-10123	3.5	4.00	14.00		
Middle River	Gravity Main	City	STMN-10124	3.0	4.00	12.00		
Middle River	Gravity Main	City	STMN-10125	3.5	4.00	14.00		
Middle River	Gravity Main	City	STMN-10126	3.0	3.95	11.85		
Middle River	Gravity Main	City	STMN-10127	2.5	4.00	10.00		
Middle River	Gravity Main	City	STMN-10128	2.0	4.10	8.20		
Middle River	Gravity Main	City	STMN-10129	2.0	4.05	8.10		
Middle River	Gravity Main	City	STMN-10130	2.0	4.10	8.20		
Middle River	Gravity Main	City	STMN-10644	2.5	3.92	9.80		
Middle River	Gravity Main	City	STMN-10645	1.0	3.98	3.98		
Middle River	Gravity Main	City	STMN-10647	1.5	4.00	6.00		
Middle River	Gravity Main	City	STMN-10648	1.0	4.00	4.00		
Middle River	Gravity Main	City	STMN-10671	2.5	3.89	9.73		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Middle River	Gravity Main	City	STMN-10672	2.5	4.01	10.03		
Middle River	Gravity Main	City	STMN-11404	2.0	4.00	8.00		
Middle River	Gravity Main	City	STMN-11405	2.0	3.98	7.96		
Middle River	Inlet	City	STIN-02807	3.5	5.00	17.50	4.44	By park
Middle River	Inlet	City	STIN-02804	3.5	5.00	17.50	4.35	By park
Middle River	Inlet	City	STIN-02806	4.5	5.00	22.50	3.99	By park
Middle River	Inlet	City	STIN-02802	1.0	5.00	5.00	3.56	By park
Middle River	Inlet	City	STIN-02729	4.0	5.00	20.00	3.99	By park
Middle River	Inlet	City	STIN-02732	5.0	5.00	25.00	4.01	By park
Middle River	Inlet	City	STIN-02793	5.0	4.03	20.15		
Middle River	Inlet	City	STIN-02789	3.0	5.00	15.00	3.78	By park
Middle River	Inlet	City	STIN-02861	3.5	4.18	14.63		
Middle River	Inlet	City	STIN-02881	3.0	3.95	11.85		
Middle River	Inlet	City	STIN-02823	2.0	4.00	8.00		
Middle River	Inlet	City	STIN-02822	2.0	3.93	7.86		
Middle River	Inlet	City	STIN-02800	2.5	3.95	9.88		
Middle River	Inlet	City	STIN-02721	3.0	4.00	12.00		
Middle River	Inlet	City	STIN-02727	3.0	3.97	11.91		
Middle River	Inlet	City	STIN-02491	3.5	4.05	14.18		
Middle River	Manhole	City	STMH-3538	3.0	4.00	12.00		
Middle River	Manhole	City	STMH-3541	2.0	5.00	10.00	3.96	By park

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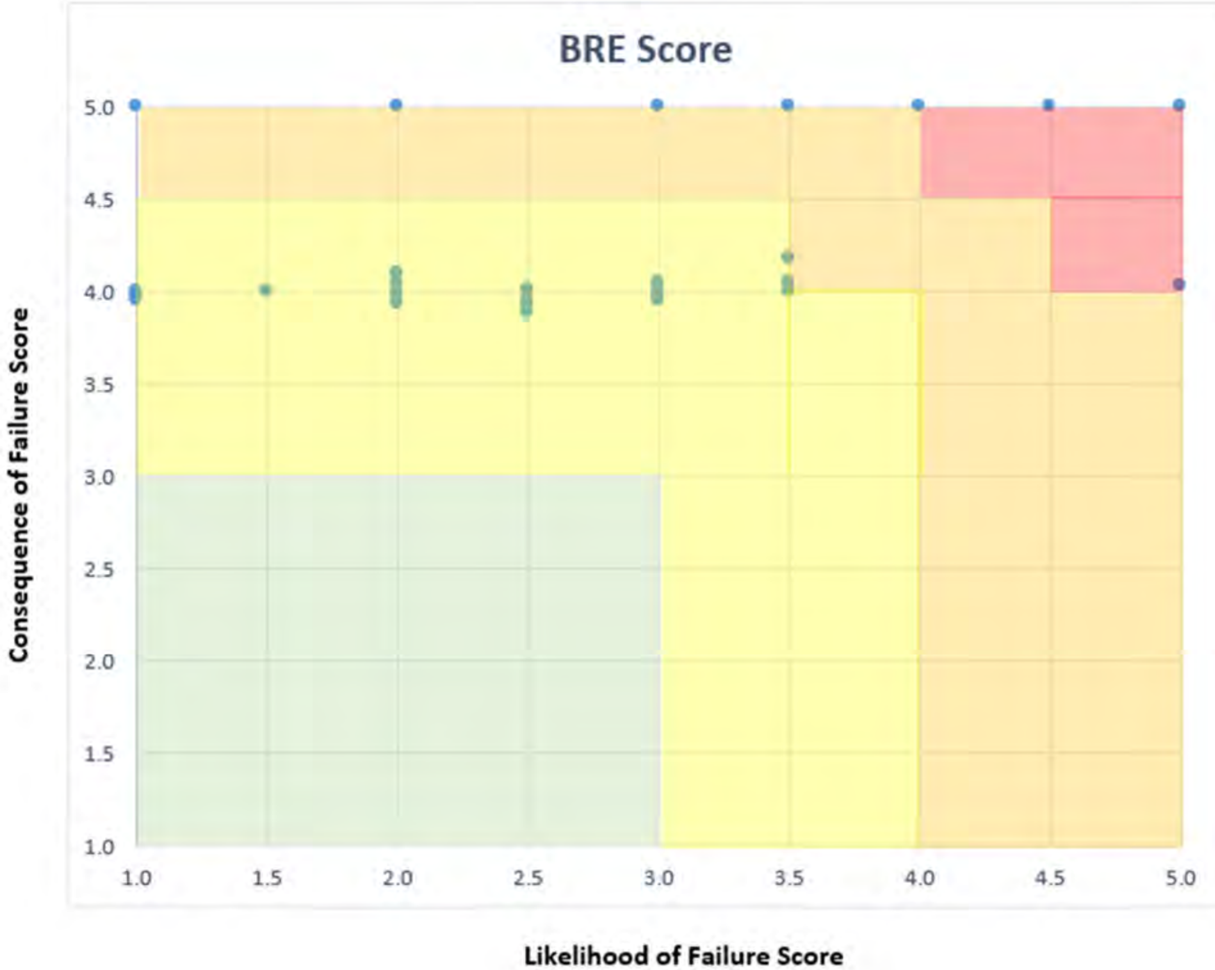
A representative BRE plot is shown in **Figure 8.38**.

Figure 8.38: Middle River Watershed Business Risk Exposure by Asset (Example)



8.5.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.30** shows examples of the LoS and strategies for hard assets.

Table 8.30: Middle River Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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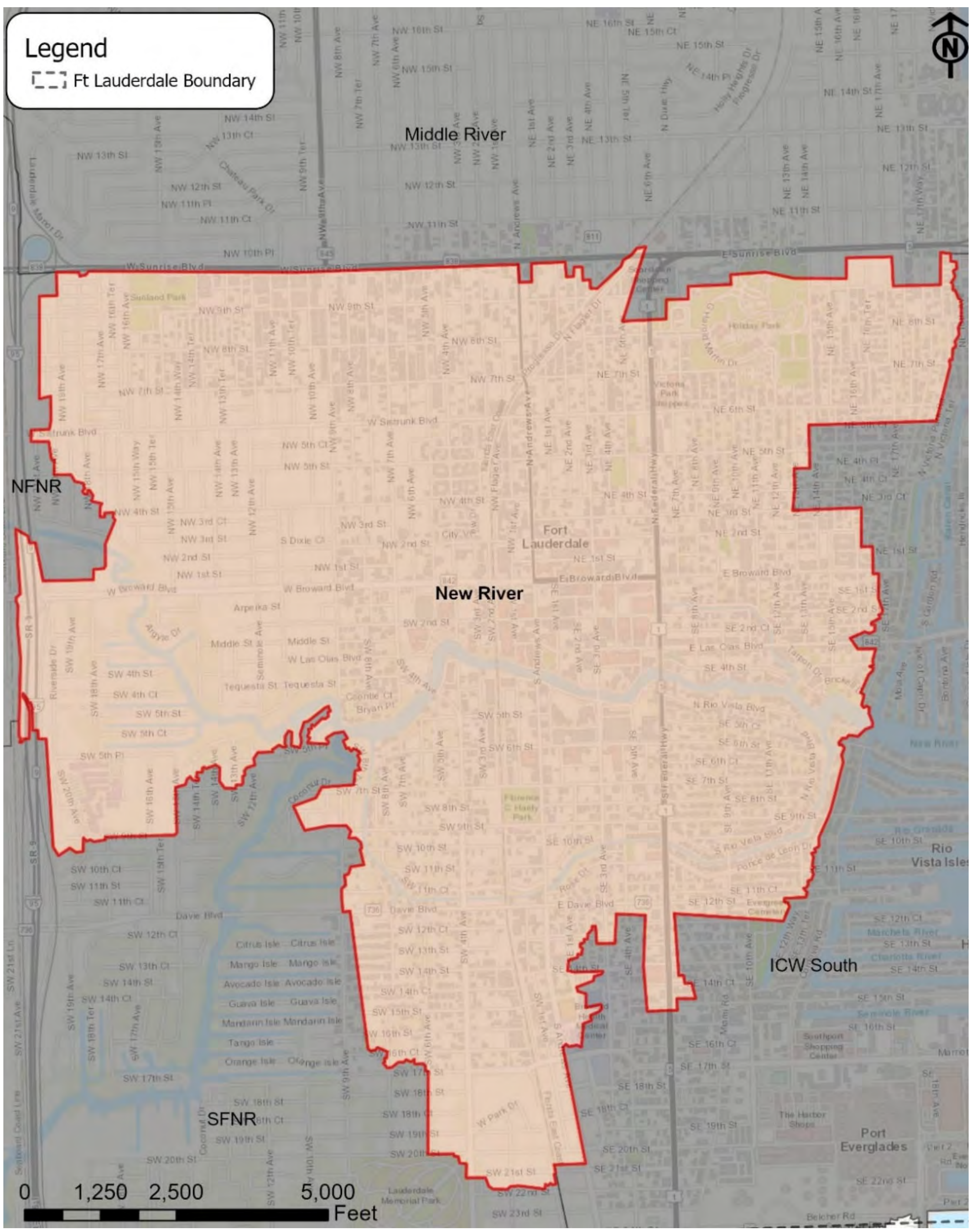
8.6 NEW RIVER

The New River watershed is located in the mid-south part of the City of Fort Lauderdale. The watershed is approximately 5.29 square miles and the entire watershed is within the City boundaries. This watershed includes the portion of North Fork of the New River (also referred to as the C-14 canal). The watershed discharges to the Intracoastal Waterway South Watershed. **Figure 8.39** illustrates the extent of the watershed.

Figure 8.39: New River Watershed Boundary



The land surface ranges in elevation from 0 to 38 feet, referenced to the North American Vertical Datum of 1988 (NAVD88), with a general slope towards New River and then eastward to the coast. Land use throughout the watershed is primarily activity center, comprising 25-percent, multiple dwelling units (two stories or less), comprising 24-percent, and single-family residential units, comprising 24-percent. The existing land use in this watershed is illustrated in **Figure 8.40**. Broward County future land use GIS data was used to develop the land use plan.

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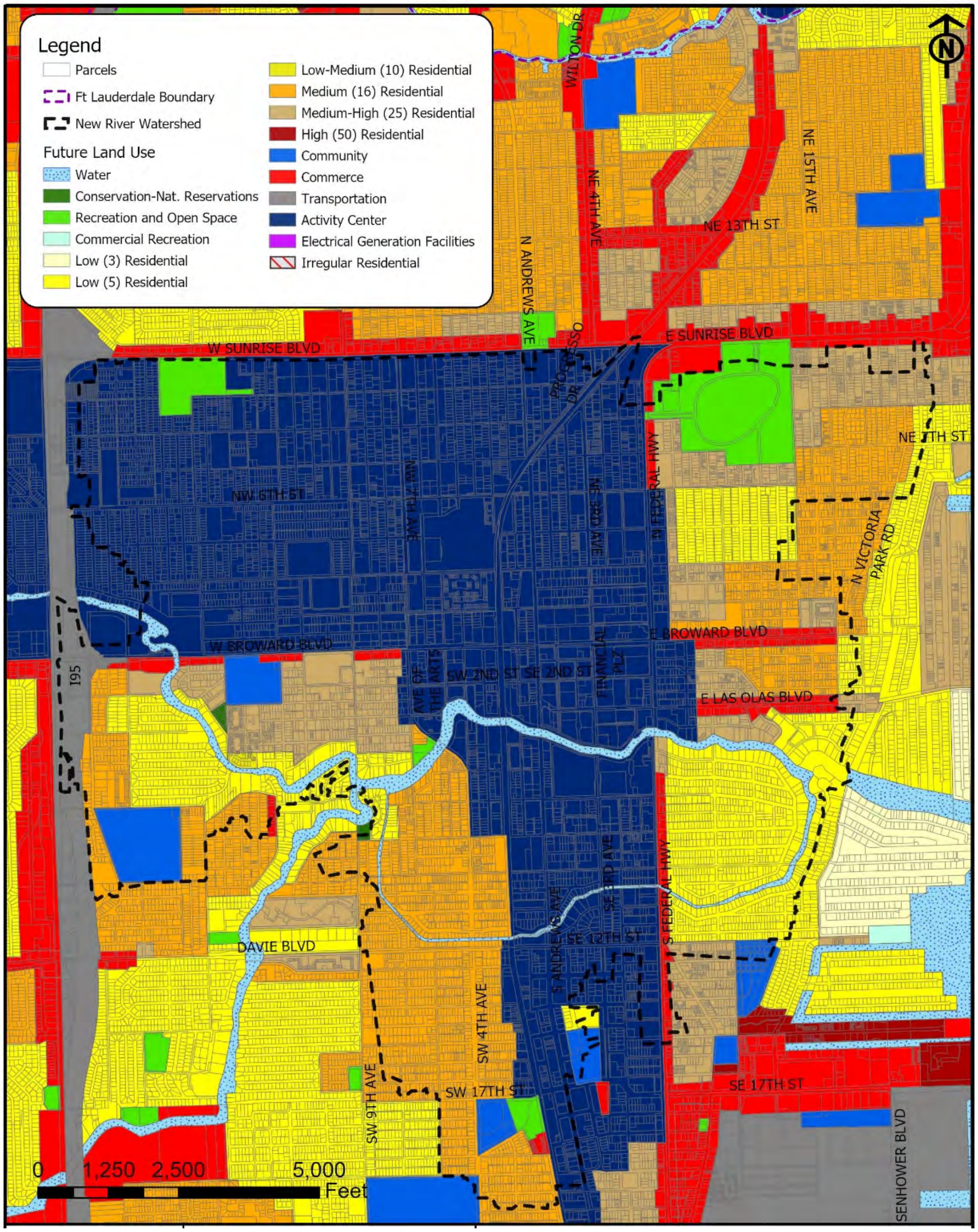
Figure 8.40: New River Land Use Plan



8.6.1 Asset Summary

8.6.1.1 Hard Assets

Table 8.31 summarizes the hard assets within New River watershed as included in the stormwater geodatabase.

Table 8.31: Summary of Hard Assets in New River Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	4
Pond (1)	0
Discharge Point	137
Drainage Well	17
Exfiltration Trench (1)	
Inlet	4037
Manhole	824
Gravity Main	5081
Network Structure	403
Pollution Control Structure (1)	
Pollution Control Device	5
Pump Station	2(2)
Weir Structure	21

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Stormwater geodatabase needs to be corrected. It indicates there are 6 stormwater pump stations in this watershed.

(3) *There are 829 unknown assets under the stormwater geodatabase*

Figure 8.41 presents the hard assets in New River watershed.

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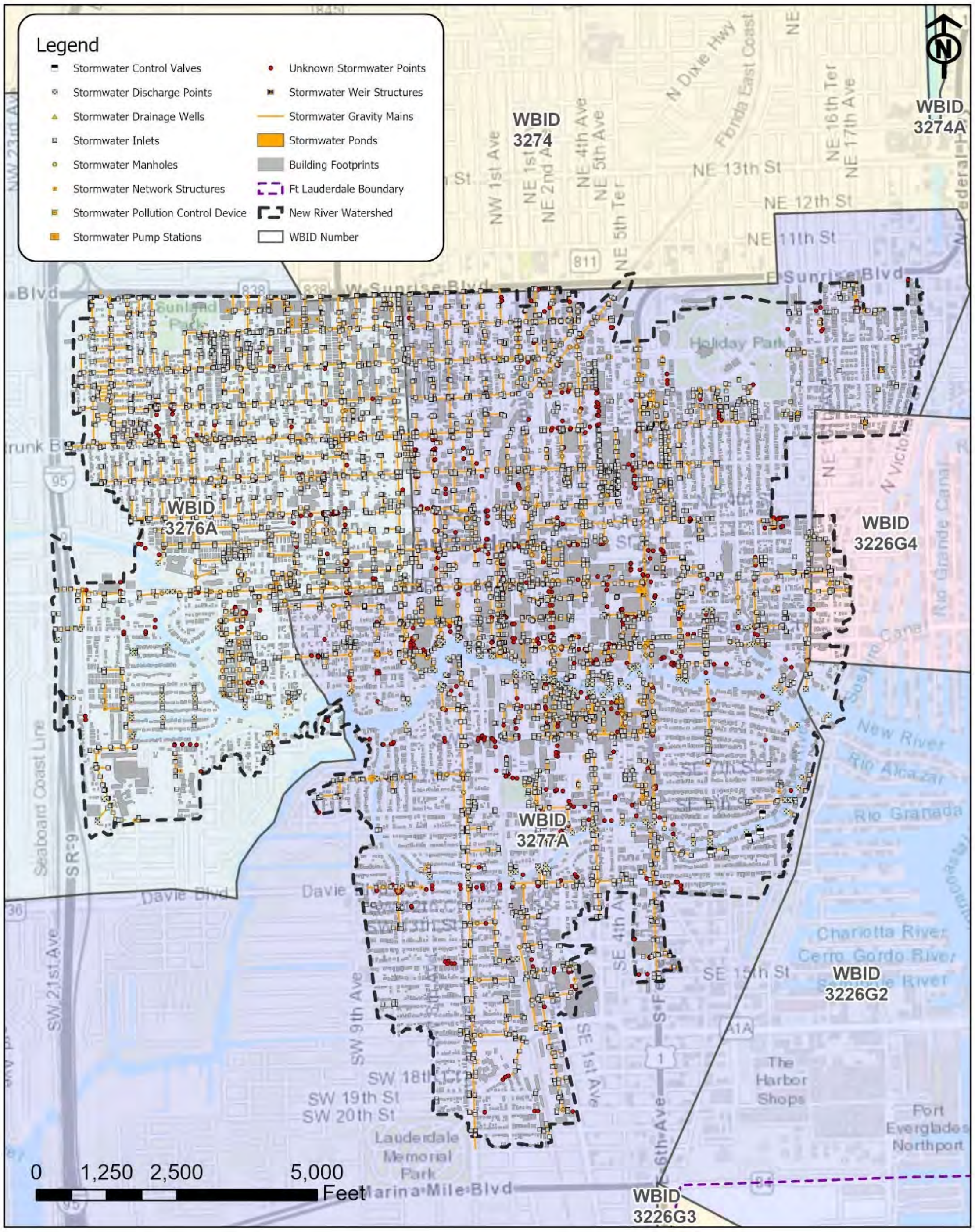
Figure 8.41: Hard Assets in New River Watershed (2019 Stormwater Geodatabase)



8.6.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in Section 2.1.2.1. Specific soft assets for the New River watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.42** illustrates the New River Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

Ordinances

The City updated its seawall ordinance to establish construction and maintenance standards to mitigate tidal flooding and sea level rise impacts. On February 17, 2017, the City issued an ordinance update to amend the unified land development regulation, section 47-19.3. The ordinance sets the minimum seawall elevation at 3.9 feet NAVD 88 and recommends design of new seawall elevation at up to 5.0 feet NAVD88. In general, under the revised ordinance, property owners must meet the City's minimum seawall requirements when:

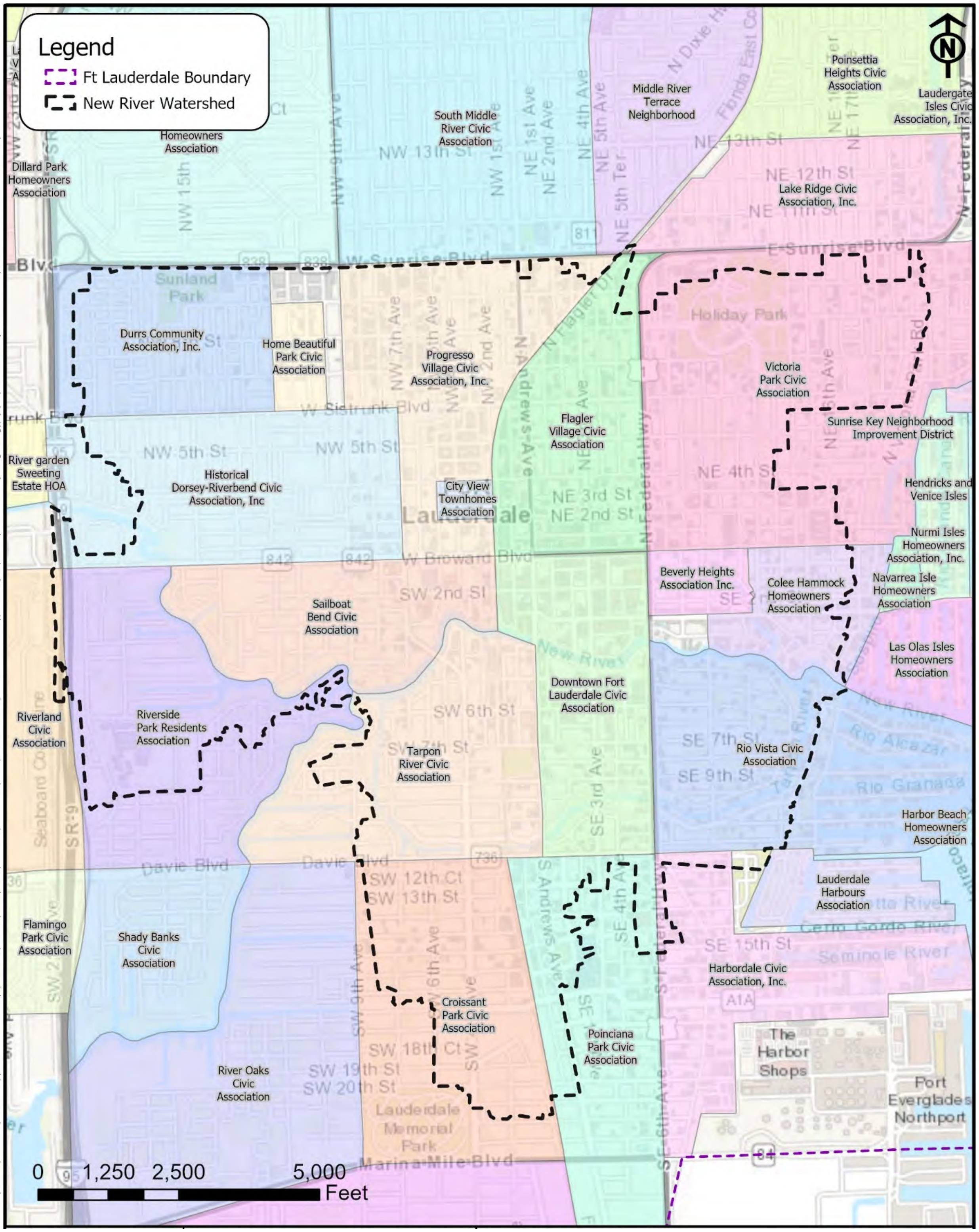
- Owner is installing a new seawall
- Owner comes in for a repair permit and it is determined that repair will cost at least 50% of the value of the structure
- Citation issued for seawall in disrepair
- Allowing tidal waters to enter property which impact adjacent properties or the right-of-way

This ordinance applies to homeowners in the eastern portion of New River Watershed.

City Planning Documents

City planning documents that may have application in the New River watershed include the 2015 Canal Dredging Plan, the 2018 Seawall Master Plan and the 2020-2024 Proposed Community Investment Plan, all of which include proposed projects that may impact infrastructure in the New River watershed. Proposed projects include over $1.5M in canal dredging and replacement and maintenance of City-owned seawalls, as well as the addition of permanent generators to power Stormwater pump stations.

Figure 8.42: New River Neighborhood Associations



Regulatory Permitting Policies & Non-Structural BMPs

As noted in **Section 1.7.1.2** NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the New River watershed are considered impaired as also noted on the TMDL Report in **Appendix C**. The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

8.6.1.3 Natural Assets

A summary of the primary natural assets within the New River watershed are illustrated in **Figure 8.43**. In general, there are:

- 3 main rivers – North Fork New River, New River and Tarpon River
- A few canals along the North Fork New River, and
- several parks including Holiday Park, Croissant Park, and Stranahan Park with a diverse variety of trees and vegetation.

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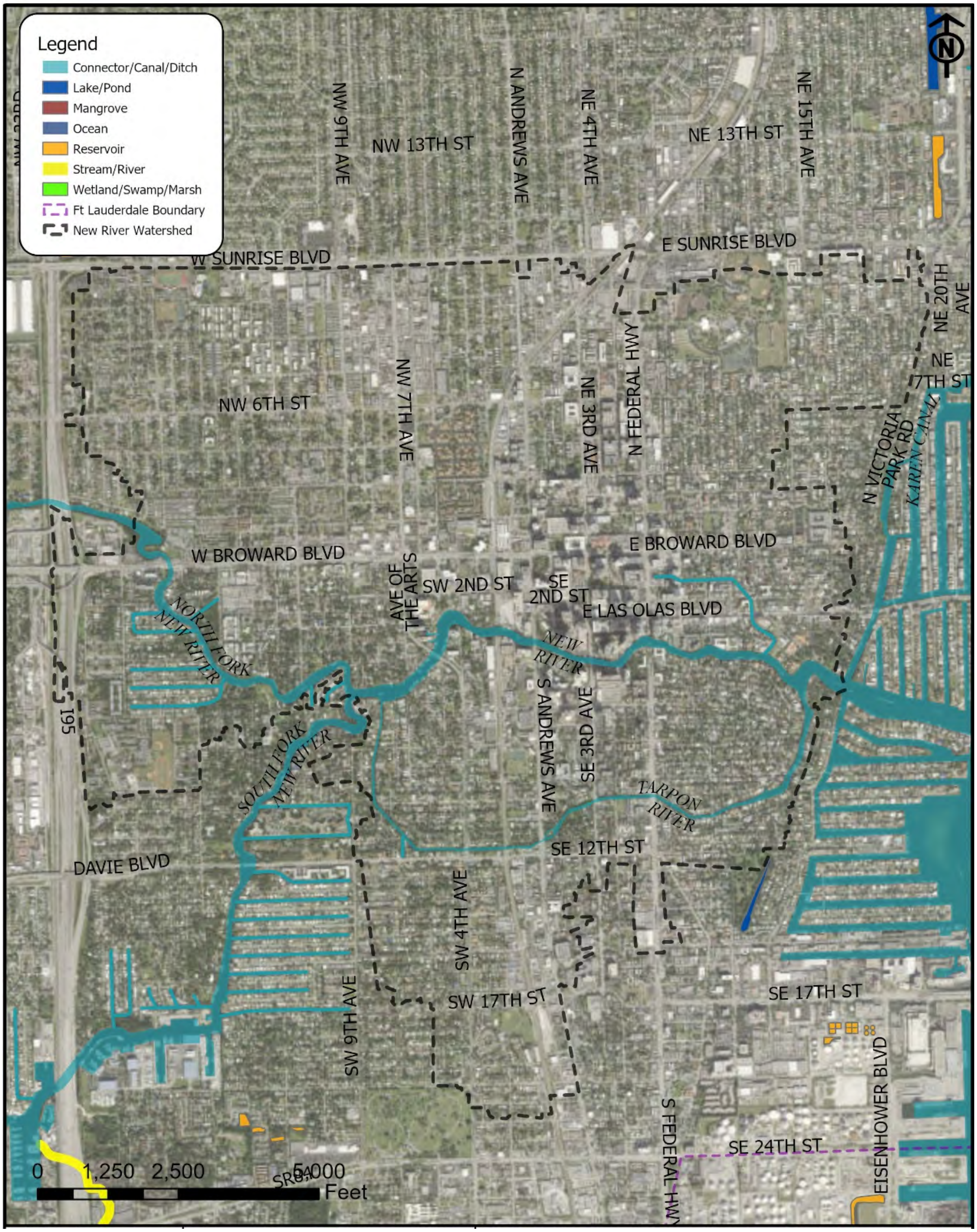
Figure 8.43: Natural Assets in New River Watershed



8.6.2 Watershed Challenges

The New River watershed faces unique challenges based on the characteristics of the watershed. Therefore, the stormwater system requires design and asset operation and maintenance strategies that are specifically tailored to the unique needs of the watershed. For example, during the Progresso neighborhood project the existing stormwater system was analyzed. As part of the proposed improvements, pipes exhibiting high velocities are proposed to be upsized to return head losses to acceptable levels. In addition, a stormwater pump station was proposed for the northeast portion of the neighborhood. The pump station will serve an area of approximately 130 acres bound by Sunrise Boulevard to the north, Progresso Drive to the east, Sistrunk Boulevard to the south and NW 5th Avenue to the west. In general, the proposed improvements for this neighborhood will reduce flooding depths in the majority of the neighborhood and will limit flooding to the roadway crown (warning stage plus 3 inches) in many areas during the 10-year/24-hour storm event. The proposed improvements are also anticipated to limit the duration of flooding to 4 hours or less for the entire neighborhood during the 10-year/24-hour storm event and for nearly the entire neighborhood for the 100-year/72-hour storm event.

Other challenges faced by this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.32**.

Table 8.32: New River Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station (e.g. proposed stormwater pump station in Progresso Village neighborhood).
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
Water Pollution Control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Baffles in stormwater structures so that oils and greases are collected and not conveyed to the proposed outfalls or gravity drainage wells.
		Enhancement of the existing swale areas to provide better surface infiltration to reduce stormwater runoff and the number of suspended solids that enter the storm sewer system.
		Sufficiently deep sumps in stormwater structures to collect debris that is captured in stormwater runoff. Water trapped below the invert outlet will exfiltrate through weep holes in the structure.
		Trash rakes and other mechanical water quality treatment structures upstream of the proposed stormwater pump station.

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Reduced Storage Capacity	Storage capacity has been reduced by the gradual accumulation of sediments over the years and the installation of the extensive landscaping and tree planting within the right of way areas by adjacent property owners (e.g. West area in Victoria Park). Additionally, significant segments of the swale areas in the right of way have been converted to impervious surfaces for driveway approaches and parking areas during various redevelopment activities over the years.	Regrade and restore swale areas. Identify potential swale restorations opportunities based on the availability of adequate right of way area adjacent to existing roadways while not impacting the root systems of existing trees, the landscaping within the right of way, and other existing facilities.

8.6.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.6.3 Asset Ownership and Inventory

Table 8.33 summarizes the hard assets in ICW South per asset ownership.

Table 8.33: Asset Inventory and Ownership in New River Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	4	4	0	0
Pond (1)	0	0	0	0
Discharge Point	137	102	30	5
Drainage Well	17	4	13	0
Exfiltration Trench (1)				
Inlet	4037	2432	1476	129
Manhole	824	393	353	78
Gravity Main	5081	2966	1805	310
Network Structure	403	177	222	4
Pollution Control Structure (1)				
Pollution Control Device	5	0	0	5
Pump Station	6	0	0	6
Unknown Point	829	0	0	829

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Weir Structure	21	7	5	9

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

8.6.4 What is the Condition and Performance of the Assets?

8.6.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the New River Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.6.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.34** shows the CoF Score by class used in this analysis.

Table 8.34: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2

Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the New River watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius around the Andrews Avenue / Broward Boulevard Intersection, as shown in **Figure 8.44.**

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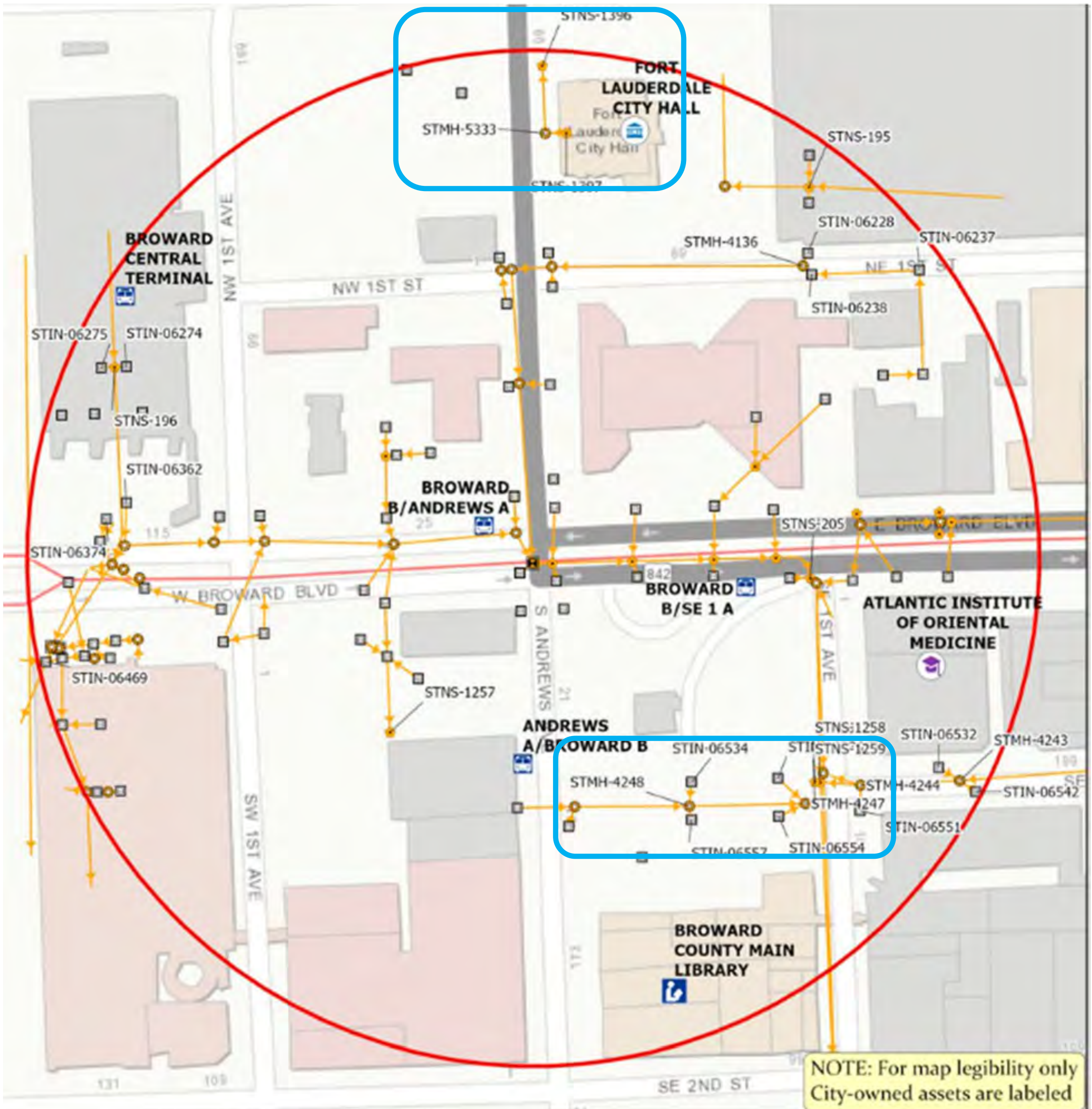
Figure 8.44: New River Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no state or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the New River Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial COF score.

For the section selected, there are eight City-owned stormwater assets next to the park around Fort Lauderdale High School. These eight assets are circled in blue in Figure 8.26 above. For example, the inlet asset class has a CoF score of 4. However, if the inlet device is located next to a park and the high school, it may be desired to increase that specific asset CoF score to a 5, showing that it is more critical than the general population of the asset.

8.6.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.35** provides the overall representation of the New River Watershed data subset used for this analysis.

Table 8.35: New River Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
New River	Gravity Main	City	STMN-01791	2	4.00	1.82		
New River	Gravity Main	City	STMN-01792	3	3.93	2.68		
New River	Gravity Main	City	STMN-01793	3	3.95	2.70		
New River	Gravity Main	City	STMN-01794	4	4.00	3.64		
New River	Gravity Main	City	STMN-01815	1	3.97	0.90		
New River	Gravity Main	City	STMN-01818	4	4.05	3.69		
New River	Gravity Main	City	STMN-01819	5	4.00	4.55		
New River	Gravity Main	City	STMN-01820	5	4.00	4.55		
New River	Gravity Main	City	STMN-01821	3	4.00	2.73		
New River	Gravity Main	City	STMN-01822	3	4.10	2.80		
New River	Gravity Main	City	STMN-04357	3	4.05	2.76		
New River	Gravity Main	City	STMN-04358	2	4.10	1.87		
New River	Gravity Main	City	STMN-04359	2	3.92	1.78		
New River	Gravity Main	City	STMN-04360	2	3.98	1.81		
New River	Gravity Main	City	STMN-04361	3	4.00	2.73		
New River	Gravity Main	City	STMN-04362	3	4.00	2.73		
New River	Gravity Main	City	STMN-04363	3	3.89	2.65		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
New River	Gravity Main	City	STMN-04371	3	4.18	2.85		
New River	Gravity Main	City	STMN-04372	2	3.95	1.80		
New River	Gravity Main	City	STMN-04373	2	4.00	1.82		
New River	Gravity Main	City	STMN-04374	5	3.93	4.47		
New River	Gravity Main	City	STMN-04375	5	4.00	4.55		
New River	Gravity Main	City	STMN-04390	2	4.00	1.82		
New River	Gravity Main	City	STMN-04391	2	3.89	1.77		
New River	Gravity Main	City	STMN-04392	3	4.01	2.74		
New River	Gravity Main	City	STMN-04393	3	4.00	2.73		
New River	Gravity Main	City	STMN-04701	3	4.00	2.73		
New River	Gravity Main	City	STMN-04702	3	3.89	2.65		
New River	Gravity Main	City	STMN-16031	3	4.01	2.74		
New River	Gravity Main	City	STMN-16032	2	4.00	1.82		
New River	Inlet	City	STIN-06374	2	3.98	1.81		
New River	Inlet	City	STIN-06362	1	4.00	0.91		
New River	Inlet	City	STIN-06237	1	4.13	0.94		
New River	Inlet	City	STIN-06238	1	4.07	0.93		
New River	Inlet	City	STIN-06228	1	3.86	0.88		
New River	Inlet	City	STIN-06275	3	3.98	2.72		
New River	Inlet	City	STIN-06274	3	4.00	2.73		
New River	Inlet	City	STIN-06534	3	4.03	2.75		
New River	Inlet	City	STIN-06557	3	5.00	3.41	4	At Library
New River	Inlet	City	STIN-06533	3	4.00	2.73		
New River	Inlet	City	STIN-06554	3	5.00	3.41	4	At Library
New River	Inlet	City	STIN-06532	3	4.00	2.73		
New River	Inlet	City	STIN-06542	3	3.89	2.65		
New River	Inlet	City	STIN-06551	3	4.01	2.74		
New River	Inlet	City	STIN-06469	3	4.00	2.73		
New River	Manhole	City	STMH-5333	3	5.00	3.41	4	At City Hall
New River	Manhole	City	STMH-4136	4	4.10	3.73		
New River	Manhole	City	STMH-4243	3	3.92	2.68		
New River	Manhole	City	STMH-4244	3	3.98	2.72		
New River	Manhole	City	STMH-4247	2	5.00	2.28	4	At Library
New River	Manhole	City	STMH-4248	2	5.00	2.28	4	At Library
New River	Network Structure	City	STNS-195	2	2.10	0.96		
New River	Network Structure	City	STNS-196	3	2.00	1.37		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
New River	Network Structure	City	STNS-205	4	1.98	1.80		
New River	Network Structure	City	STNS-207	4	2.05	1.87		
New River	Network Structure	City	STNS-1257	4	2.00	1.82		
New River	Network Structure	City	STNS-1258	4	1.95	1.77		
New River	Network Structure	City	STNS-1259	3	5.00	3.41	2	At Library
New River	Network Structure	City	STNS-1396	3	5.00	3.41	2	At City Hall
New River	Network Structure	City	STNS-1397	3	5.00	3.41	2	At City Hall

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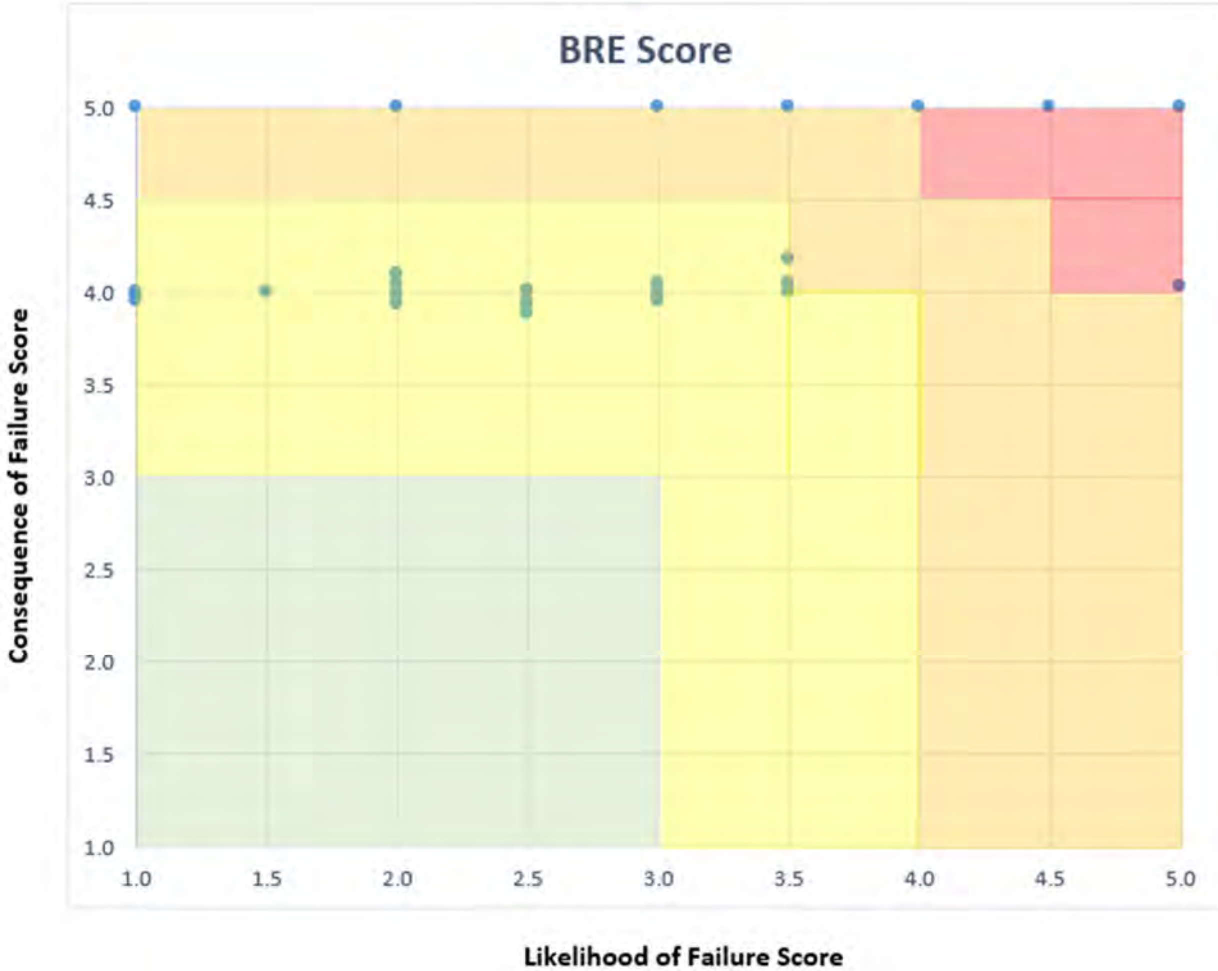
A representative BRE plot is shown in **Figure 8.45.**

Figure 8.45: New River Watershed Business Risk Exposure by Asset (Example)



8.6.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.36** shows examples of the LoS and strategies for hard assets.

Table 8.36: New River Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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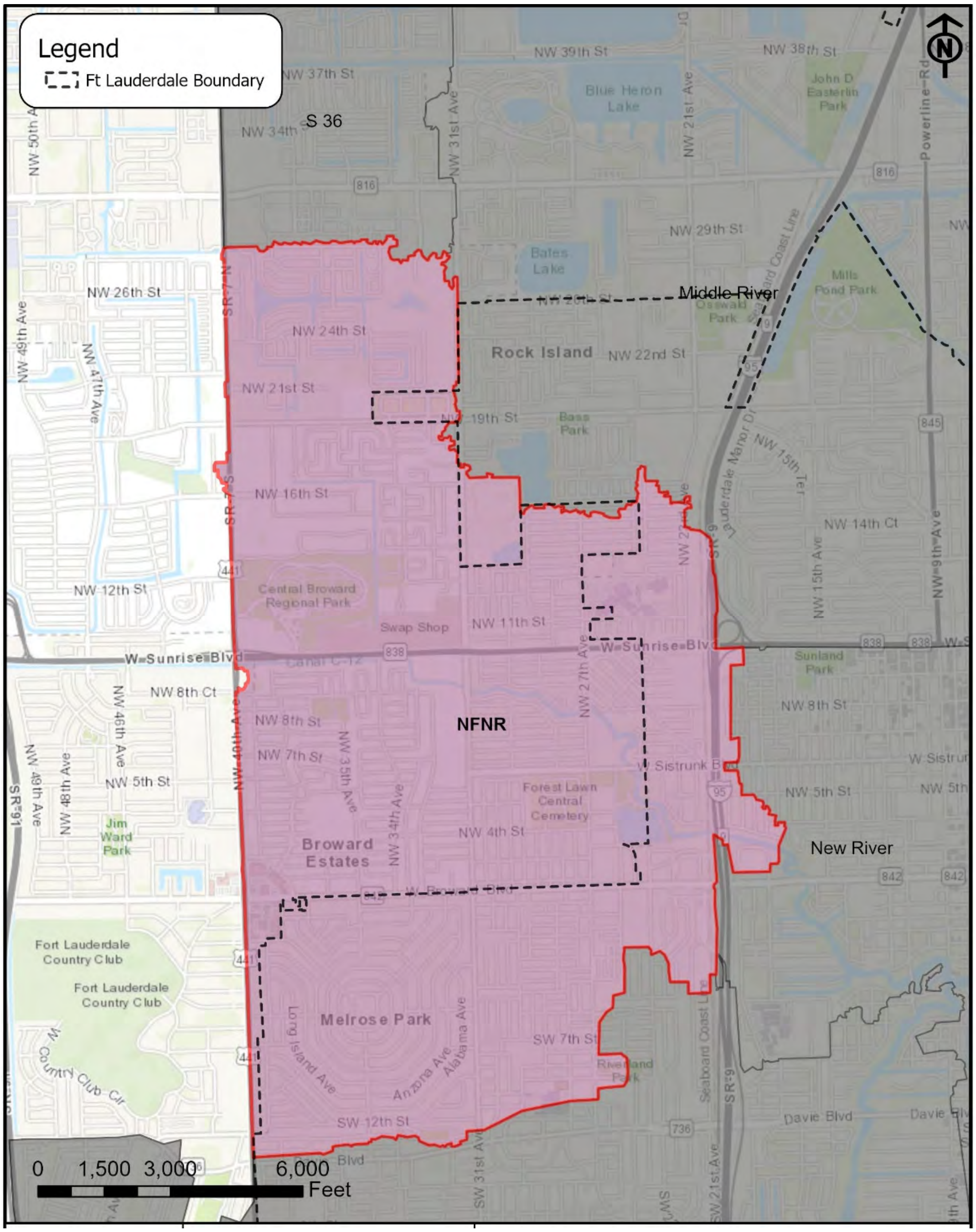
8.7 NORTH FORK NEW RIVER (NFNR)

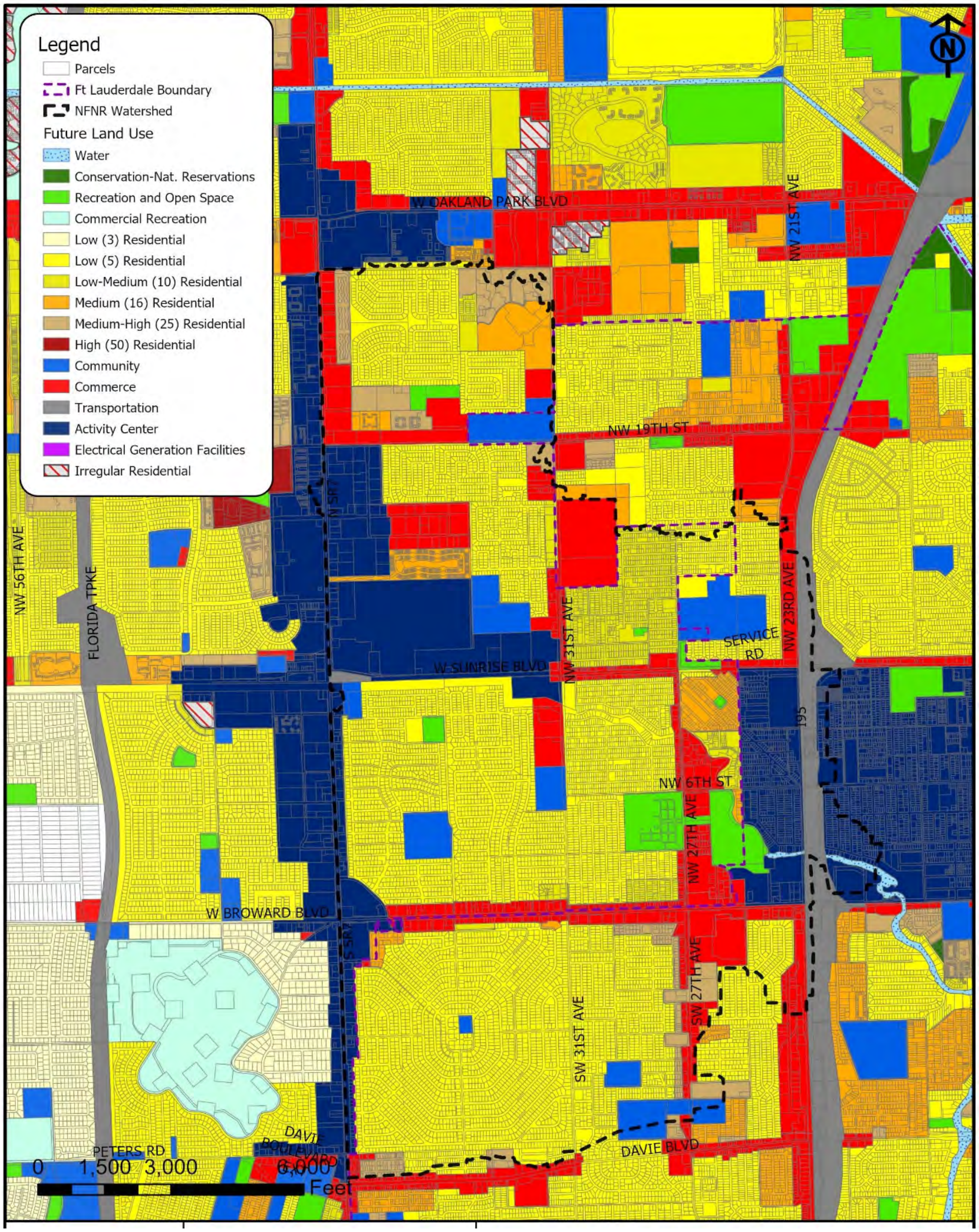
The NFNR watershed is located on the southwest part of the City of Fort Lauderdale, Florida. The watershed is approximately 6.40 square miles out of which 2.56 square miles are within the City boundaries. **Figure 8.46** illustrates the extent of the watershed.

Figure 8.46: NFNR Watershed Boundary



Land use throughout the watershed is primarily low-medium density residential. The existing land use in this watershed is illustrated in **Figure 8.47**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.47: NFNR Land Use Plan



8.7.1 Asset Summary

8.7.1.1 Hard Assets

A summary of the hard assets within NFNR watershed as included in the stormwater geodatabase is presented in **Table 8.37.**

Table 8.37: Summary of Hard Assets in North Fork New River (NFNR) Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	1
Pond (1)	18
Discharge Point	76
Drainage Well	0
Exfiltration Trench (1)	
Inlet	1128
Manhole	136
Gravity Main	1289
Network Structure	52
Pollution Control Structure (1)	
Pollution Control Device	53
Pump Station	0
Weir Structure	11

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) There are 185 unknown assets under the stormwater geodatabase in this watershed.

Figure 8.48 presents the hard assets in NFNR watershed.

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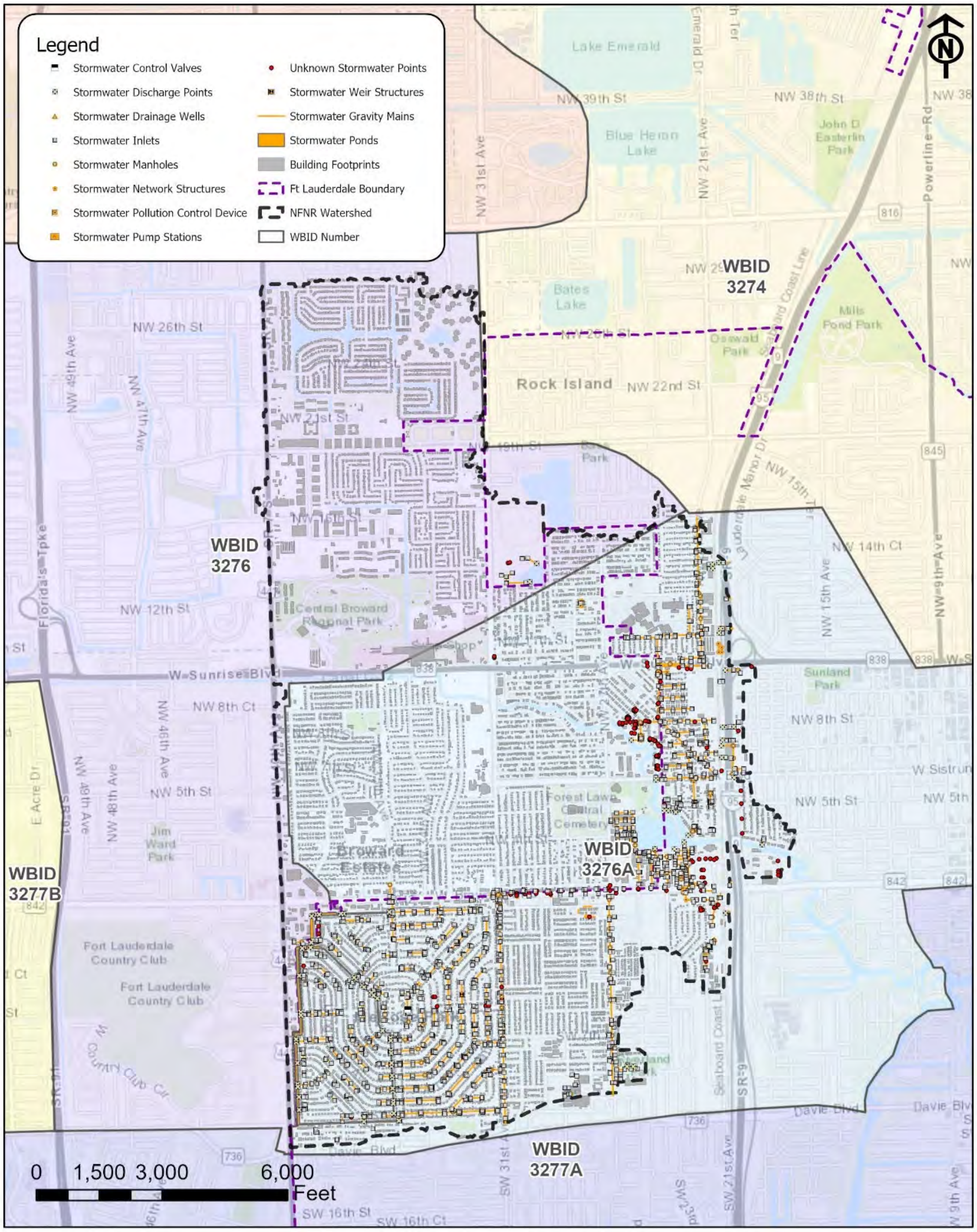
Figure 8.48: Hard Assets in NFNR (2019 Stormwater Geodatabase)



8.7.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1**. Specific soft assets for the NFNR watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.49** illustrates the NFNR Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

City Planning Documents

City planning documents that may have application in the NFNR watershed include the 2020-2024 Proposed Community Investment Plan, which include proposed projects that may impact infrastructure in the NFNR watershed including the proposed Stormwater Master Plan infrastructure for the Dorsey Riverbend Neighborhood.

Regulatory Permitting Policies & Non-Structural BMPs

As noted in Section 1.7.1.2 NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the NFNR watershed are considered impaired as also noted on the TMDL Report in **Appendix C.** The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

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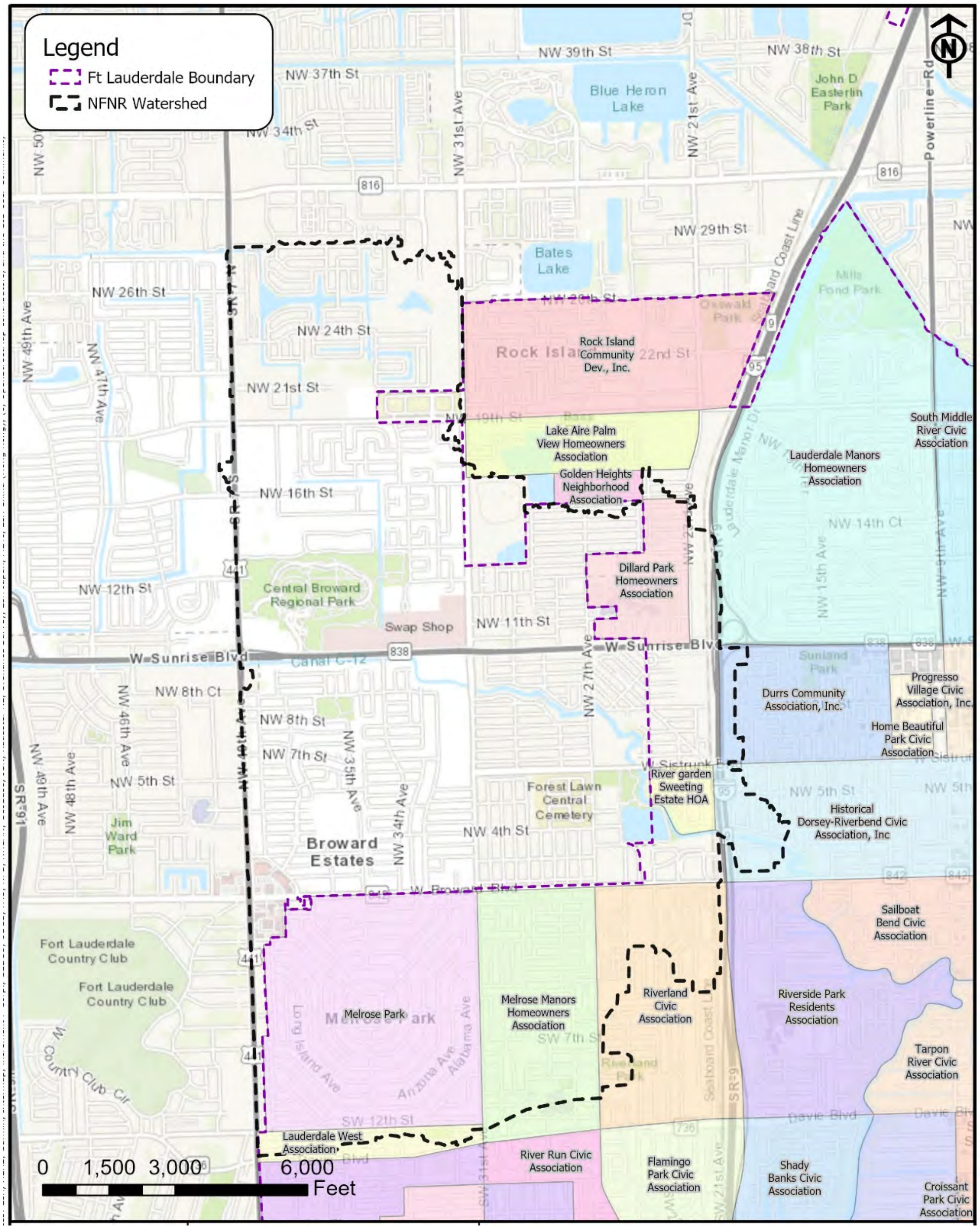
Figure 8.49: NFNR Neighborhood Associations



8.7.1.3 Natural Assets

A summary of the primary natural assets within the NFNR watershed are illustrated in **Figure 8.50**. In general, there are:

- approximately 8 reservoirs,
- 1 river – North Fork New River,
- A few canals along the North Fork New River, and
- several parks including Delevoe Park with a diverse variety of trees and vegetation.

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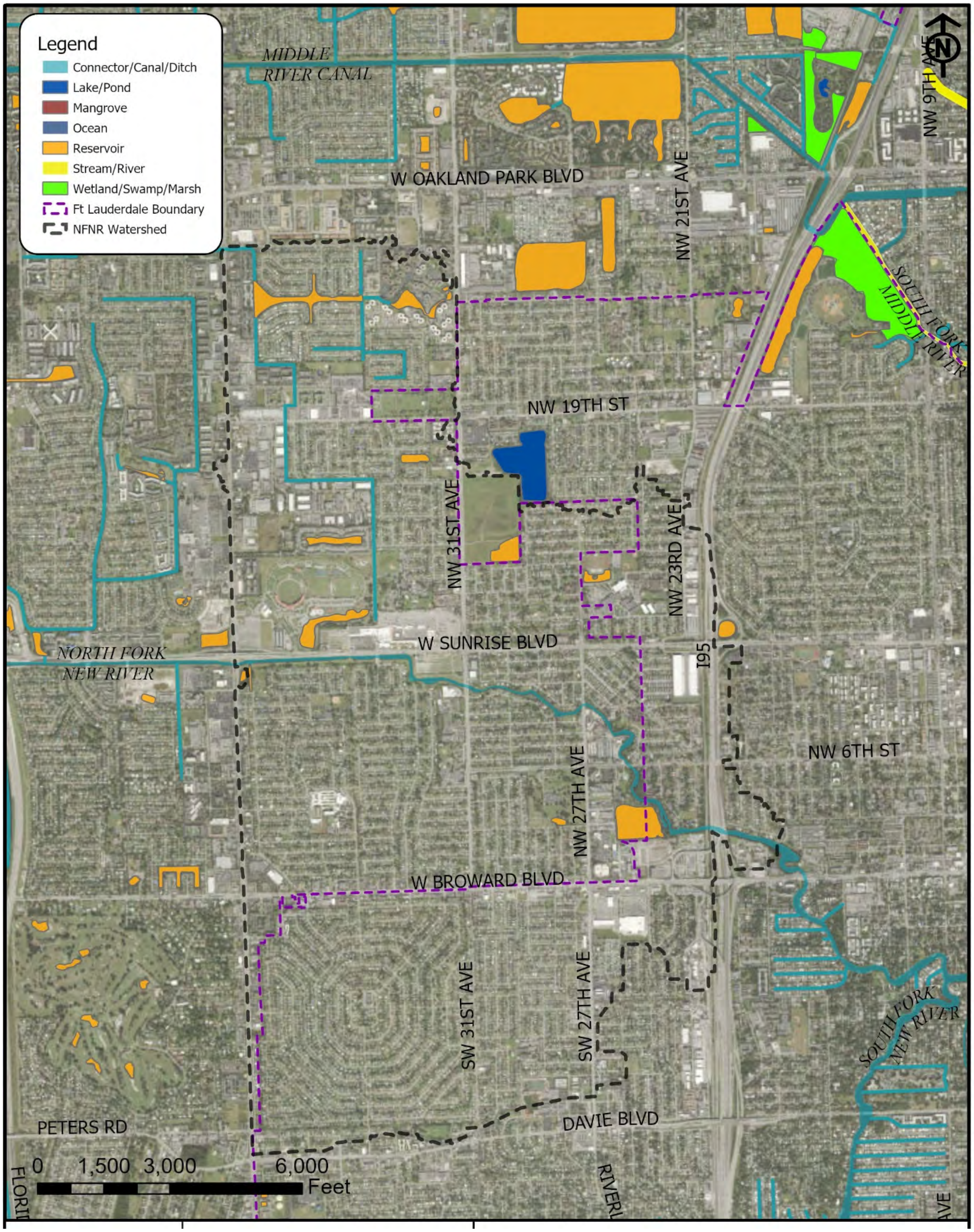
Figure 8.50: Natural Assets in NFNR Watershed



8.7.2 Watershed Challenges

ICW North watershed faces unique challenges based on the characteristics of the watershed. Therefore, the stormwater system requires design and asset operation and maintenance strategies that are specifically tailored to the unique needs of the watershed. For example, in Durrs Neighborhood, one of the seven priority neighbors, during the Stormwater Master Plan design the drainage structures in this neighborhood were observed to be in proper working condition, but some structures were not located at the low point along the roadways. In areas of single family homes, the condition of most grass swales within the right-of-way ranged from fair to good; however, eroded swales were observed along some streets. Various areas of isolated ponding were observed as a result of localized low points without inlets for stormwater collection. Therefore, the primary goal is to provide Durrs, which currently has significant areas with undersized infrastructure, with a comprehensive system which will be adaptable to changing climate conditions in the future. A major objective is to collect the runoff from the low areas. Selective pipe upsizing, pipe interconnections, the installation of permeable pavement and exfiltration trench will be used to reduce road flooding in the residential areas. An additional interceptor installed within the Dorsey Riverbend neighborhood will collect runoff from the Durrs storm sewer and ultimately direct it to the North Fork of the New River. Tertiary storm sewers will collect and direct flow toward major pipelines. Swales and permeable pavement will be utilized where possible to increase storage, promote infiltration and reduce nuisance flooding. Proposed improvements are intended to reduce flood stage and time of inundation above road crowns for a 10 year-24 hour design storm event and to protect against structural flooding in a 100 year-72 hour storm event. Flood stage and duration reductions will be achieved through a combination of added storage and discharge capacity via the community investments.

Some other challenges faced by this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.38**.

Table 8.38: NFNR Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Waterways pollution control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Install exfiltration trenches, restored swales, permeable pavement, and specifically designed water quality structures located upstream of the new pump stations and new outfall.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from the same channel.	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Surface improvements, including grassed swale restoration, replacing standard pavements with permeable pavement, and minor roadway re-grading, are proposed without pipe network improvements.

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
		Existing storm sewer pipe upsizing and new storm sewer installation will provide the existing collection system with increased conveyance capacity.
		Installation of new gravity drainage wells will allow stormwater to be discharged to the aquifer at localized points throughout the neighborhood, reducing the overall stormwater runoff which must be conveyed via the storm sewer system and discharged to the NFNR.
Reservoir	Saltwater intrusion	Manage wellfield pumpage, relocate wells and monitor saltwater monitoring wells

8.7.3 Asset Ownership and Inventory

Table 8.39 summarizes the hard assets in NFNR per asset ownership.

Table 8.39: Asset Inventory and Ownership in NFNR Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	1	0	0	1
Pond (1)	18	18	0	0
Discharge Point	76	52	19	5
Drainage Well	0	0	0	0
Exfiltration Trench (1)				
Inlet	1128	743	337	48
Manhole	136	48	37	51
Gravity Main	1289	793	314	182
Network Structure	52	36	13	3
Pollution Control Structure (1)				
Pollution Control Device	53	0	0	53
Pump Station	0	0	0	0
Unknown Point	185	0	0	185
Weir Structure	11	2	2	7

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

8.7.4 What is the Condition and Performance of the Assets?

8.7.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the NFNR Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.7.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

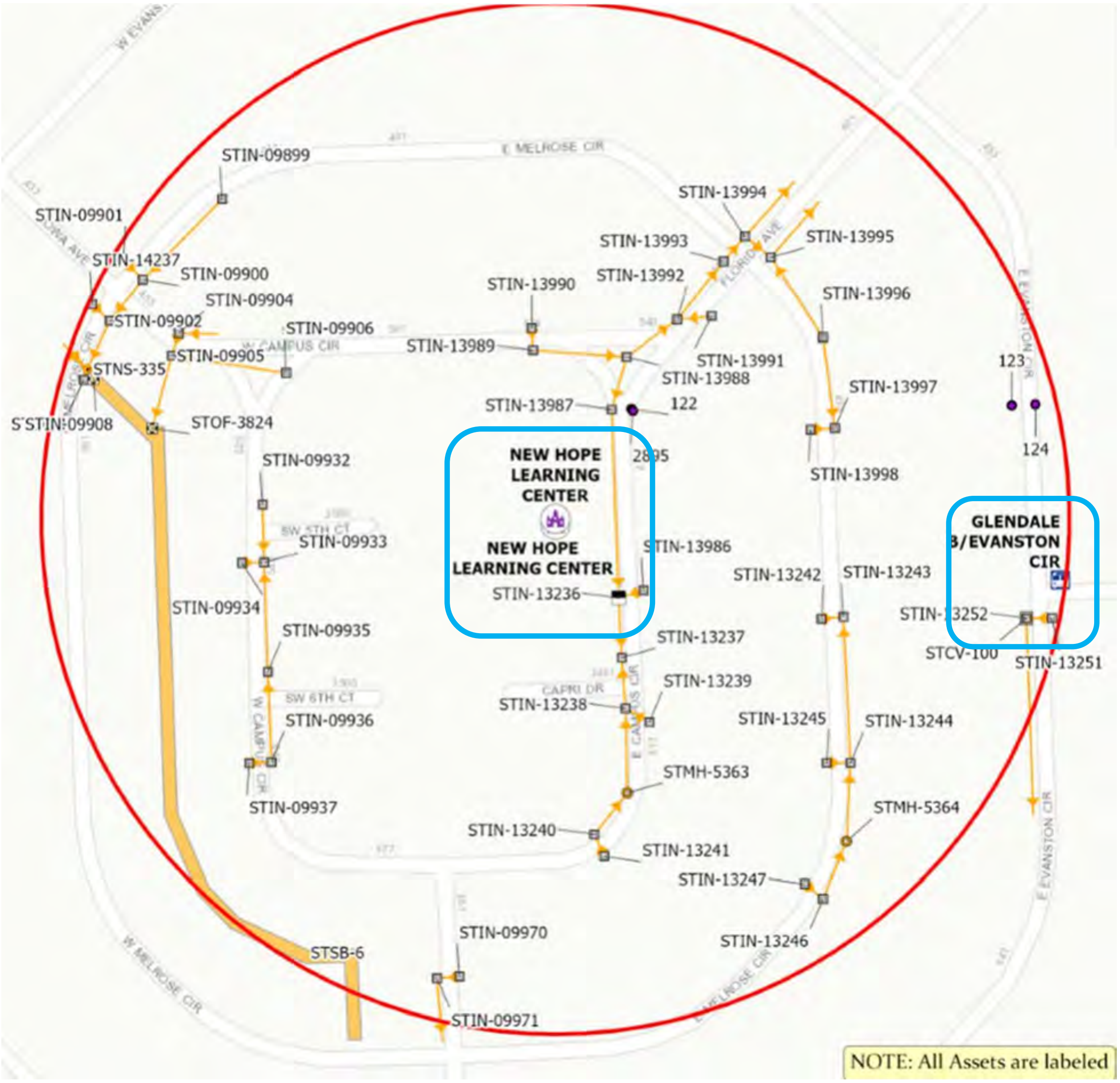
The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.40** shows the CoF Score by class used in this analysis.

Table 8.40: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the NFNR Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius around the E Campus Circle / Florida Avenue Intersection, as shown in **Figure 8.51.**

Figure 8.51: NFNR Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the NFNR Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score.

For the section selected, there are five City-owned stormwater assets next to a bus stop and the New Hope Learning Center. These five assets are circled in blue in **Figure 8.50** above. For example, the inlet asset class has a CoF score of 4. However, if the inlet device is located next to a bus stop, it may be desired to increase that specific asset CoF score to a 5, showing that it is more critical than the general population of the asset.

The assets near critical facilities whose CoF scores were changed due to proximity to a critical facility are identified in **Table 8.41**.

8.7.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.41** provides the overall representation of the NFNR Watershed data subset used for this analysis.

Table 8.41 NFNR Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
NFNR	Gravity Main	City	STMN-12382	2.0	4.05	8.10		
NFNR	Gravity Main	City	STMN-12383	3.5	4.00	14.00		
NFNR	Gravity Main	City	STMN-12384	3.5	4.00	14.00		
NFNR	Gravity Main	City	STMN-12386	4.5	4.00	18.00		
NFNR	Gravity Main	City	STMN-12387	1.0	3.95	3.95		
NFNR	Gravity Main	City	STMN-12388	4.0	4.00	16.00		
NFNR	Gravity Main	City	STMN-12389	5.0	4.10	20.50		
NFNR	Gravity Main	City	STMN-12390	5.0	4.05	20.25		
NFNR	Gravity Main	City	STMN-12392	3.0	4.10	12.30		
NFNR	Gravity Main	City	STMN-12393	3.5	3.92	13.72		
NFNR	Gravity Main	City	STMN-12420	3.0	3.98	11.94		
NFNR	Gravity Main	City	STMN-12421	2.0	4.00	8.00		
NFNR	Gravity Main	City	STMN-12422	2.0	4.00	8.00		
NFNR	Gravity Main	City	STMN-12423	2.5	3.89	9.73		
NFNR	Gravity Main	City	STMN-12424	3.0	4.18	12.54		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
NFNR	Gravity Main	City	STMN-12459	3.0	3.95	11.85		
NFNR	Gravity Main	City	STMN-12461	3.5	4.00	14.00		
NFNR	Gravity Main	City	STMN-16143	3.0	3.93	11.79		
NFNR	Gravity Main	City	STMN-16144	2.0	3.95	7.90		
NFNR	Gravity Main	City	STMN-16145	1.5	4.00	6.00		
NFNR	Gravity Main	City	STMN-16146	5.0	3.97	19.85		
NFNR	Gravity Main	City	STMN-16147	5.0	4.05	20.25		
NFNR	Gravity Main	City	STMN-16148	1.5	4.00	6.00		
NFNR	Gravity Main	City	STMN-16149	2.0	4.00	8.00		
NFNR	Gravity Main	City	STMN-16150	3.0	4.00	12.00		
NFNR	Gravity Main	City	STMN-16151	3.5	4.10	14.35		
NFNR	Gravity Main	City	STMN-16152	3.5	4.05	14.18		
NFNR	Gravity Main	City	STMN-16153	3.0	4.10	12.30		
NFNR	Gravity Main	City	STMN-16154	3.0	3.92	11.76		
NFNR	Gravity Main	City	STMN-16159	2.5	3.98	9.95		
NFNR	Gravity Main	City	STMN-16161	2.0	4.00	8.00		
NFNR	Gravity Main	City	STMN-16758	1.5	4.00	6.00		
NFNR	Gravity Main	City	STMN-16759	1.5	3.89	5.84		
NFNR	Gravity Main	City	STMN-16760	1.0	4.18	4.18		
NFNR	Gravity Main	City	STMN-16761	1.0	3.95	3.95		
NFNR	Gravity Main	City	STMN-16762	3.0	4.00	12.00		
NFNR	Gravity Main	City	STMN-16763	3.5	3.93	13.76		
NFNR	Gravity Main	City	STMN-16764	3.0	4.00	12.00		
NFNR	Gravity Main	City	STMN-16765	2.5	4.00	10.00		
NFNR	Gravity Main	City	STMN-16766	3.0	3.89	11.67		
NFNR	Gravity Main	City	STMN-16767	2.5	4.01	10.03		
NFNR	Gravity Main	City	STMN-16768	3.0	4.00	12.00		
NFNR	Gravity Main	City	STMN-16769	3.0	3.98	11.94		
NFNR	Gravity Main	City	STMN-21357	3.0	4.00	12.00		
NFNR	Inlet	City	STIN-09899	3.5	4.13	14.46		
NFNR	Inlet	City	STIN-09900	3.0	4.07	12.21		
NFNR	Inlet	City	STIN-09901	4.0	3.86	15.44		
NFNR	Inlet	City	STIN-09902	3.5	3.98	13.93		
NFNR	Inlet	City	STIN-14237	3.0	4.00	12.00		
NFNR	Inlet	City	STIN-09904	3.0	4.03	12.09		
NFNR	Inlet	City	STIN-09905	2.5	4.00	10.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
NFNR	Inlet	City	STIN-09906	2.5	3.93	9.83		
NFNR	Inlet	City	STIN-09908	3.5	3.95	13.83		
NFNR	Inlet	City	STIN-09932	4.5	4.00	18.00		
NFNR	Inlet	City	STIN-09933	4.0	3.97	15.88		
NFNR	Inlet	City	STIN-09934	4.0	4.05	16.20		
NFNR	Inlet	City	STIN-09935	3.5	4.00	14.00		
NFNR	Inlet	City	STIN-09936	3.0	4.00	12.00		
NFNR	Inlet	City	STIN-09937	3.0	4.00	12.00		
NFNR	Inlet	City	STIN-09970	1.0	4.10	4.10		
NFNR	Inlet	City	STIN-09971	1.5	4.00	6.00		
NFNR	Inlet	City	STIN-13236	2.0	5.00	10.00	4.23	By religious center
NFNR	Inlet	City	STIN-13237	3.0	3.95	11.85		
NFNR	Inlet	City	STIN-13238	3.5	4.00	14.00		
NFNR	Inlet	City	STIN-13239	3.0	3.93	11.79		
NFNR	Inlet	City	STIN-13240	3.5	3.95	13.83		
NFNR	Inlet	City	STIN-13241	3.0	4.00	12.00		
NFNR	Inlet	City	STIN-13242	2.5	3.97	9.93		
NFNR	Inlet	City	STIN-13243	2.0	4.05	8.10		
NFNR	Inlet	City	STIN-13244	2.0	4.00	8.00		
NFNR	Inlet	City	STIN-13245	2.0	4.00	8.00		
NFNR	Inlet	City	STIN-13246	2.5	4.00	10.00		
NFNR	Inlet	City	STIN-13247	1.0	3.95	3.95		
NFNR	Inlet	City	STIN-13251	1.5	5.00	7.50	3.78	By bus stop
NFNR	Inlet	City	STIN-13252	1.0	5.00	5.00	3.75	By bus stop
NFNR	Inlet	City	STIN-13986	2.5	3.95	9.88		
NFNR	Inlet	City	STIN-13987	2.5	5.00	12.50	4.9	By religious center
NFNR	Inlet	City	STIN-13988	2.0	3.97	7.94		
NFNR	Inlet	City	STIN-13989	2.0	4.05	8.10		
NFNR	Inlet	City	STIN-13990	3.0	4.00	12.00		
NFNR	Inlet	City	STIN-13991	2.5	4.00	10.00		
NFNR	Inlet	City	STIN-13992	3.5	4.00	14.00		
NFNR	Inlet	City	STIN-13993	3.5	3.95	13.83		
NFNR	Inlet	City	STIN-13994	5.0	4.00	20.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
NFNR	Inlet	City	STIN-13995	3.5	4.10	14.35		
NFNR	Inlet	City	STIN-13996	3.5	4.05	14.18		
NFNR	Inlet	City	STIN-13997	3.0	4.10	12.30		
NFNR	Inlet	City	STIN-13998	2.5	3.92	9.80		
NFNR	Manhole	City	STMH-5363	3.0	3.98	11.94		
NFNR	Manhole	City	STMH-5364	3.5	4.00	14.00		
NFNR	Network Structure	City	STNS-335	3.0	2.10	6.30		
NFNR	Discharge Point	City	STOF-3824	4.0	4.05	16.20		
NFNR	Discharge Point	City	STOF-3826	3.5	3.96	13.86		
NFNR	Pond	City	STSB-6	3.0	3.00	9.00		
NFNR	Control Valve	City	STCV-135	3.0	5.00	15.00		
NFNR	Pollution Control Structure	City	STCV-100	2.5	5.00	12.50	4.31	By bus stop

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A representative BRE plot is shown in **Figure 8.52.**

Figure 8.52: NFNR Watershed Business Risk Exposure by Asset (Example)

8.7.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.42** shows examples of the LoS and strategies for hard assets.

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Table 8.42: NFNR Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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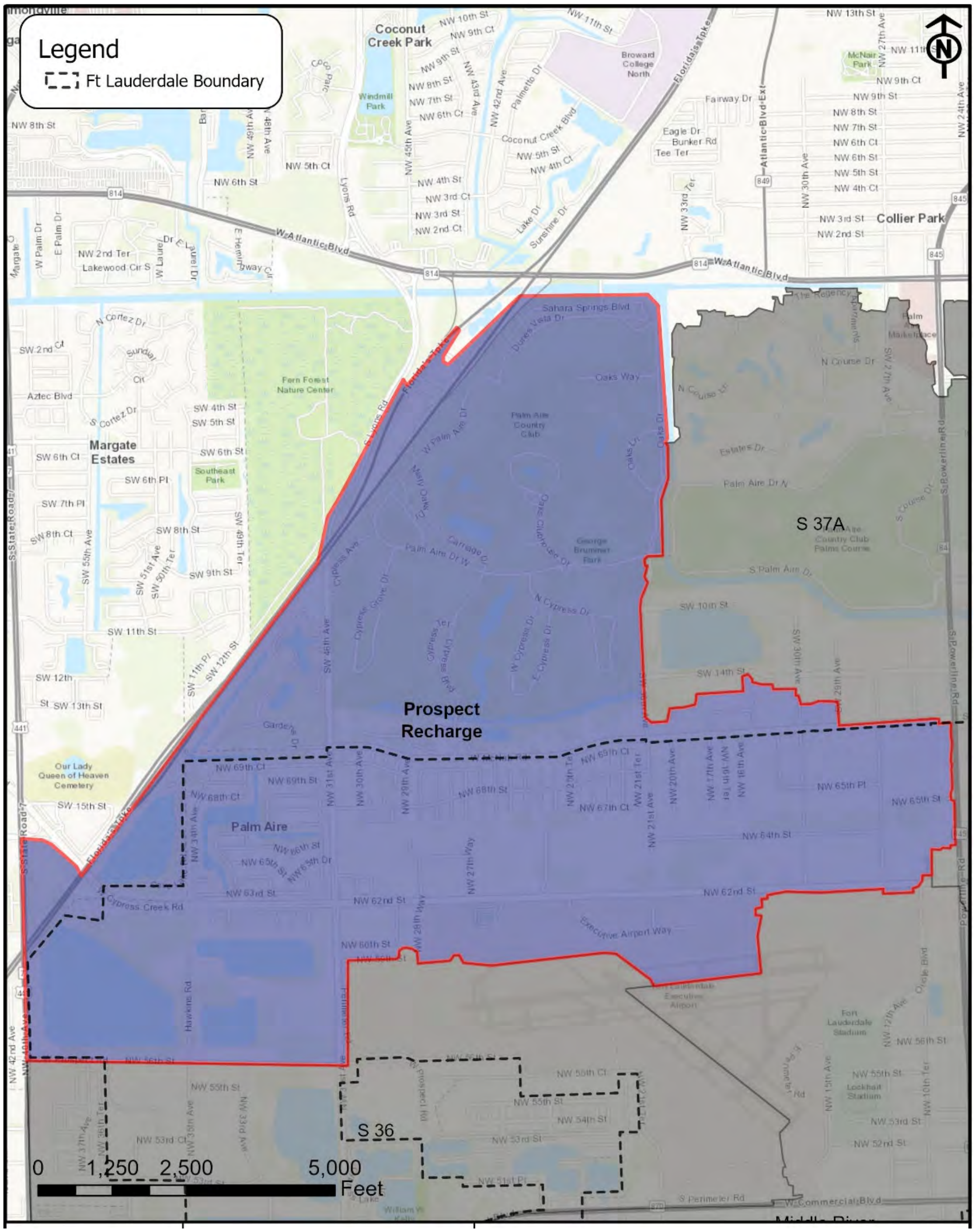
8.8 PROSPECT RECHARGE

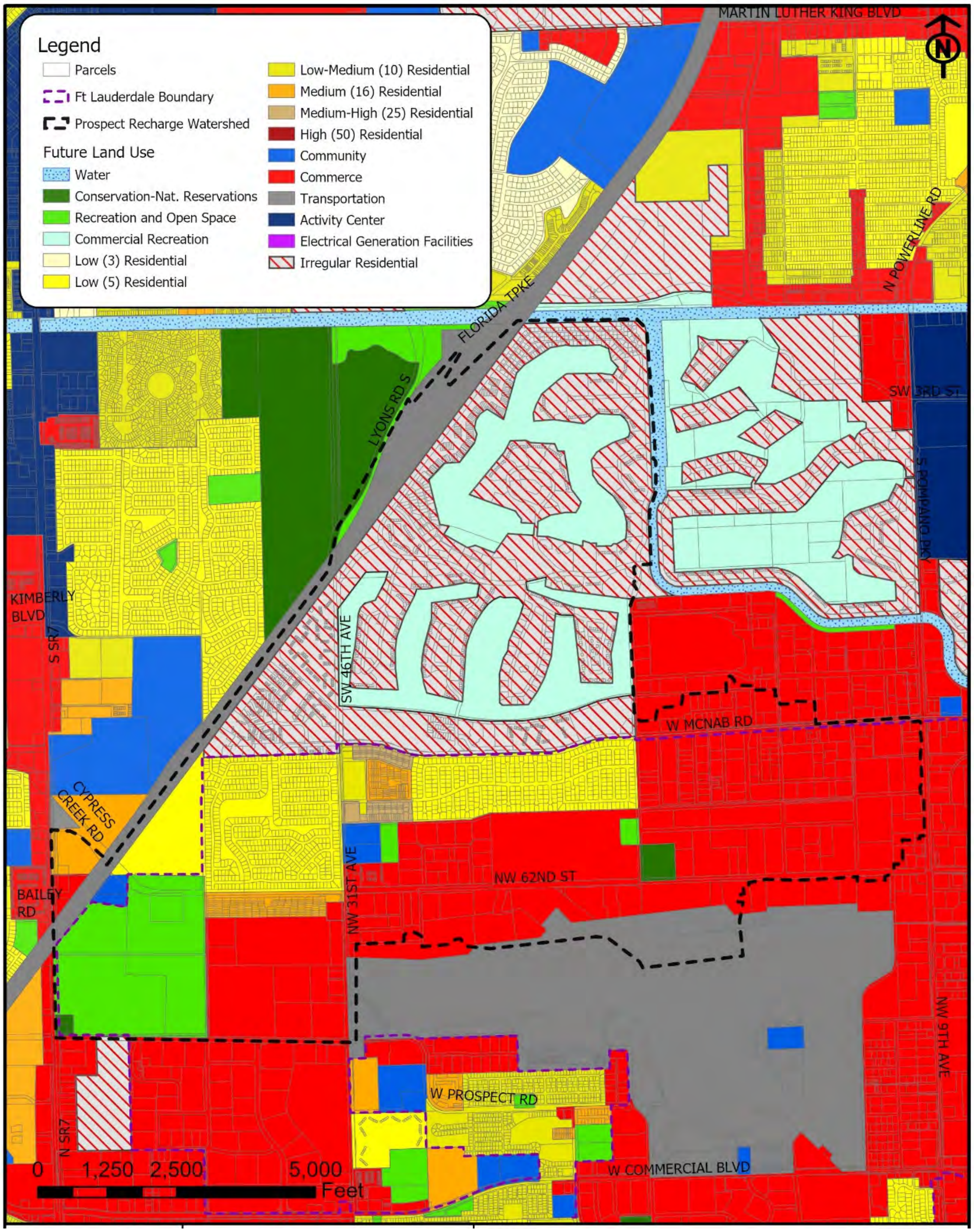
The Prospect Recharge watershed is located on the northwest part of the City of Fort Lauderdale, Florida. The watershed is approximately 3.71 square miles out of which 1.97 square miles are within the City boundaries. **Figure 8.53** illustrates the extent of the watershed.

Figure 8.53: Prospect Recharge Watershed Boundary



Land use throughout the watershed is primarily commercial and irregular residential. The existing land use in this watershed is illustrated in **Figure 8.54**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.54: Prospect Recharge Land Use Plan



8.8.1 Asset Summary

8.8.1.1 Hard Assets

A summary of the hard assets within Prospect Recharge watershed as included in the stormwater geodatabase is presented in **Table 8.43**.

Table 8.43: Summary of Hard Assets in Prospect Recharge Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	0
Pond (1)	0
Discharge Point	62
Drainage Well	0
Exfiltration Trench (1)	
Inlet	559
Manhole	178
Gravity Main	782
Network Structure	24
Pollution Control Structure (1)	
Pollution Control Device	3
Pump Station	0
Weir Structure	25

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) There are 122 unknown assets under the stormwater geodatabase in this watershed.

Figure 8.55 presents the hard assets in Prospect Recharge watershed.

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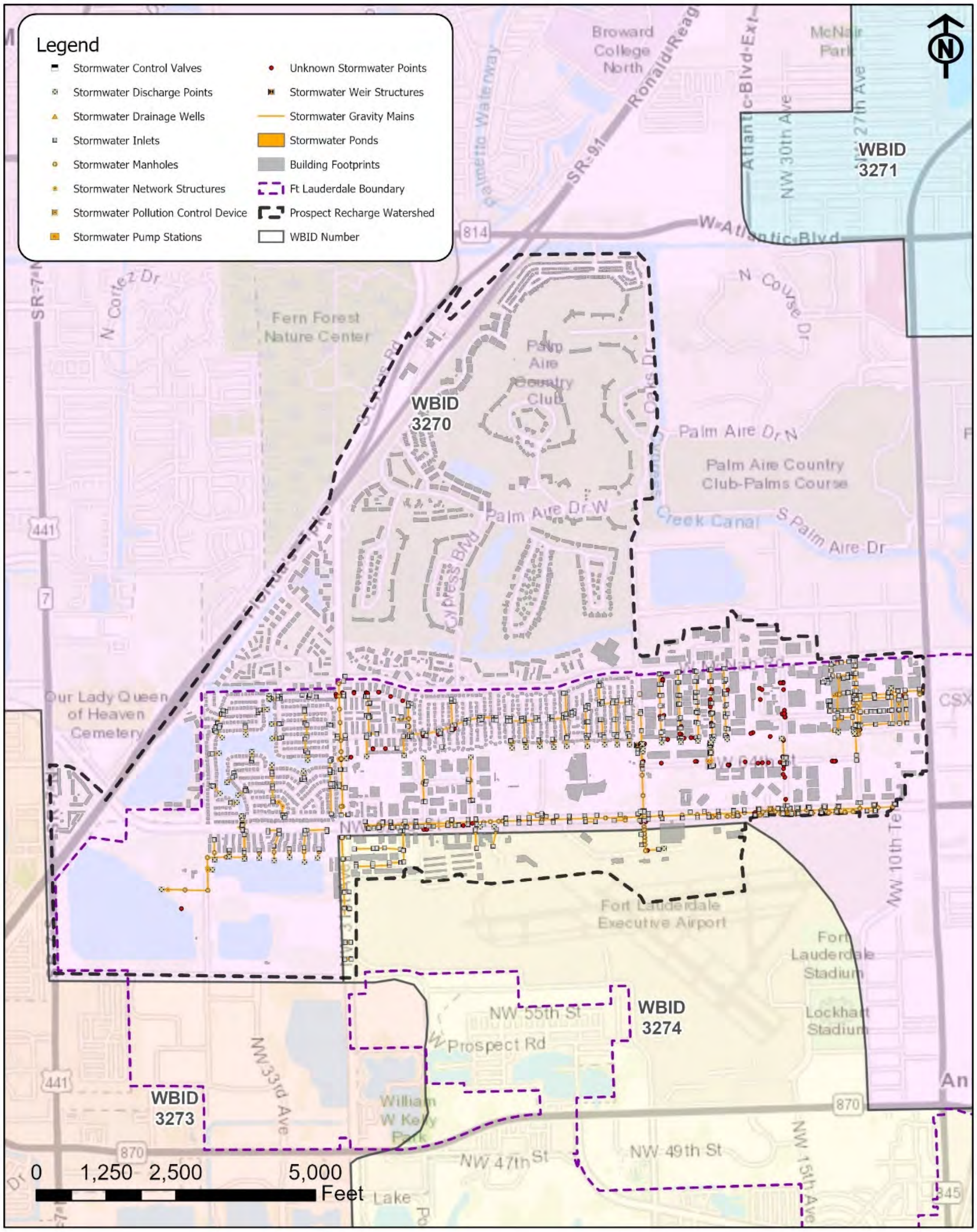
Figure 8.55: Hard Assets in Prospect Recharge Watershed



8.8.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in Section 2.1.2.1. Specific soft assets for the Prospect Recharge watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.56** illustrates the Prospect Recharge Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

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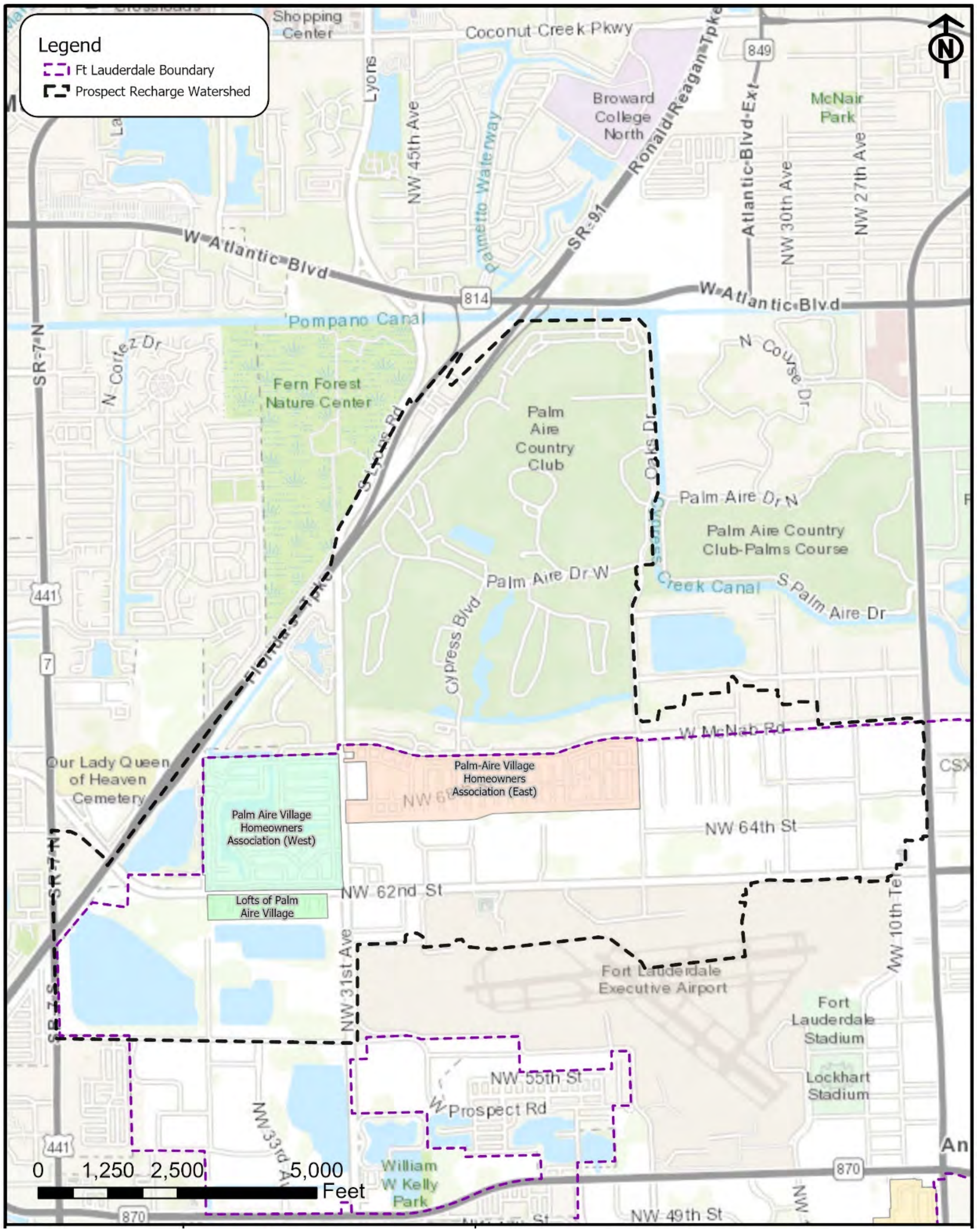
Figure 8.56: Prospect Recharge Neighborhood Associations



8.8.1.3 Natural Assets

A summary of the primary natural assets within the Prospect Recharge watershed are illustrated in **Figure 8.57**. In general, there are:

- approximately 33 reservoirs – with in the City’s boundary there are four large reservoirs on the south of the watershed,
- several canals,
- 4 wetlands, and
- a large open space – Palm Air Country Club which include the majority of the small reservoirs.

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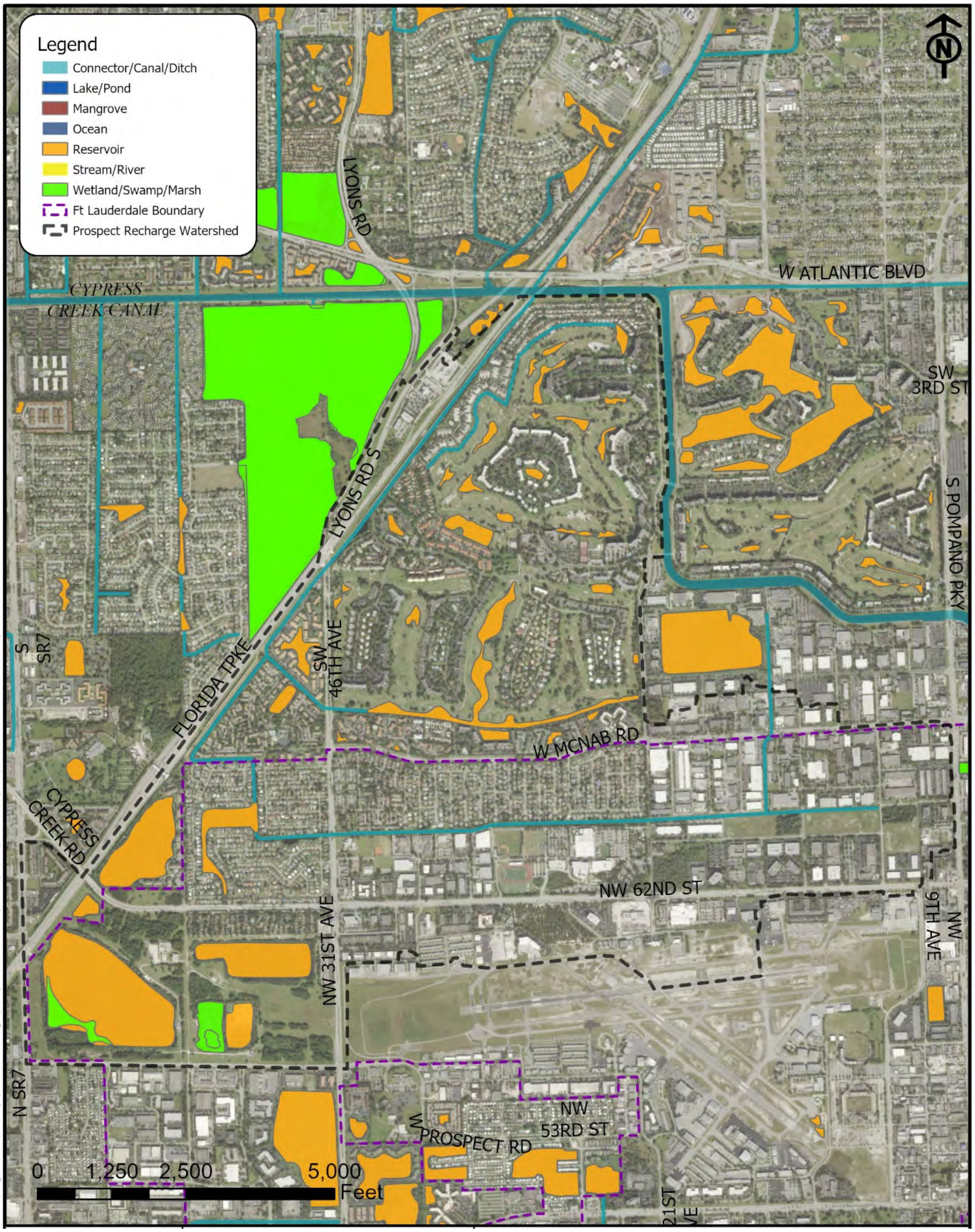
Figure 8.57: Summary of Natural Assets in Prospect Recharge Watershed



8.8.2 Watershed Challenges

Some challenges in this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.44**.

Table 8.44: Prospect Recharge Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Water Pollution Control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Enhancement of the existing swale areas to provide better surface infiltration to reduce stormwater runoff and the number of suspended solids that enter the storm sewer system.
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from the same channel same	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection
Reservoir	Saltwater intrusion	Manage wellfield pumpage, relocate wells and monitor saltwater monitoring wells

8.8.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.8.3 Asset Ownership and Inventory

Table 8.45 summarizes the hard assets in Prospect Recharge per asset ownership.

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Table 8.45 Asset Inventory and Ownership in Prospect Recharge Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	0	0	0	0
Pond (1)	0	0	0	0
Discharge Point	62	49	5	8
Drainage Well	0	0	0	0
Exfiltration Trench (1)				
Inlet	559	348	162	49
Manhole	178	53	15	110
Gravity Main	782	399	102	281
Network Structure	24	12	11	1
Pollution Control Structure (1)				
Pollution Control Device	3	1	0	2
Pump Station	0	0	0	0
Unknown Point	122	0	0	122
Weir Structure	25	3	0	22

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

8.8.4 What is the Condition and Performance of the Assets?

8.8.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the Prospect Recharge Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.8.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.46** shows the CoF Score by class used in this analysis.

Table 8.46: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed Prospect Recharge Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius between NW 62nd and 63rd Streets and NW 32nd Avenue and Way as shown in **Figure 8.58.**

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Figure 8.58: Prospect Recharge Watershed Data Subset Used for CoF Analysis

The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the Prospect Recharge Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score.

For the section selected, there are two City-owned stormwater assets next to a park on the far west side of the area selected. These two assets are circled in blue in **Figure 8.58**. The assets near critical facilities whose CoF scores were changed due to proximity to a critical facility are identified in **Table 8.47**

8.8.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.47** provides the overall representation of the Prospect Recharge Watershed data subset used for this analysis.

Table 8.47: Prospect Ridge Watershed CoF (Example)

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Prospect Recharge	Gravity Main	City	STMN-03038	1.0	3.97	3.97		
Prospect Recharge	Gravity Main	City	STMN-03039	4.0	4.05	16.20		
Prospect Recharge	Gravity Main	City	STMN-03040	5.0	4.00	20.00		
Prospect Recharge	Gravity Main	City	STMN-03041	5.0	4.00	20.00		
Prospect Recharge	Gravity Main	City	STMN-03042	3.0	4.00	12.00		
Prospect Recharge	Gravity Main	City	STMN-03043	3.5	3.95	13.83		
Prospect Recharge	Gravity Main	City	STMN-03044	3.0	4.00	12.00		
Prospect Recharge	Gravity Main	City	STMN-03045	2.0	4.10	8.20		
Prospect Recharge	Gravity Main	City	STMN-03046	2.0	4.05	8.10		
Prospect Recharge	Gravity Main	City	STMN-03047	2.5	4.10	10.25		
Prospect Recharge	Gravity Main	City	STMN-03048	3.0	3.92	11.76		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Prospect Recharge	Gravity Main	City	STMN-03049	3.0	3.98	11.94		
Prospect Recharge	Gravity Main	City	STMN-03050	3.5	4.00	14.00		
Prospect Recharge	Gravity Main	City	STMN-03051	3.0	4.00	12.00		
Prospect Recharge	Gravity Main	City	STMN-03052	2.0	3.89	7.78		
Prospect Recharge	Gravity Main	City	STMN-03053	1.5	4.01	6.02		
Prospect Recharge	Gravity Main	City	STMN-03054	5.0	4.00	20.00		
Prospect Recharge	Gravity Main	City	STMN-03055	5.0	3.98	19.90		
Prospect Recharge	Gravity Main	City	STMN-03056	1.5	4.00	6.00		
Prospect Recharge	Gravity Main	City	STMN-03057	2.0	4.13	8.26		
Prospect Recharge	Gravity Main	City	STMN-03058	3.0	4.07	12.21		
Prospect Recharge	Gravity Main	City	STMN-03059	3.5	3.86	13.51		
Prospect Recharge	Gravity Main	City	STMN-11841	3.5	3.98	13.93		
Prospect Recharge	Gravity Main	City	STMN-11842	3.0	4.00	12.00		
Prospect Recharge	Gravity Main	City	STMN-11849	3.0	4.03	12.09		
Prospect Recharge	Gravity Main	City	STMN-11850	2.5	4.10	10.25		
Prospect Recharge	Gravity Main	City	STMN-16465	2.0	4.00	8.00		
Prospect Recharge	Gravity Main	City	STMN-16466	1.5	4.18	6.27		
Prospect Recharge	Gravity Main	City	STMN-16467	1.5	3.95	5.93		
Prospect Recharge	Gravity Main	City	STMN-16468	1.0	4.00	4.00		
Prospect Recharge	Gravity Main	City	STMN-16469	1.0	3.93	3.93		
Prospect Recharge	Gravity Main	City	STMN-16470	3.0	3.95	11.85		
Prospect Recharge	Gravity Main	City	STMN-16471	3.5	4.00	14.00		
Prospect Recharge	Gravity Main	City	STMN-16472	3.0	3.97	11.91		
Prospect Recharge	Gravity Main	City	STMN-16473	2.5	4.05	10.13		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Prospect Recharge	Inlet	City	STIN-00656	3.0	4.00	12.00		
Prospect Recharge	Inlet	City	STIN-00660	2.5	4.00	10.00		
Prospect Recharge	Inlet	City	STIN-00649	3.0	4.00	12.00		
Prospect Recharge	Inlet	City	STIN-00648	3.0	3.95	11.85		
Prospect Recharge	Inlet	City	STIN-00646	3.0	3.98	11.94		
Prospect Recharge	Inlet	City	STIN-00647	3.5	3.88	13.58		
Prospect Recharge	Inlet	City	STIN-00650	3.0	4.00	12.00		
Prospect Recharge	Inlet	City	STIN-00672	4.0	4.10	16.40		
Prospect Recharge	Inlet	City	STIN-00705	3.5	4.00	14.00		
Prospect Recharge	Inlet	City	STIN-00691	3.0	4.18	12.54		
Prospect Recharge	Inlet	City	STIN-00661	3.0	3.95	11.85		
Prospect Recharge	Inlet	City	STIN-00669	2.5	4.00	10.00		
Prospect Recharge	Inlet	City	STIN-00700	2.5	3.93	9.83		
Prospect Recharge	Inlet	City	STIN-00658	3.5	3.95	13.83		
Prospect Recharge	Inlet	City	STIN-00668	4.5	4.00	18.00		
Prospect Recharge	Inlet	City	STIN-00694	5.0	3.97	19.85		
Prospect Recharge	Inlet	City	STIN-00703	5.0	4.05	20.25		
Prospect Recharge	Inlet	City	STIN-13565	3.0	4.00	12.00		
Prospect Recharge	Inlet	City	STIN-13566	3.5	4.00	14.00		
Prospect Recharge	Inlet	City	STIN-13567	3.0	4.00	12.00		
Prospect Recharge	Inlet	City	STIN-13568	2.0	3.95	7.90		
Prospect Recharge	Inlet	City	STIN-13569	2.0	4.00	8.00		
Prospect Recharge	Inlet	City	STIN-13570	2.5	4.10	10.25		
Prospect Recharge	Inlet	City	STIN-13571	3.0	3.97	11.91		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
Prospect Recharge	Manhole	City	STMH-3131	3.0	4.05	12.15		
Prospect Recharge	Manhole	City	STMH-3132	3.5	4.00	14.00		
Prospect Recharge	Manhole	City	STMH-3133	3.0	4.00	12.00		
Prospect Recharge	Manhole	City	STMH-3134	2.0	4.00	8.00		
Prospect Recharge	Manhole	City	STMH-3135	1.5	3.95	5.93		
Prospect Recharge	Manhole	City	STMH-4822	5.0	3.78	18.90	3.78	By park
Prospect Recharge	Network Structure	City	STNS-310	5.0	2.20	11.00	2.20	By park
Prospect Recharge	Network Structure	City	STNS-311	1.5	1.95	2.93		
Prospect Recharge	Network Structure	City	STNS-465	2.0	2.00	4.00		
Prospect Recharge	Network Structure	City	STNS-466	3.0	2.05	6.15		
Prospect Recharge	Discharge Point	City	STOF-2817	3.5	4.00	14.00		
Prospect Recharge	Discharge Point	City	STOF-2818	3.5	3.95	13.83		
Prospect Recharge	Discharge Point	City	STOF-2820	3.0	4.03	12.09		
Prospect Recharge	Discharge Point	City	STOF-2821	3.0	4.08	12.24		
Prospect Recharge	Discharge Point	City	STOF-2823	2.5	4.00	10.00		

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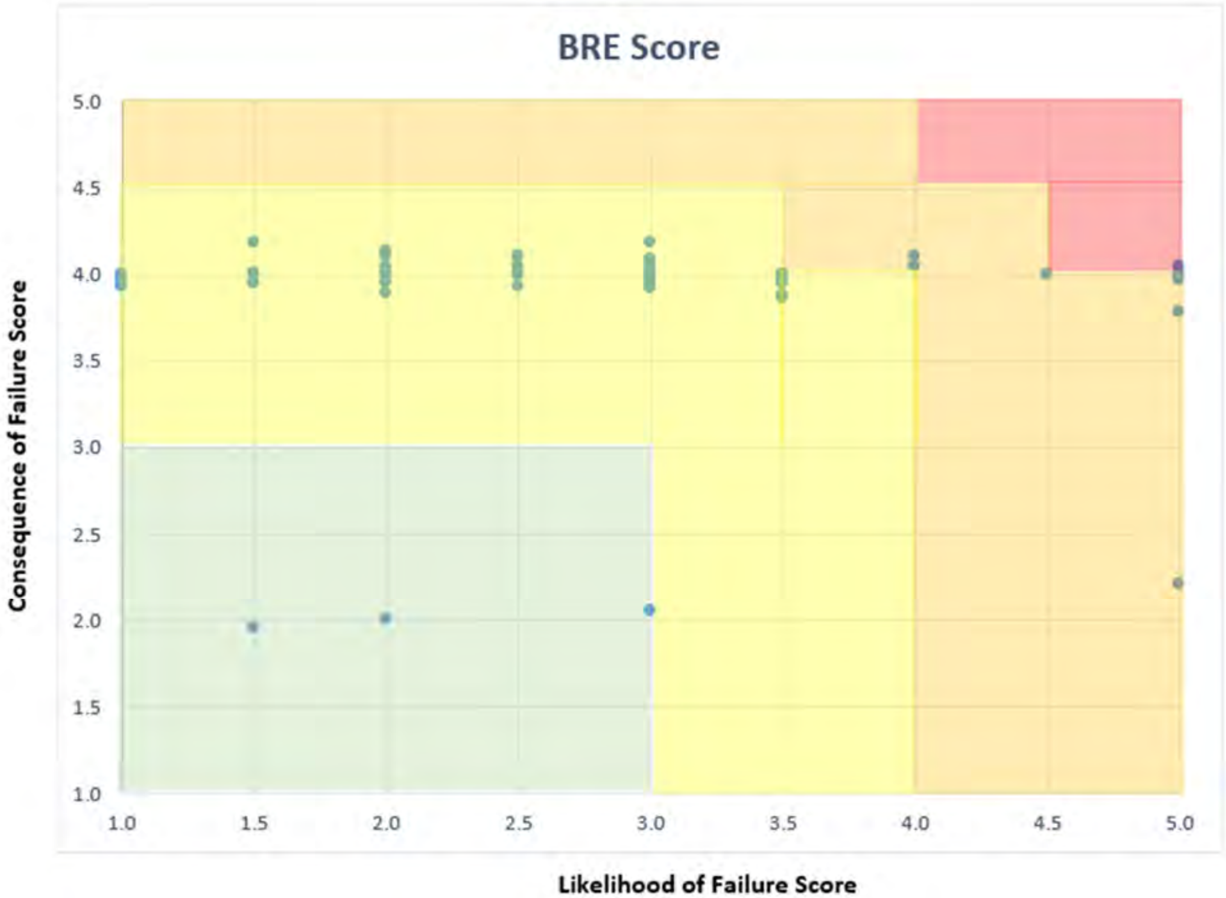
A representative BRE plot is shown in **Figure 8.59.**

Figure 8.59: Prospect Recharge Watershed Business Risk Exposure by Asset (Example)



8.8.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.48** shows examples of the LoS and strategies for hard assets.

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Table 8.48: Prospect Recharge Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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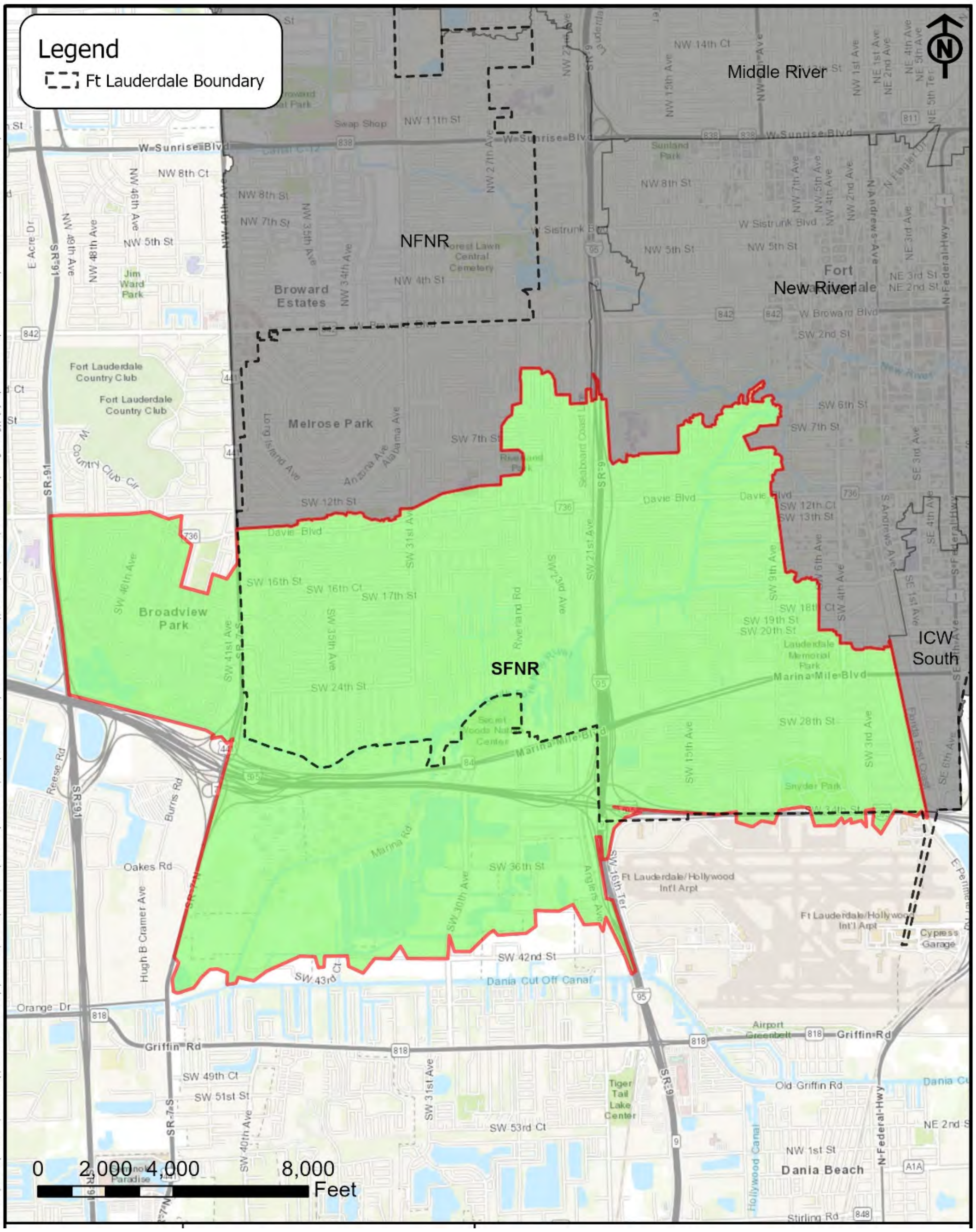
8.9 SOUTH FORK NEW RIVER (SFNR)

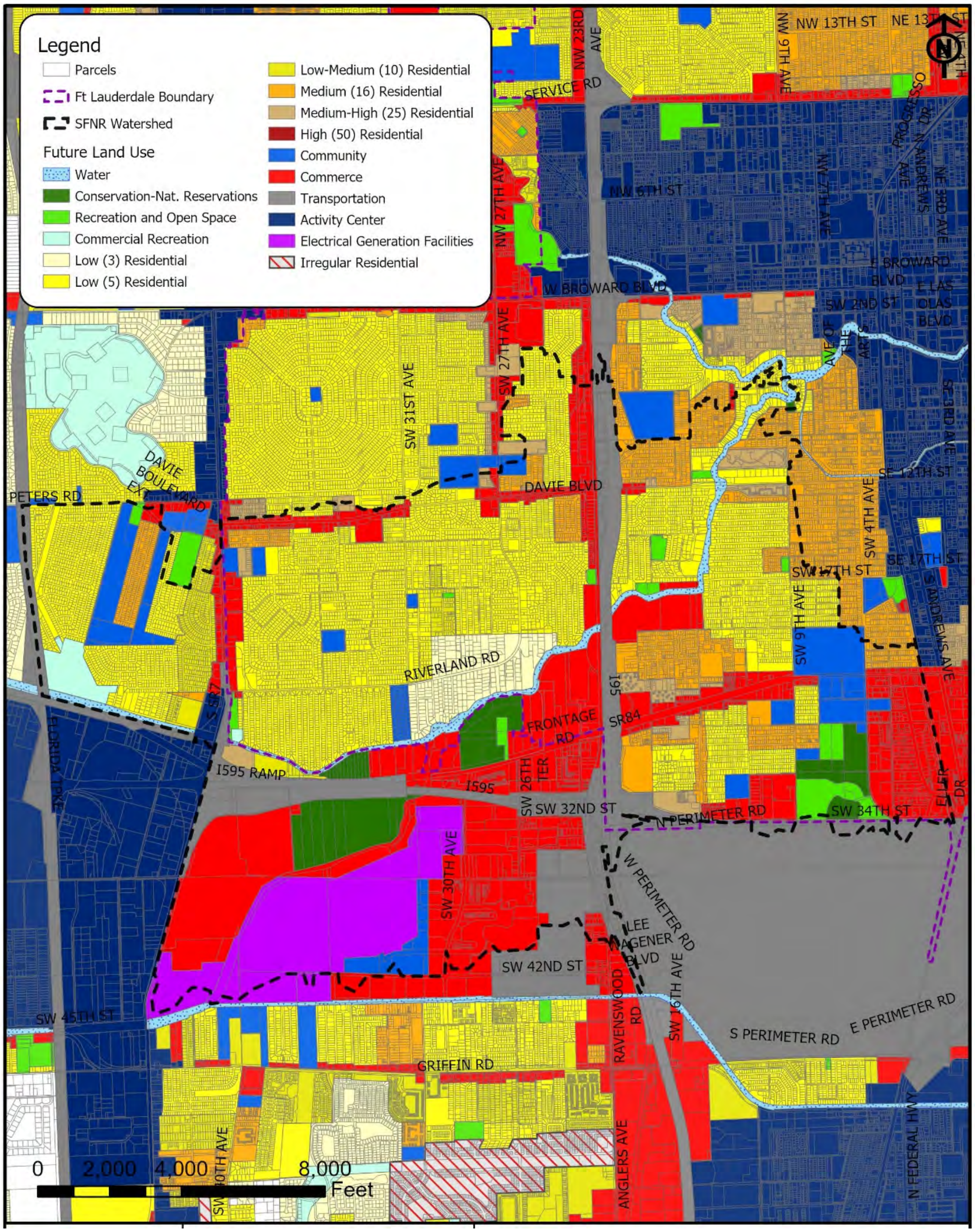
The SFNR watershed is located on the southwest part of the City of Fort Lauderdale, Florida. The watershed is approximately 9.65 square miles out of which 15.86 square miles are within the City boundaries. **Figure 8.60** illustrates the extent of the watershed.

Figure 8.60: SFNR Watershed Boundary



Land use throughout the watershed is well mix of several land use categories (low-medium residential, commercial, electrical generation facilities). The existing land use in this watershed is illustrated in **Figure 8.61**. Broward County future land use GIS data was used to develop the land use plan.

Figure 8.61: SFNR Land Use Plan



8.9.1 Asset Summary

8.9.1.1 Hard Assets

A summary of the hard assets within SFNR watershed as included in the stormwater geodatabase is presented in **Table 8.49**.

Table 8.49: Summary of Hard Assets in South Fork New River (SFNR) Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	2
Pond (1)	0
Discharge Point	180
Drainage Well	0
Exfiltration Trench (1)	
Inlet	1569
Manhole	215
Gravity Main	1778
Network Structure	98
Pollution Control Structure (1)	
Pollution Control Device	16
Pump Station	0
Weir Structure	5

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~400 ft Southward.

(3) There are 225 unknown assets under the stormwater geodatabase in this watershed.

Figure 8.62 presents the hard assets in SFNR watershed.

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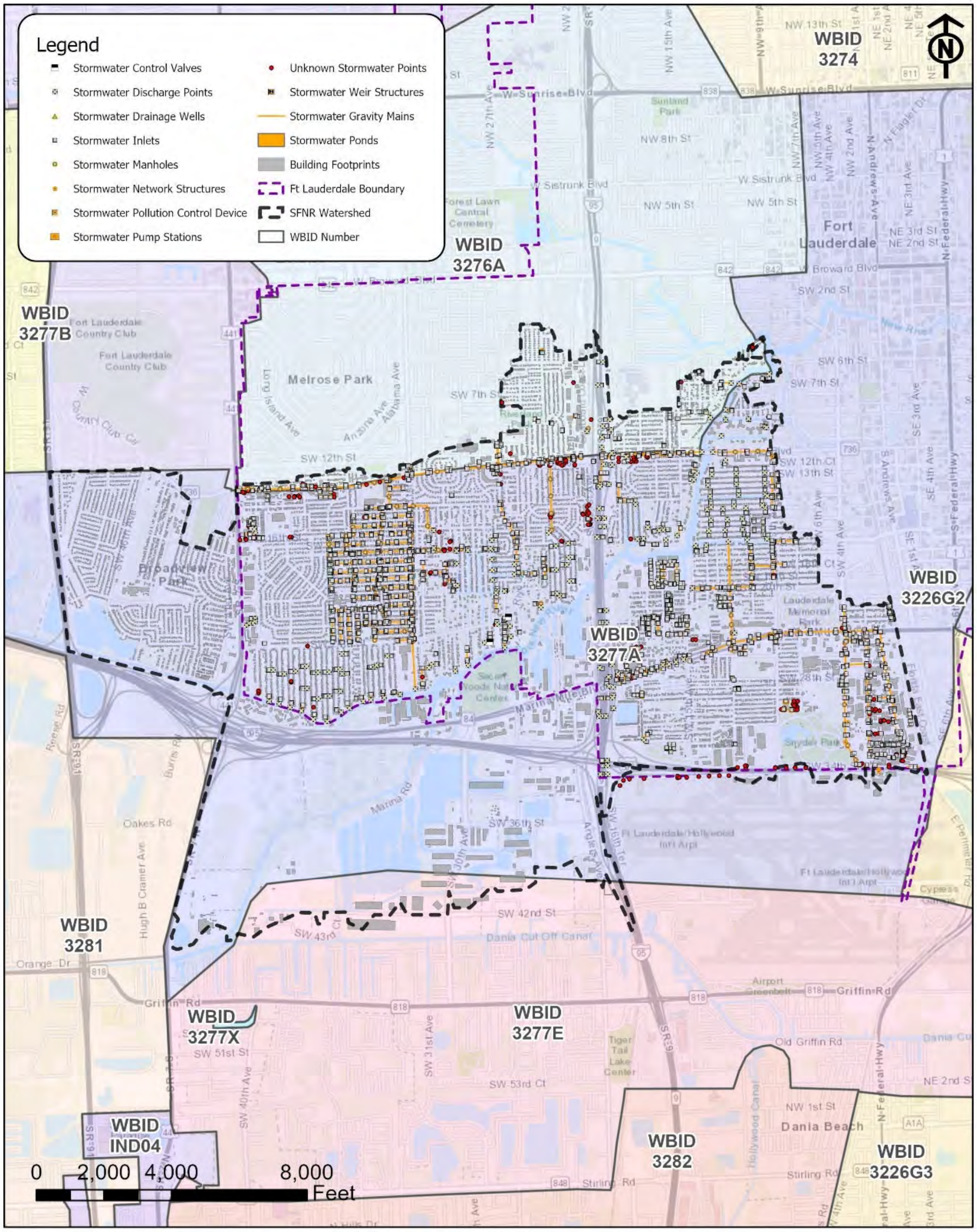
Figure 8.62: Hard Assets in SFNR



8.9.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1**. Specific soft assets for the SFNR watershed are detailed below.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.63** illustrates the SFNR Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

City Planning Documents

City planning documents that may have application in the SFNR watershed include the 2020-2024 Proposed Community Investment Plan, which include proposed projects that may impact infrastructure in the SFNR watershed including improved stormwater infrastructure for the Melrose Manor Neighborhood and a new Stormwater system, Stormwater preserve park, wetland area, and related park amenities for the River Oaks neighborhood.

Regulatory Permitting Policies & Non-Structural BMPs

As noted in **Section 1.7.1.2** NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the SFNR watershed are considered impaired as also noted on the TMDL Report in **Appendix C**. The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

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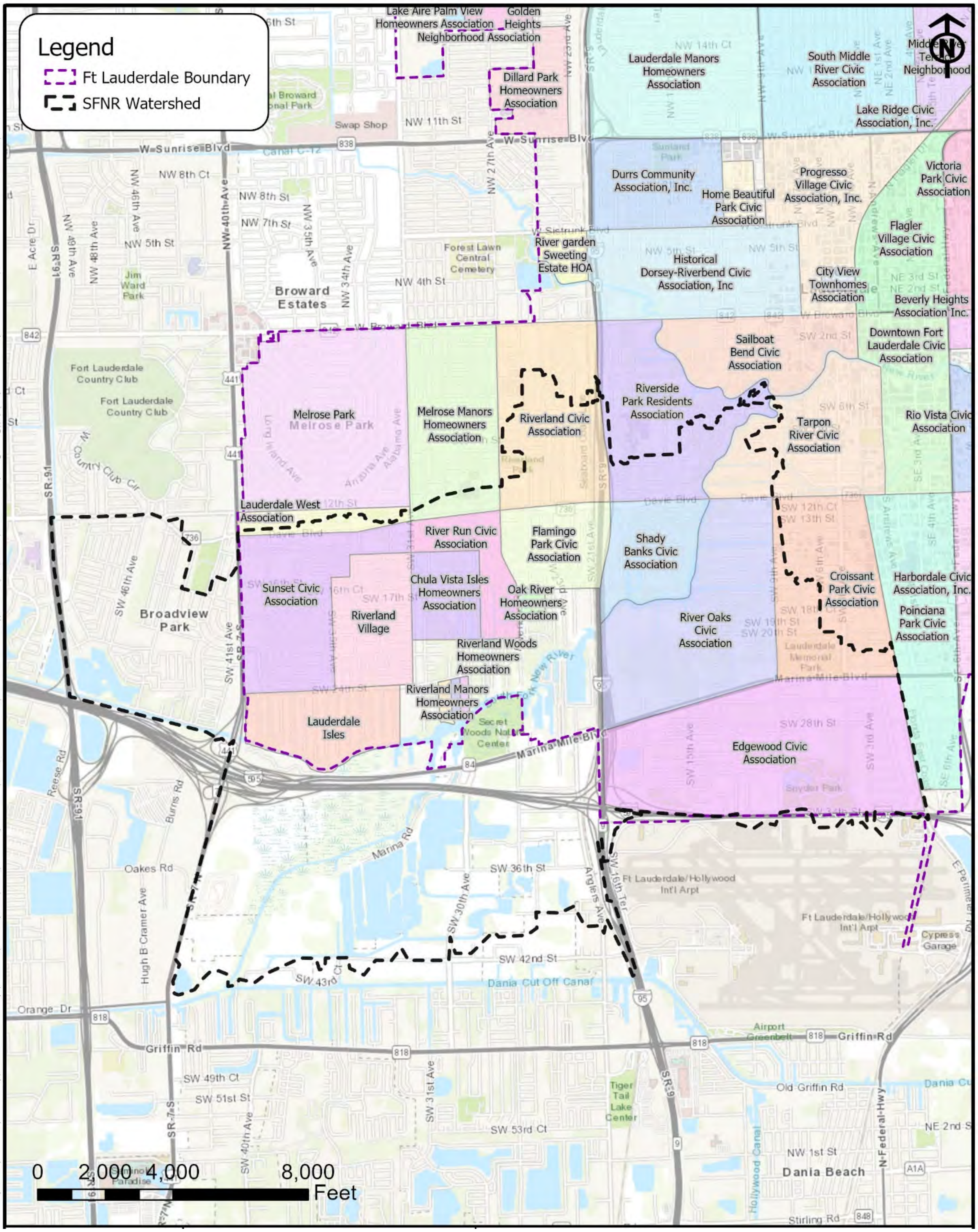
Figure 8.63: SFNR Neighborhood Associations



8.9.1.3 Natural Assets

The primary natural assets within the SFNR watershed are illustrated in **Figure 8.64**. In general, there are:

- approximately 25 reservoirs,
- 13 wetlands including the wetland under the River Oaks Stormwater and Preserve Park Project,
- 1 river – North Fork New River,
- several canals around North Fork New River,
- Osceola Creek,
- Several open areas such as the Snyder Park, Edgewood Passive Park, and Secret Woods Nature Center with a diverse variety of trees and vegetation.

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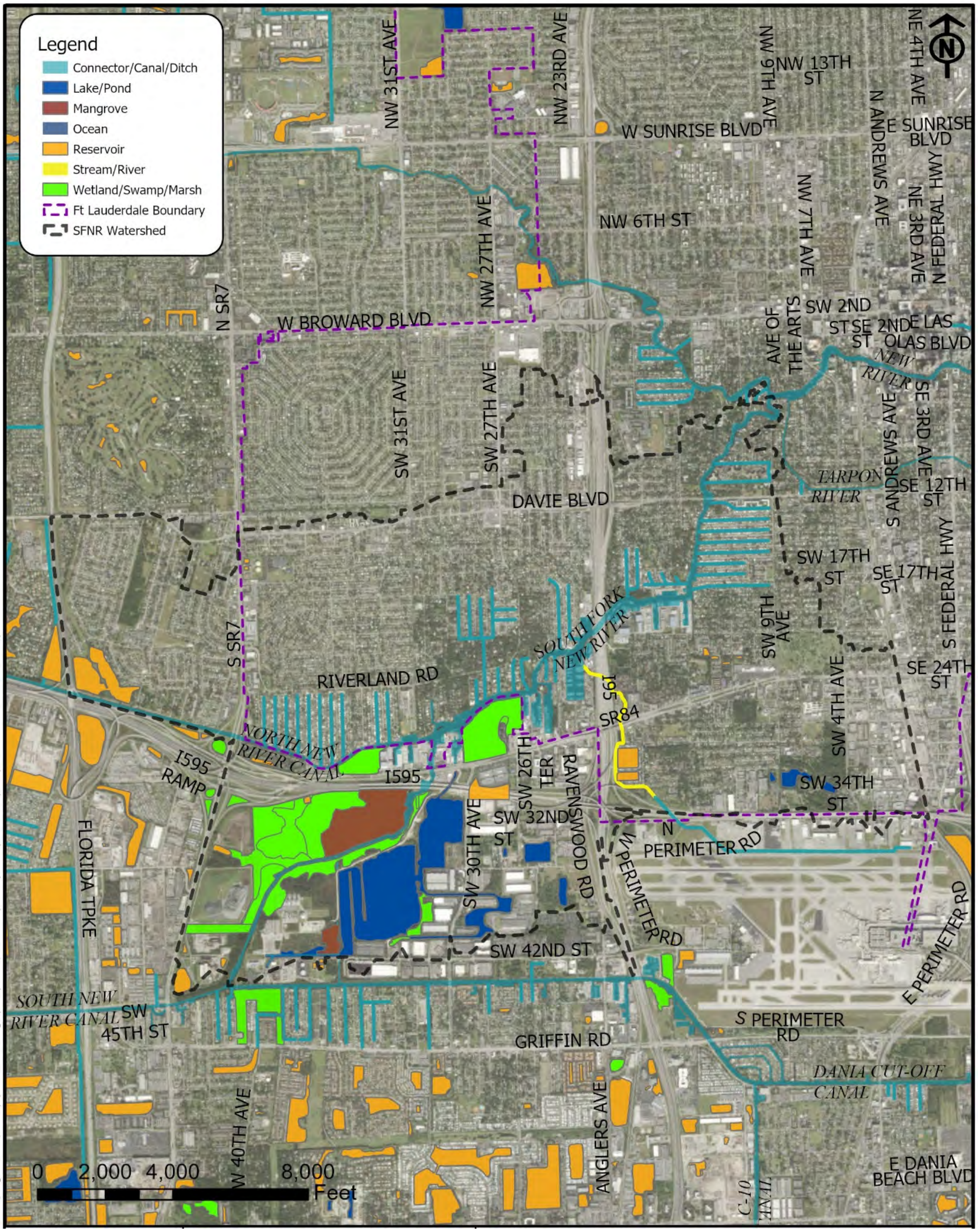
Figure 8.64: Summary of Natural Assets in South Fork New River (SFNR)Watershed



8.9.2 Watershed Challenges

Each of the ten watersheds face common and specific challenges that impact their respective Levels of Service. For example, the proposed Stormwater Master Plan improvements for the Edgewood Neighborhood and River Oaks Neighborhood addressed that much of the right of way that would typically facilitate swale drainage has not been properly graded to achieve that purpose and/or has been hardened for parking. The primary goal of the proposed improvements is to provide to this watershed, which currently has very limited stormwater management infrastructure in many areas, with a comprehensive stormwater system which will be adaptable to changing climate conditions in the future. A major objective is to redirect runoff from the low areas in central Edgewood north, through River Oaks, and ultimately to the South Fork New River. The major storm sewer trunk lines to facilitate this run along SW 9th Avenue, SW 12th Avenue, SW 28th Street, and finally SW 15th Avenue (which will continue on through River Oaks). Tertiary storm sewers will collect and direct flow toward these major lines. Swales and permeable pavement will be utilized where possible to increase storage, promote infiltration and reduce nuisance flooding. Improvements in the western section of Edgewood will help to direct flow toward Osceola Creek and move it more efficiently toward the South Fork New River. Maintenance improvements to the Osceola canal itself are also intended. In the eastern section of Edgewood, selective pipe upsizing and the installation of permeable pavement and exfiltration trench will be used to reduce road flooding in the industrial area. Proposed improvements are intended to reduce flood stage and time of inundation above road crowns for a 10 year-24 hour design storm event and to protect against structural flooding in a 100 year-72 hour storm event where feasible.

The challenges faced by this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.50**.

Table 8.50: SFNR Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Undersized and limited stormwater infrastructure	Undersized stormwater infrastructure due to development; some limited areas with exfiltration trenches and limited outfall capacity	Upsize stormwater infrastructure; use tertiary storm sewers to collect and direct flow toward major storm sewer trunk lines to redirect runoff from the low areas in central Edgewood north, through River Oaks, and ultimately to the South Fork New River.
		Swales and permeable pavement will be utilized where possible to increase storage, promote infiltration and reduce nuisance flooding.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from the same channel.	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Waterways pollution control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Install exfiltration trenches, restored swales, permeable pavement), and specifically designed water quality structures.

8.9.3 Asset Ownership and Inventory

Table 8.51 summarizes the hard assets in SFNR per asset ownership.

Table 8.51: Asset Inventory and Ownership in South Fork New River (SFNR) Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	2	2	0	0
Pond (1)	0	0	0	0
Discharge Point	180	113	66	1
Drainage Well	0	0	0	0
Exfiltration Trench (1)				
Inlet	1569	967	494	108
Manhole	215	99	88	28
Gravity Main	1778	1059	529	190
Network Structure	98	61	36	1
Pollution Control Structure (1)				
Pollution Control Device	16	1	0	15
Pump Station	0	0	0	0
Unknown Point	225	0	0	225
Weir Structure	5	1	1	3

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) Assets were buffered outside of boundary by ~400 ft Southward.

8.9.4 What is the Condition and Performance of the Assets?

8.9.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the SFNR Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.9.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

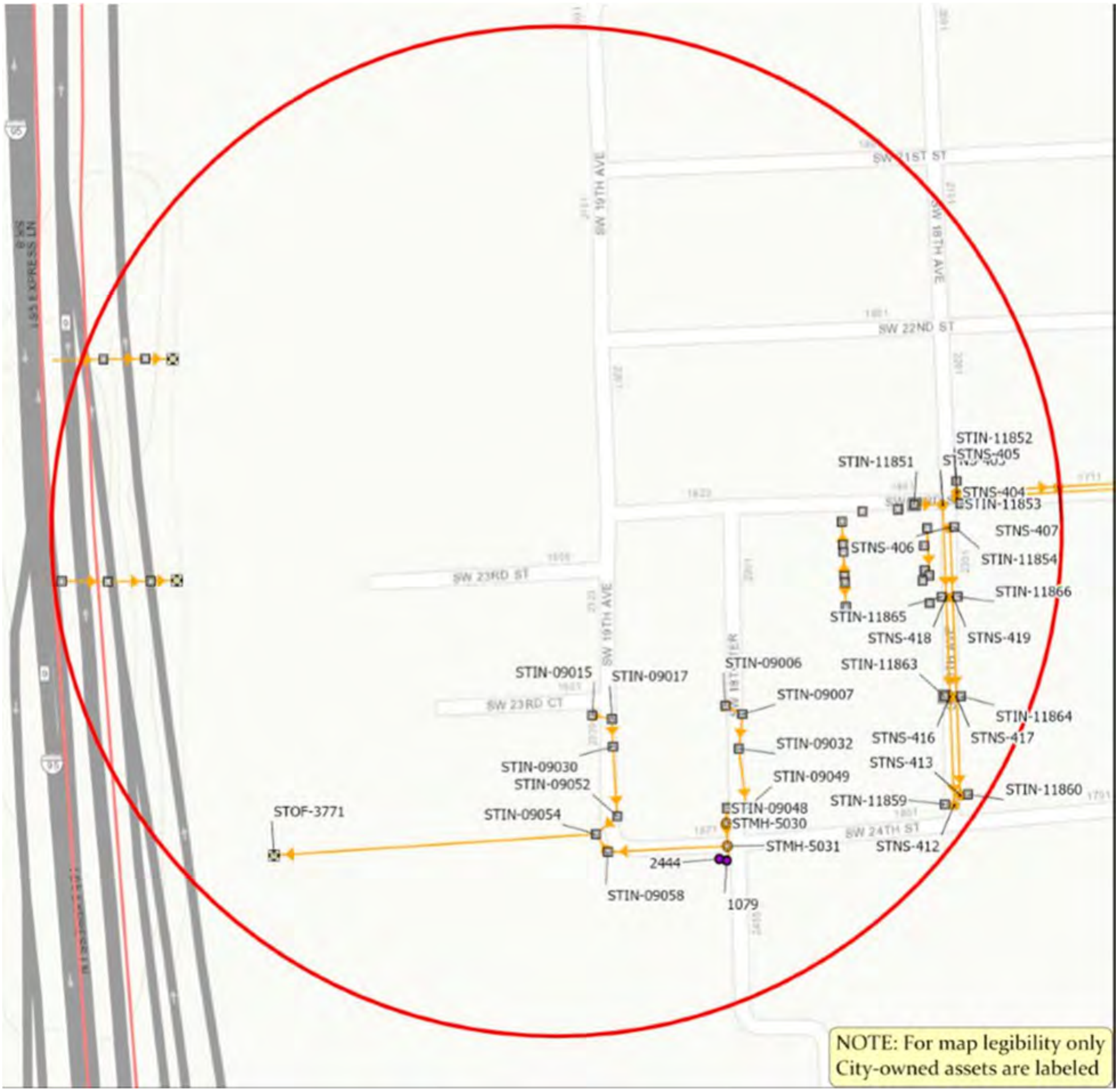
The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.52** shows the CoF Score by class used in this analysis.

Table 8.52: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the SFNR Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius around the SW 19th Avenue / SW 23rd Street Intersection, as shown in **Figure 8.65.**

Figure 8.65: SFNR Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the SFNR Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score. For the section selected, there are no City-owned stormwater assets.

8.9.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.53** provides the overall representation of the SFNR Watershed data subset used for this analysis.

Table 8.53: SFNR Watershed CoF (Example)

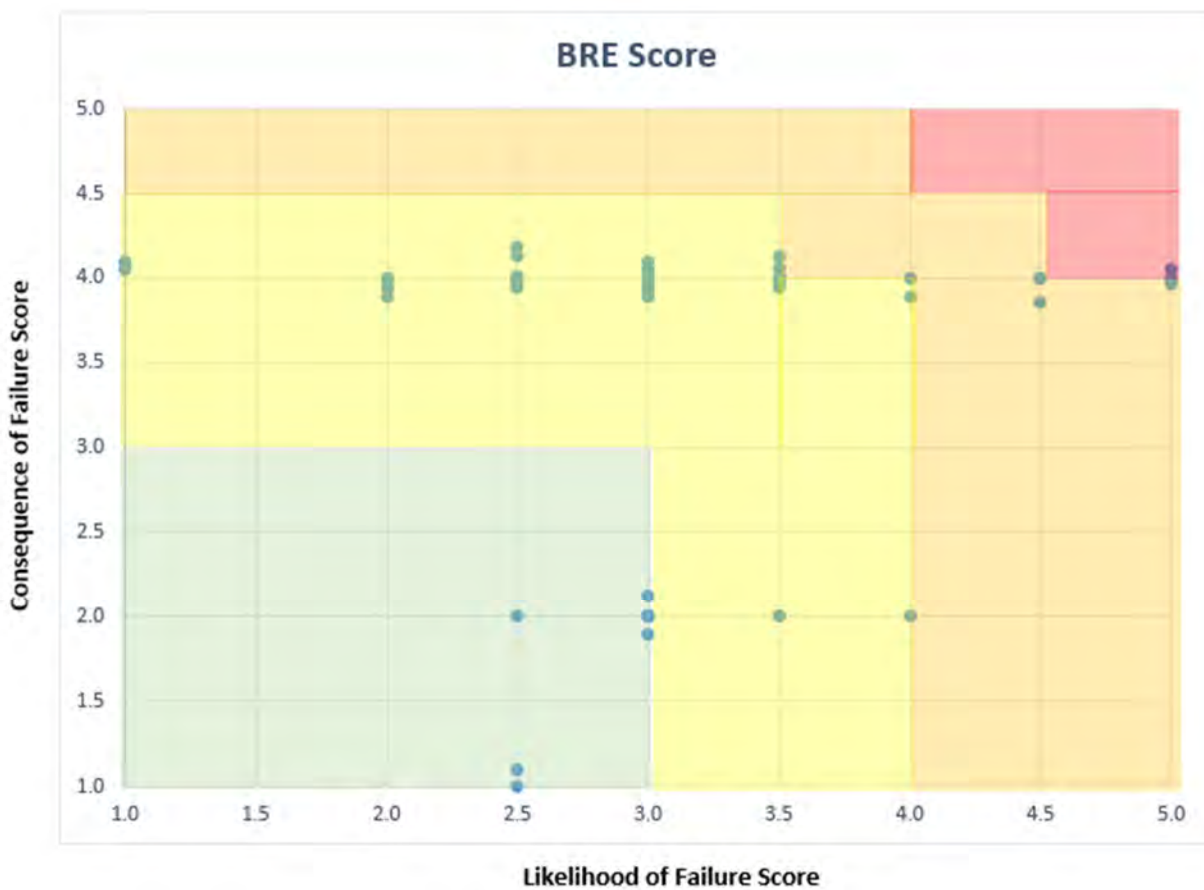
Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
SNFR	Gravity Main	City	STMN-07626	1.0	4.05	4.05		
SNFR	Gravity Main	City	STMN-07627	1.0	4.10	4.10		
SNFR	Gravity Main	City	STMN-07628	3.0	3.92	11.76		
SNFR	Gravity Main	City	STMN-07629	3.5	3.98	13.93		
SNFR	Gravity Main	City	STMN-07630	3.0	4.00	12.00		
SNFR	Gravity Main	City	STMN-07631	2.5	4.00	10.00		
SNFR	Gravity Main	City	STMN-07632	3.0	3.89	11.67		
SNFR	Gravity Main	City	STMN-07633	2.5	4.18	10.45		
SNFR	Gravity Main	City	STMN-07634	3.0	3.95	11.85		
SNFR	Gravity Main	City	STMN-07635	3.0	4.00	12.00		
SNFR	Gravity Main	City	STMN-13569	3.0	3.93	11.79		
SNFR	Gravity Main	City	STMN-13570	3.5	4.00	14.00		
SNFR	Gravity Main	City	STMN-13571	3.0	4.00	12.00		
SNFR	Gravity Main	City	STMN-14633	4.0	3.89	15.56		
SNFR	Gravity Main	City	STMN-14634	3.5	4.01	14.04		
SNFR	Gravity Main	City	STMN-14635	3.0	4.00	12.00		
SNFR	Gravity Main	City	STMN-14636	3.0	3.98	11.94		
SNFR	Gravity Main	City	STMN-14637	2.5	4.00	10.00		
SNFR	Gravity Main	City	STMN-14639	2.5	4.13	10.33		
SNFR	Gravity Main	City	STMN-14641	3.5	4.07	14.25		
SNFR	Gravity Main	City	STMN-14644	4.5	3.86	17.37		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
SNFR	Gravity Main	City	STMN-14645	5.0	3.98	19.90		
SNFR	Gravity Main	City	STMN-14648	5.0	4.00	20.00		
SNFR	Gravity Main	City	STMN-14649	3.0	4.03	12.09		
SNFR	Gravity Main	City	STMN-14650	3.5	4.00	14.00		
SNFR	Gravity Main	City	STMN-14651	3.0	3.93	11.79		
SNFR	Gravity Main	City	STMN-14652	2.0	3.95	7.90		
SNFR	Gravity Main	City	STMN-14653	2.0	4.00	8.00		
SNFR	Gravity Main	City	STMN-14654	2.5	3.97	9.93		
SNFR	Gravity Main	City	STMN-14655	3.0	4.05	12.15		
SNFR	Gravity Main	City	STMN-14656	3.0	4.00	12.00		
SNFR	Gravity Main	City	STMN-14657	3.5	4.00	14.00		
SNFR	Inlet	City	STIN-09015	3.5	4.00	14.00		
SNFR	Inlet	City	STIN-09017	3.0	4.10	12.30		
SNFR	Inlet	City	STIN-09030	2.0	4.00	8.00		
SNFR	Inlet	City	STIN-09052	2.0	4.00	8.00		
SNFR	Inlet	City	STIN-09006	2.5	3.95	9.88		
SNFR	Inlet	City	STIN-09007	3.0	4.00	12.00		
SNFR	Inlet	City	STIN-09032	3.0	3.93	11.79		
SNFR	Inlet	City	STIN-09049	3.5	3.95	13.83		
SNFR	Inlet	City	STIN-09048	4.5	4.00	18.00		
SNFR	Inlet	City	STIN-09054	5.0	3.97	19.85		
SNFR	Inlet	City	STIN-11851	5.0	4.05	20.25		
SNFR	Inlet	City	STIN-11852	3.0	4.00	12.00		
SNFR	Inlet	City	STIN-11853	3.5	4.00	14.00		
SNFR	Inlet	City	STIN-11854	3.0	4.00	12.00		
SNFR	Inlet	City	STIN-11859	2.0	3.95	7.90		
SNFR	Inlet	City	STIN-11860	2.0	3.89	7.78		
SNFR	Inlet	City	STIN-11863	2.5	4.01	10.03		
SNFR	Inlet	City	STIN-11864	3.0	4.00	12.00		
SNFR	Inlet	City	STIN-11865	3.0	3.98	11.94		
SNFR	Inlet	City	STIN-11866	3.5	4.00	14.00		
SNFR	Inlet	City	STIN-09058	3.5	4.13	14.46		
SNFR	Manhole	City	STMH-5030	4.0	4.00	16.00		
SNFR	Manhole	City	STMH-5031	4.5	4.00	18.00		
SNFR	Network Structure	City	STNS-403	3.0	2.00	6.00		
SNFR	Network Structure	City	STNS-404	3.5	2.00	7.00		
SNFR	Network Structure	City	STNS-405	4.0	2.00	8.00		
SNFR	Network Structure	City	STNS-406	3.0	2.00	6.00		
SNFR	Network Structure	City	STNS-407	3.0	2.00	6.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
SNFR	Network Structure	City	STNS-412	2.5	2.00	5.00		
SNFR	Network Structure	City	STNS-413	3.0	2.00	6.00		
SNFR	Network Structure	City	STNS-416	3.0	1.89	5.67		
SNFR	Network Structure	City	STNS-417	3.0	2.12	6.36		
SNFR	Network Structure	City	STNS-418	3.5	2.00	7.00		
SNFR	Network Structure	City	STNS-419	3.0	2.00	6.00		
SNFR	Discharge Point	City	STOF-3771	3.0	4.00	12.00		
SNFR	Pollution Control Structure	City	STCV-122	2.5	1.10	2.75		
SNFR	Pollution Control Structure	City	STCV-126	2.5	1.00	2.50		

A representative BRE plot is shown in **Figure 8.66**.

Figure 8.66: SFNR Watershed Business Risk Exposure by Asset (Example)



8.9.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LoF, the City will select one of the following O&M strategies: Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.54** shows examples of the LoS and strategies for hard assets.

Table 8.54: SFNR Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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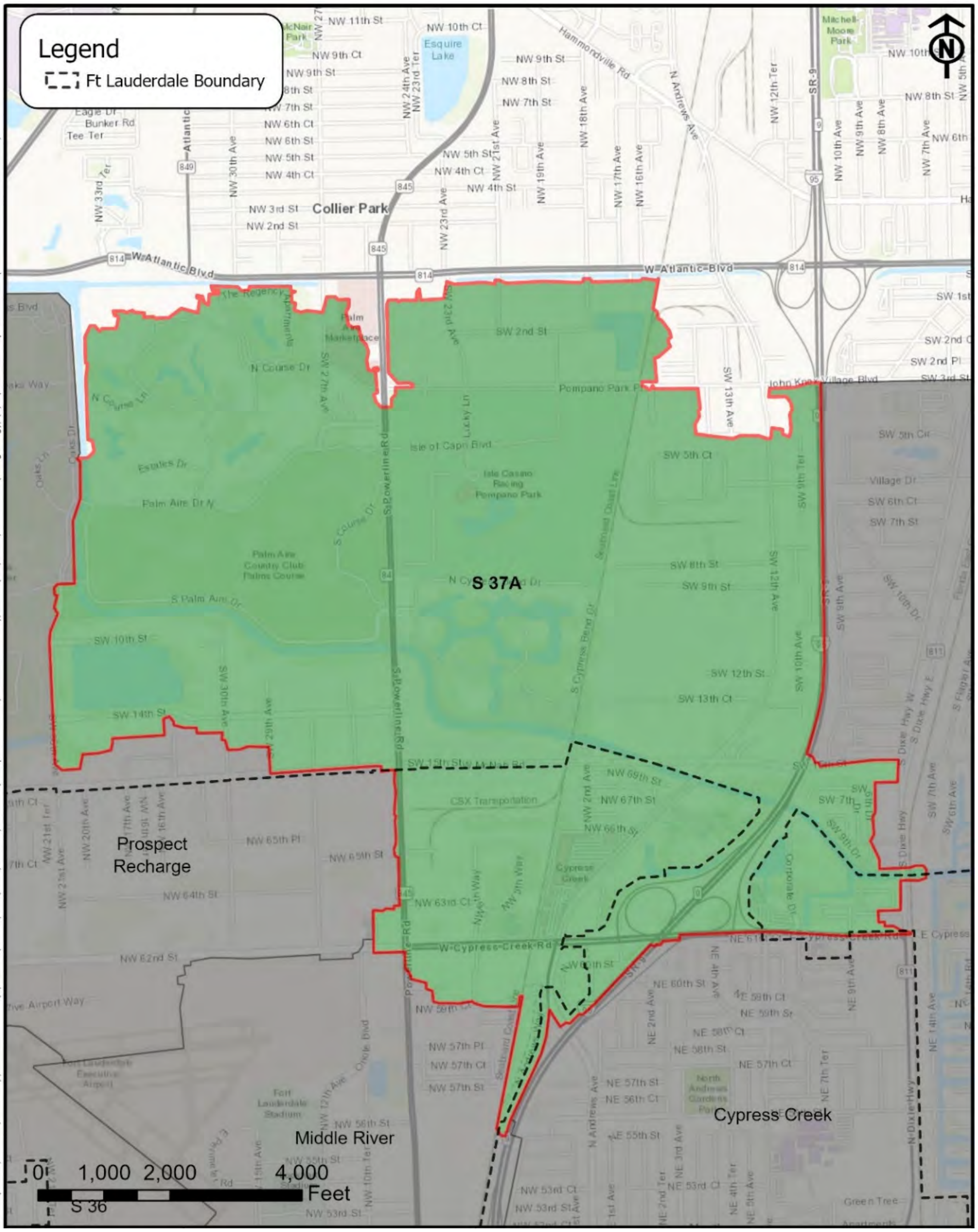
8.10 UPTOWN S 37A

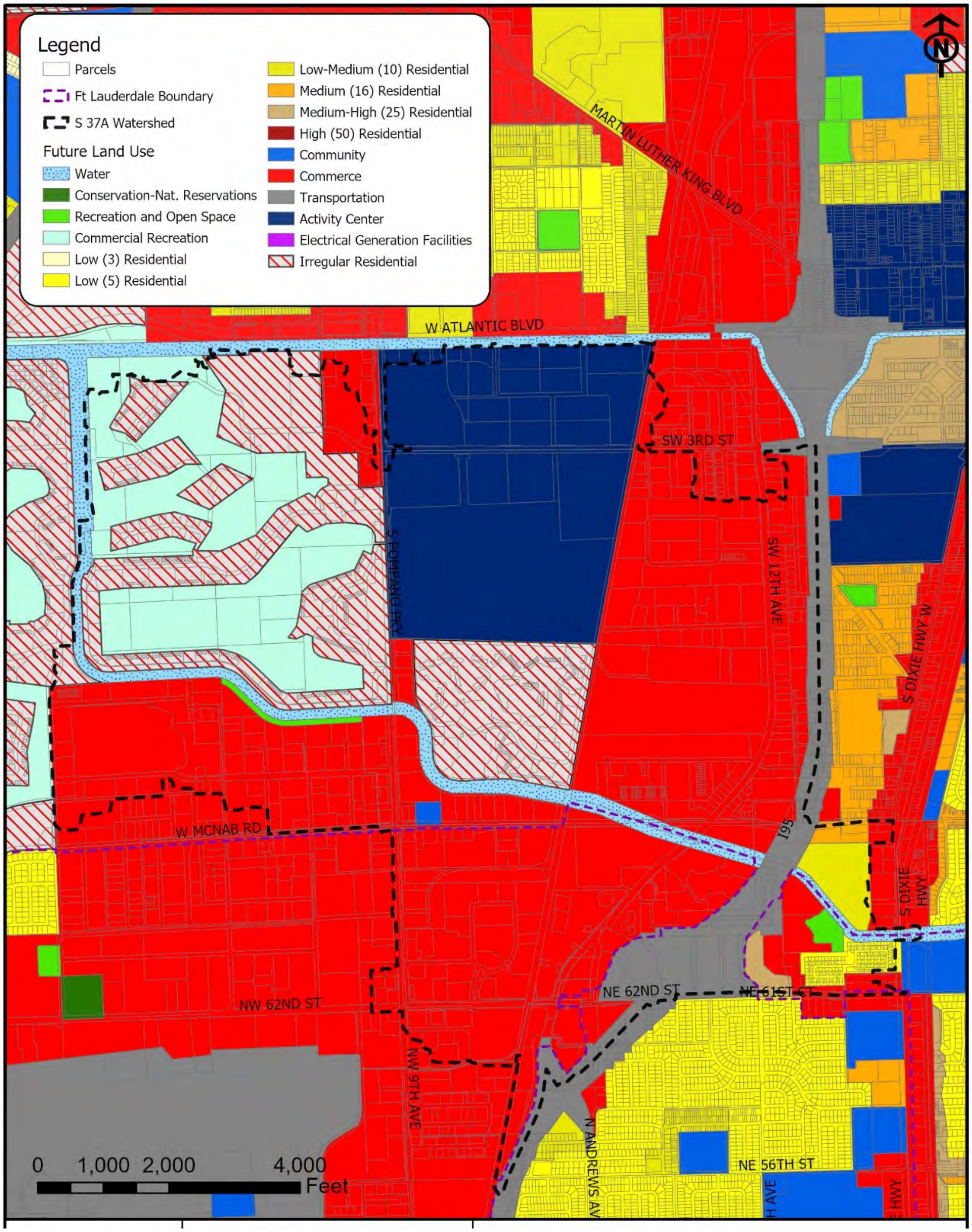
The Uptown S 37A (S 37A) watershed is located on the mid-north part of the City of Fort Lauderdale, Florida. The watershed is approximately 3.54 square miles out of which 0.63 square miles are within the City boundaries. **Figure 8.67** illustrates the extent of the watershed.

Figure 8.67: S37A Watershed Boundary



Land use throughout the watershed is primarily commercial. The existing land use in this watershed is illustrated in **Figure 8.68** Broward County future land use GIS data was used to develop the land use plan.

Figure 8.68: S 37A Land Use Plan



8.10.1 Asset Summary

8.10.1.1 Hard Assets

A summary of the hard assets within S 37A watershed as included in the stormwater geodatabase is presented in **Table 8.55**.

Table 8.55: Summary of Hard Assets in Uptown S 37A Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory
Control Valve	0
Pond [(1)]	0
Discharge Point	5
Drainage Well	0
Exfiltration Trench [(1)]	
Inlet	91
Manhole	51
Gravity Main	178
Network Structure	28
Pollution Control Structure [(1)]	
Pollution Control Device	1
Pump Station	0
Weir Structure	19

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

(2) There are 64 unknown assets under the stormwater geodatabase in this watershed.

Figure 8.69 presents the hard assets in S 37A watershed.

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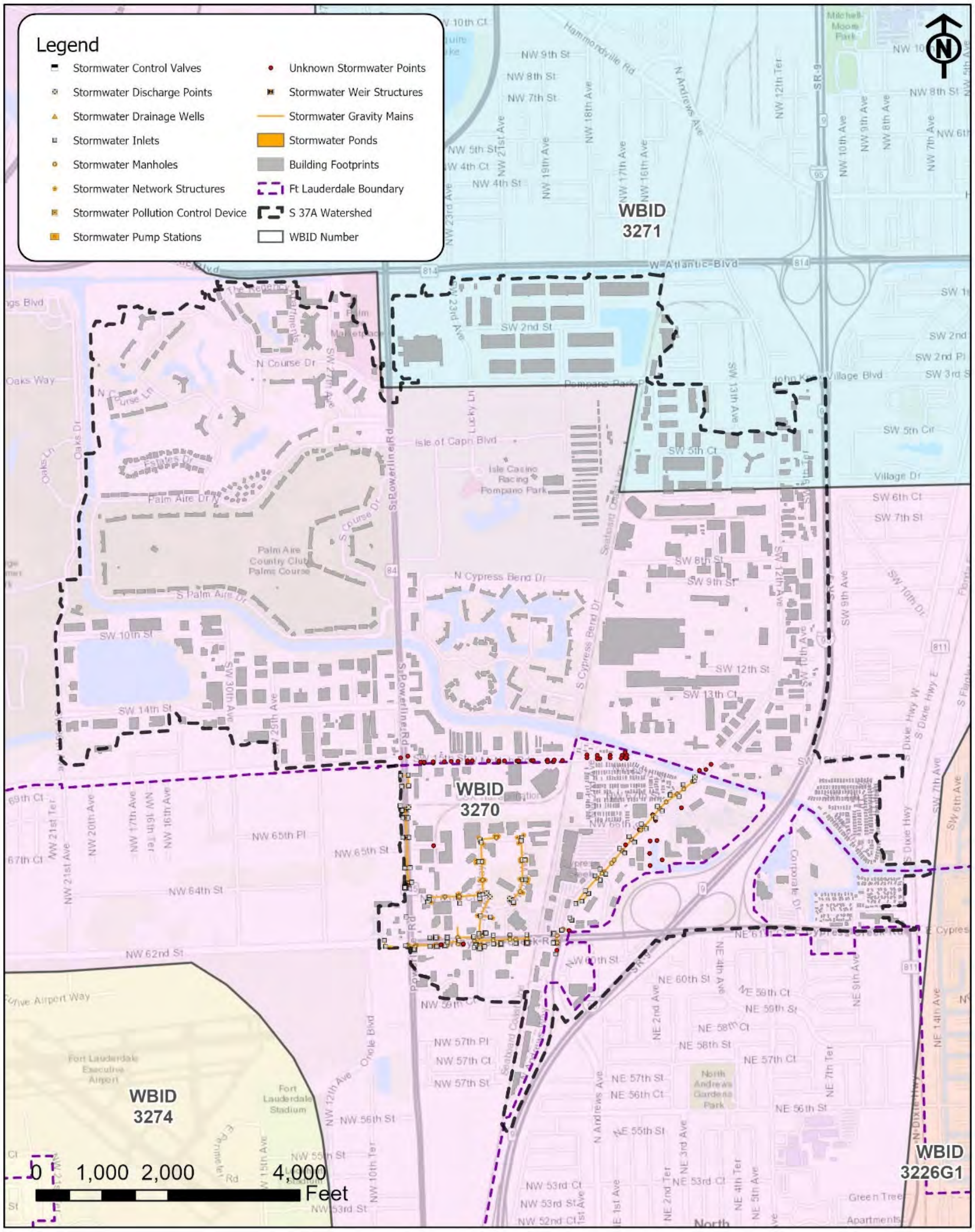
Figure 8.69: Hard Assets in S 37A Watershed (2019 Stormwater Geodatabase)



8.10.1.2 Soft Assets

A summary of soft assets that applies to all watersheds is included in **Section 2.1.2.1**. Specific soft assets for the S 37A watershed are detailed below.

Regulatory Permitting Policies & Non-Structural BMPs

As noted in Section 1.7.1.2 NPDES and Water Quality, the City has established goals related to overall improvement of subject surface waters that have been identified as impaired by the US EPA and FDEP. Water bodies within the S 37A watershed are considered impaired as also noted on the TMDL Report in **Appendix C**. The City has an ongoing partnership with Broward County to perform a comprehensive water quality study to evaluate and monitor the effects of stormwater on the water quality of canals and rivers within the City.

Good Will Relationships & Public Credibility with Neighbors

Goodwill relationships and credibility with the public and community partners regarding the performance of the City watershed management activities including flood risk and water quality management are measured annually by the Neighbor Survey. **Figure 8.70** illustrates the S 37A Neighborhood Associations (HOAs). **Appendix D** presents the Neighborhood Associations citywide.

In addition, the success of education and outreach activities undertaken to build goodwill relationships with neighbors will be measured via neighbor survey results, the number of neighbor complaints, and involvement of the public on community outreach meetings.

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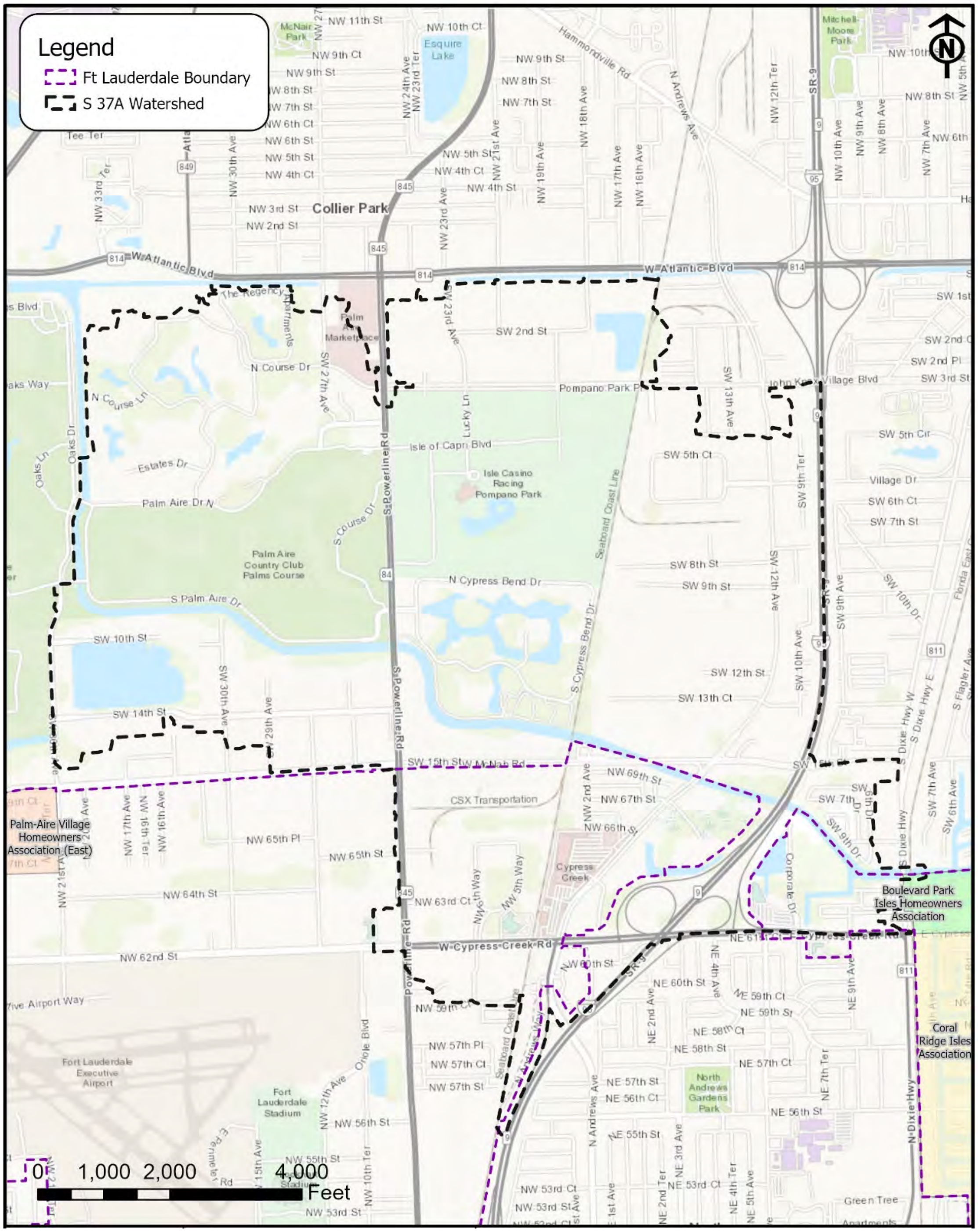
Figure 8.70: S 37A Watershed Neighborhood Associations



8.10.1.3 Natural Assets

A summary of the primary natural assets within the S 37A watershed are illustrated in **Figure 8.71**. In general, there are:

- approximately 39 reservoirs,
- 6 wetlands,
- open areas including a portion of the Palm Aire Country Club with trees, and
- one main canal – Cypress Creek Canal

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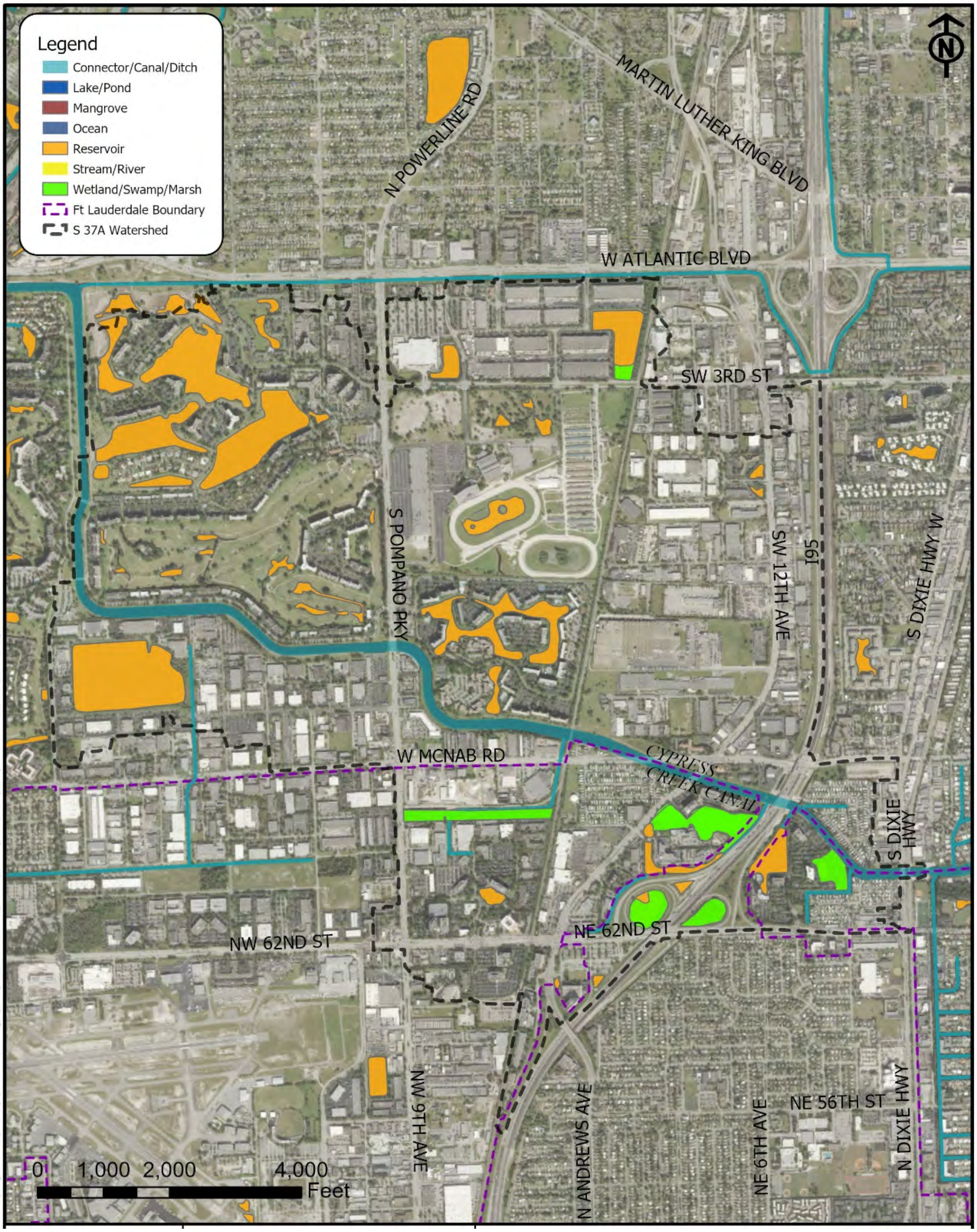
Figure 8.71: Summary of Natural Assets in S 37A Watershed



8.10.2 Watershed Challenges

Some challenges in this watershed and the respective stormwater design and operation and maintenance solutions are outlined in **Table 8.56**.

Table 8.56: S 37A Watershed Challenges and Solutions

Challenge Source	Challenge Description	Stormwater Design and Operation Solution(s)
Sea Wall	Ownership determination	2018 Seawall Master Plan, which identifies all City-owned seawalls.
	Ordinance compliance and enforcement	The City adopted an ordinance (homeowners in the eastern portion of the Middle River Watershed) requiring property owners to elevate the height and ensure the functionality of their seawall.
	Seawall replacement prioritization	Replace/elevate seawalls as per established priority.
Water Pollution Control	Runoff contains water pollutants and floating debris that could potentially contaminate waterways	Enhancement of the existing swale areas to provide better surface infiltration to reduce stormwater runoff and the number of suspended solids that enter the storm sewer system.
Undersized stormwater infrastructure	Undersized stormwater infrastructure due to development	Upsize stormwater infrastructure; install stormwater pump station.
High Groundwater Table	Limits storage and water quality treatment options	Installation of new outfalls, permeable pavers, or stormwater storage areas.
City Stormwater interfaces with adjacent cities	Stormwater assets do not always end at the City limits. This results in co-responsibility for the asset that may feed to or receive stormwater from the City or the feeder assets from the same channel	Identify and document all interfaces and establish the condition at the points of intersection. Reach agreement and coordinate with adjacent communities to share asset management responsibilities for areas of intersection
Reservoir	Saltwater intrusion	Manage wellfield pumpage, relocate wells and monitor saltwater monitoring wells

8.10.2.1 Identification and Prioritization of Challenges

Each of the ten watersheds has unique challenges that will compete for City resources (financial and human). During the implementation phase of the WAMP, the selected LoS will be optimized in order to meet water quality requirements and maintain stormwater best management practices. A prioritization and LoS optimization tracking mechanism will be established to assess operation and asset maintenance performance against LoS delivery.

8.10.3 Asset Ownership and Inventory

Table 8.57 summarizes the hard assets in S 37A per asset ownership.

Table 8.57: Asset Inventory and Ownership in Uptown S 37A Watershed (2019 Stormwater Geodatabase)

Existing Feature Classes	Total Asset Inventory	City-Owned Asset Inventory	Non-City Owned Asset Inventory	Unidentified Ownership Asset Inventory
Control Valve	0	0	0	0
Pond (1)	0	0	0	0
Discharge Point	5	3	1	1
Drainage Well	0	0	0	0
Exfiltration Trench (1)				
Inlet	91	25	60	6
Manhole	51	7	1	43
Gravity Main	178	60	19	99
Network Structure	28	28	0	0
Pollution Control Structure (1)				
Pollution Control Device	1	0	0	1
Pump Station	0	0	0	0
Unknown Point	64	0	0	64
Weir Structure	19	0	6	13

(1) GIS Schema does not contain asset inventory at this point. Asset class is under development or developed for future attribute population.

8.10.4 What is the Condition and Performance of the Assets?

8.10.4.1 Proposed Condition Assessment Plan

The condition of the assets must be assessed in order to determine the overall Likelihood of Failure (LoF) of each asset. To determine the condition of the asset, each asset must be visually inspected and given a condition score of 1 (excellent shape) to 5 (needs to be replaced). In order to develop the asset risks in the S 37A Watershed, the Hazen team used assumed various LoF scores for the assets in the watershed subsection reviewed. The LoF cannot actually be determined at this point in time, as it requires an actual condition assessment be performed on the assets followed by an estimate of the asset's remaining useful life and an estimate of the asset's capacity, where applicable.

Recognizing that the City's ability to perform condition assessments on all assets in every watershed is both financially and resource constrained, the City will need to prioritize and stage condition assessment through a series of phases and protracted timeline as part of the plan. It is recommended that the staging of asset condition assessments be approached and planned as discussed in **Section 8.1.4.1**, which will help the City focus its resources on assessing the condition of the most critical assets first. Where an asset can have a capacity rating, the capacity should be reviewed to determine how efficient the asset is operating. Finally, an estimated remaining useful life for each asset should be determined. These components are discussed in detail in **Section 2.2**.

8.10.5 What is the Criticality of the Assets?

Calculation of an asset's criticality, or Consequence of Failure (CoF), is an important factor for determining the overall asset risk. An asset's criticality is based upon three major factors: social, environmental, and economic. These three major factors are referred to as the triple bottom line. Calculation of the CoF is discussed in detail in **Section 2**.

The Hazen team estimated a CoF for each asset class. This CoF score was used across all the watersheds. **Table 8.58** shows the CoF Score by class used in this analysis.

Table 8.58: CoF Scores by Asset Class (Example)

Asset Class	CoF Score
Control Valve	5
Pond	3
Discharge Point	4
Drainage Well	4
Exfiltration Trench	2
Inlet	4
Manhole	4
Gravity Main	4
Network Structure	2
Pollution Control Structure	1
Pump Station	4
Weir Structure	1

After the initial CoF class score was developed for each asset class, the Hazen team reviewed the S 37A Watershed and, in conjunction with the City, identified a small subset of the watershed on which to perform an example CoF analysis. This subset was a 500-foot radius north of NW 62nd St on NW 6th Way as shown in **Figure 8.72**.

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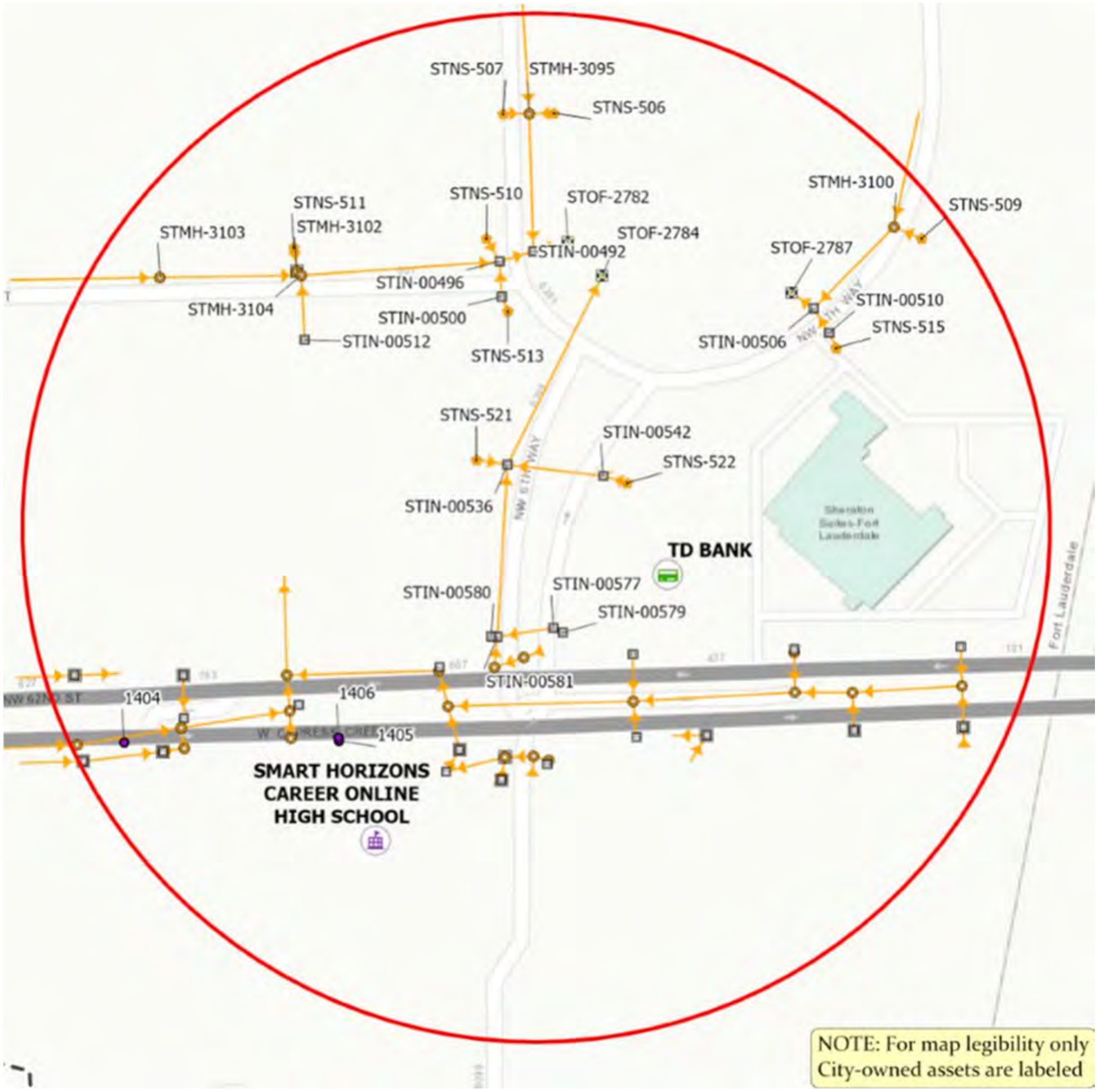
Figure 8.72: S 37A Watershed Data Subset Used for CoF Analysis



The various City stormwater assets within this section were identified by asset ID, placed into an initial asset register, then placed on a map. Note that this analysis included only City-owned assets; no State or private assets were included.

In order to provide guidance on establishing full CoF scores, after the initial asset register was established, the Hazen team reviewed the subset of assets in the S 37A Watershed assets and estimated the CoF score for each asset based upon asset class. The Hazen team modified the scores of the individual assets to demonstrate what the CoF may look like when actually implemented.

Within the watershed section identified, the Hazen team reviewed the area to identify any potential critical facilities. Critical facilities included buildings/locations such as a hospital, government building, fire or police station, educational facility, or bus stop. The purpose of identifying critical assets is to be able to uniquely review the critical asset and determine if the CoF score for a specific asset should be modified to a high criticality from its initial CoF score. For the section selected, there are no City-owned stormwater assets.

8.10.6 What is the Risk of the Assets?

Using the CoF and LoF scores, a representative Business Risk Exposure (BRE) score can be calculated using the following formula:

BRE = LoF x CoF

When all of the information is entered into the asset register, the City will have a complete picture of what is making up the risk score for each asset. **Table 8.59** provides the overall representation of the S 37A Watershed data subset used for this analysis.

Table 8.59 S 37A Watershed CoF (Example)

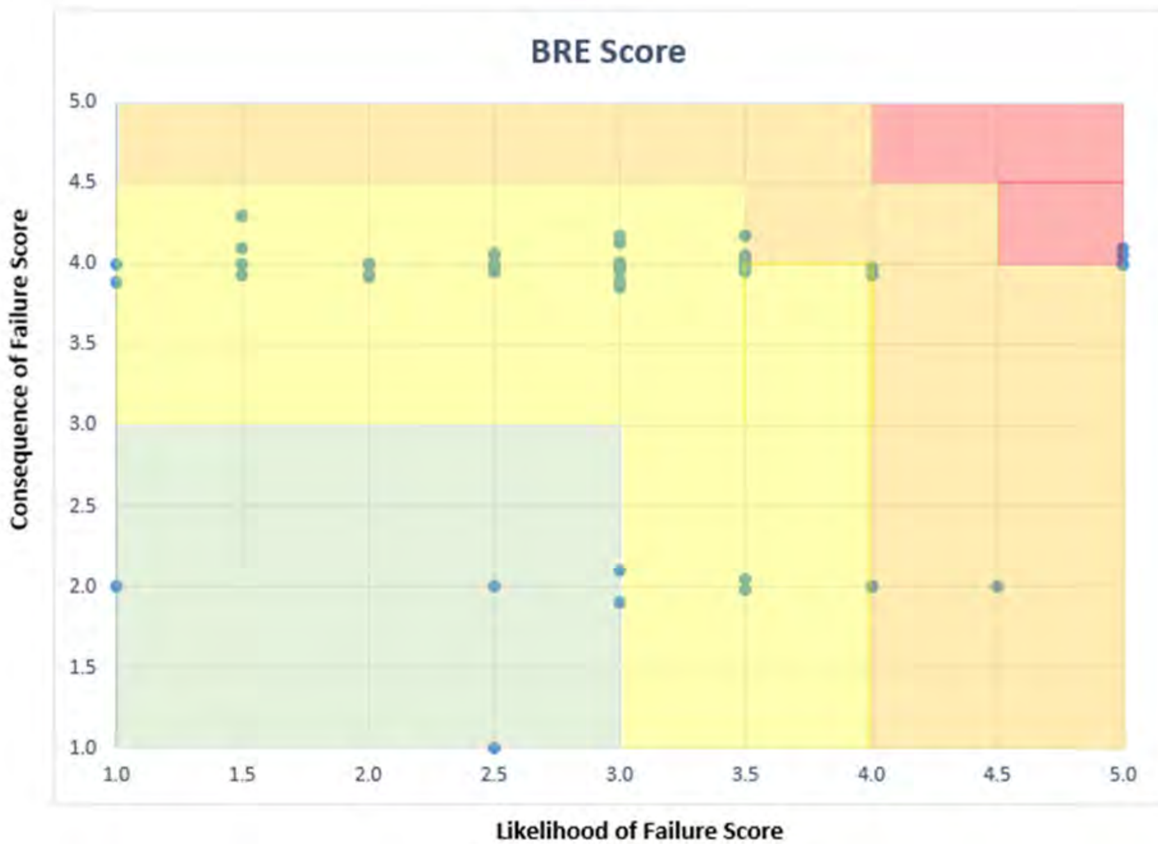
Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
S 37A	Gravity Main	City	STMN-03825	4.0	3.98	15.92		
S 37A	Gravity Main	City	STMN-03826	5.0	4.00	20.00		
S 37A	Gravity Main	City	STMN-03827	5.0	4.00	20.00		
S 37A	Gravity Main	City	STMN-03829	3.0	3.89	11.67		
S 37A	Gravity Main	City	STMN-03834	3.5	4.18	14.63		
S 37A	Gravity Main	City	STMN-03835	3.0	3.95	11.85		
S 37A	Gravity Main	City	STMN-03836	2.0	4.00	8.00		
S 37A	Gravity Main	City	STMN-03838	2.0	3.93	7.86		
S 37A	Gravity Main	City	STMN-03839	2.5	3.95	9.88		
S 37A	Gravity Main	City	STMN-03840	3.0	4.00	12.00		
S 37A	Gravity Main	City	STMN-03841	3.0	3.97	11.91		
S 37A	Gravity Main	City	STMN-03842	3.5	4.05	14.18		
S 37A	Gravity Main	City	STMN-03843	3.0	4.00	12.00		
S 37A	Gravity Main	City	STMN-03844	2.0	4.00	8.00		
S 37A	Gravity Main	City	STMN-03845	1.5	4.00	6.00		
S 37A	Gravity Main	City	STMN-03846	5.0	4.10	20.50		
S 37A	Gravity Main	City	STMN-03847	5.0	4.05	20.25		
S 37A	Gravity Main	City	STMN-03848	1.5	4.10	6.15		
S 37A	Gravity Main	City	STMN-03849	2.0	3.92	7.84		
S 37A	Gravity Main	City	STMN-03850	3.0	3.98	11.94		
S 37A	Gravity Main	City	STMN-03852	3.5	4.00	14.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
S 37A	Gravity Main	City	STMN-03853	3.5	4.00	14.00		
S 37A	Gravity Main	City	STMN-03854	3.0	3.89	11.67		
S 37A	Gravity Main	City	STMN-03855	3.0	4.18	12.54		
S 37A	Gravity Main	City	STMN-03874	2.5	3.95	9.88		
S 37A	Gravity Main	City	STMN-03875	2.0	4.00	8.00		
S 37A	Gravity Main	City	STMN-03876	1.5	3.93	5.90		
S 37A	Gravity Main	City	STMN-03877	1.5	4.00	6.00		
S 37A	Gravity Main	City	STMN-03879	1.0	4.00	4.00		
S 37A	Inlet	City	STIN-00506	1.0	3.89	3.89		
S 37A	Inlet	City	STIN-00510	3.0	4.01	12.03		
S 37A	Inlet	City	STIN-00492	3.5	4.00	14.00		
S 37A	Inlet	City	STIN-00496	3.0	3.98	11.94		
S 37A	Inlet	City	STIN-00500	2.5	4.00	10.00		
S 37A	Inlet	City	STIN-00577	3.0	4.13	12.39		
S 37A	Inlet	City	STIN-00581	2.5	4.07	10.18		
S 37A	Inlet	City	STIN-00536	3.0	3.86	11.58		
S 37A	Inlet	City	STIN-00542	3.0	3.98	11.94		
S 37A	Inlet	City	STIN-00579	3.0	4.00	12.00		
S 37A	Inlet	City	STIN-00580	3.5	4.03	14.11		
S 37A	Inlet	City	STIN-00512	3.0	4.00	12.00		
S 37A	Manhole	City	STMH-3095	4.0	3.93	15.72		
S 37A	Manhole	City	STMH-3100	3.5	3.95	13.83		
S 37A	Manhole	City	STMH-3102	3.0	4.00	12.00		
S 37A	Manhole	City	STMH-3103	3.0	3.97	11.91		
S 37A	Manhole	City	STMH-3104	2.5	4.05	10.13		
S 37A	Network Structure	City	STNS-506	2.5	2.00	5.00		
S 37A	Network Structure	City	STNS-507	3.5	2.05	7.18		
S 37A	Network Structure	City	STNS-509	4.5	2.00	9.00		
S 37A	Network Structure	City	STNS-510	4.0	2.00	8.00		
S 37A	Network Structure	City	STNS-511	4.0	2.00	8.00		
S 37A	Network Structure	City	STNS-513	3.5	1.98	6.93		
S 37A	Network Structure	City	STNS-515	3.0	1.90	5.70		
S 37A	Network Structure	City	STNS-521	3.0	2.10	6.30		
S 37A	Network Structure	City	STNS-522	1.0	2.00	2.00		
S 37A	Discharge Point	City	STOF-2782	1.5	4.30	6.45		
S 37A	Discharge Point	City	STOF-2784	2.0	4.00	8.00		

Watershed	Asset Class	Owner	Asset ID (Facility Identified)	LoF Score	CoF Score	BRE	Original CoF Score	Reason for CoF Change
S 37A	Discharge Point	City	STOF-2787	2.5	4.00	10.00		
S 37A	Pollution Control Structure	City	STCV-84	2.5	1.00	2.50		

A representative BRE plot is shown in **Figure 8.73**.

Figure 8.73: S 37A Watershed Business Risk Exposure by Asset (Example)



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8.10.7 Operations, Maintenance and Replacement Strategies

Operations and Maintenance strategies are based upon the relative ranking and associated risks (some elevated) of the entire asset registry. To determine the correct maintenance strategy for each asset class and specific assets, the City will need to perform condition assessments. Starting with the most critical assets and based on the LOF, the City will select one of the following O&M strategies such as Run-To-Failure (RTF), Inspection and Testing (I&T), Time Based (TBM) or Condition-Based Maintenance (CBM). **Table 8.60** shows examples of the LoS and strategies for hard assets.

Table 8.60: S 37A Assets Maintenance Strategy

Classes	LoS	Maintenance Strategy
Discharge Point	LoS C	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance; Predictive Maintenance; Risk Contingencies
Inlet	LoS A	Run-To-Failure; Routine Inspection; Routine Testing
Gravity Main	LoS B	Run-To-Failure; Routine Inspection; Routine Testing; Preventive Inspection; Corrective Maintenance

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SECTION 9 – References

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APPENDIX A: WAMP INITIATIVE IMPLEMENTATION ROADMAP AND SCHEDULE

Appendix A - WAMP Initiative Implementation Roadmap and Schedule

DELIVERABLES SECTION	DESCRIPTION	IAM SECTION	IAM ELEMENTS	PRIORITY	EFFORT: FTL	EFFORT: OUTSIDE	FTL RESOURCES	OUTSIDE RESOURCES	Year 1	Year 2	Year 3	Year 4	Year 5
Strategy and Planning	Complete the WAMP and develop an organization wide Asset Management policy statement. This should take into account leveraging the WAMP framework across all asset systems and developing tactical asset management plans for each asset management system.	**1**	1, 2 and 5	High/Medium	0%	100%	Executive Leadership / AM Steering Committee / Engr Planning Mgr	$1,100,000					
Asset Management Decision Making	These recommendations focus on improving the overall asset management decision-making and include the following: - Establishing the capital prioritization process including risk - Developing a formalized business case evaluation methodology - Implementing problem, cause, and remedy codes into Cityworks - Implementing the IPSECA process across O&M activities - Optimizing PM scheduling based upon risk	**2**	6, 7, 8, 9, and 10	High/Medium/Low	0%	100%	Executive Leadership/ AM Steering Committee / O&M Mgrs / IT	$850,000					
Asset Lifecycle Management	Focus on the full asset lifecycle process from formalizing processes and workflows, determining when and in which system asset management attributes are updated, and determining workforce gaps and how to close these gaps in order to effectively carry out asset management.	**3**	11 - 21	High/Medium/Low	0%	100%	Executive Leadership / Engr Plng Mgrs, / IT / O&M Mgrs	$725,000					
Asset Information	Implement simple procedures to facilitate how asset management data is collected and input into Cityworks. To make this effective, AMPs must be created for each asset system in order to know what data to collect and input into Cityworks.	**4**	22-25	High/Medium	0%	100%	IT / AM Steering Committee	$350,000					
Organization & People	Establishes membership and procedures for oversight of the asset management program, including organizational Levels of Service (LOS) and KPIs related to monitoring of asset management progress, and monitoring and reporting these LOS and KPIs to senior management.	**5**	26-30	Medium/Low	0%	100%	Exec Leadership / AM Steering Committee / IT / Maint Mgrs	$475,000					
Risk & Review	These recommendations focus on identifying asset risks and implementing processes, procedures, and tools focused on including risk in overall business planning. For example, a formalized change management procedures document identifies the procedures required to modify existing practices and protocols, and identifies any risks associated with the changes.	**6**	31-39	Medium	0%	100%	Executive Leadership/ AM Steering Committee / Engr Planning Mgr	$700,000					
								$4,200,000	$316,700	$1,483,300	$1,433,300	$966,700	

Priority	
High	
Medium	
Low	

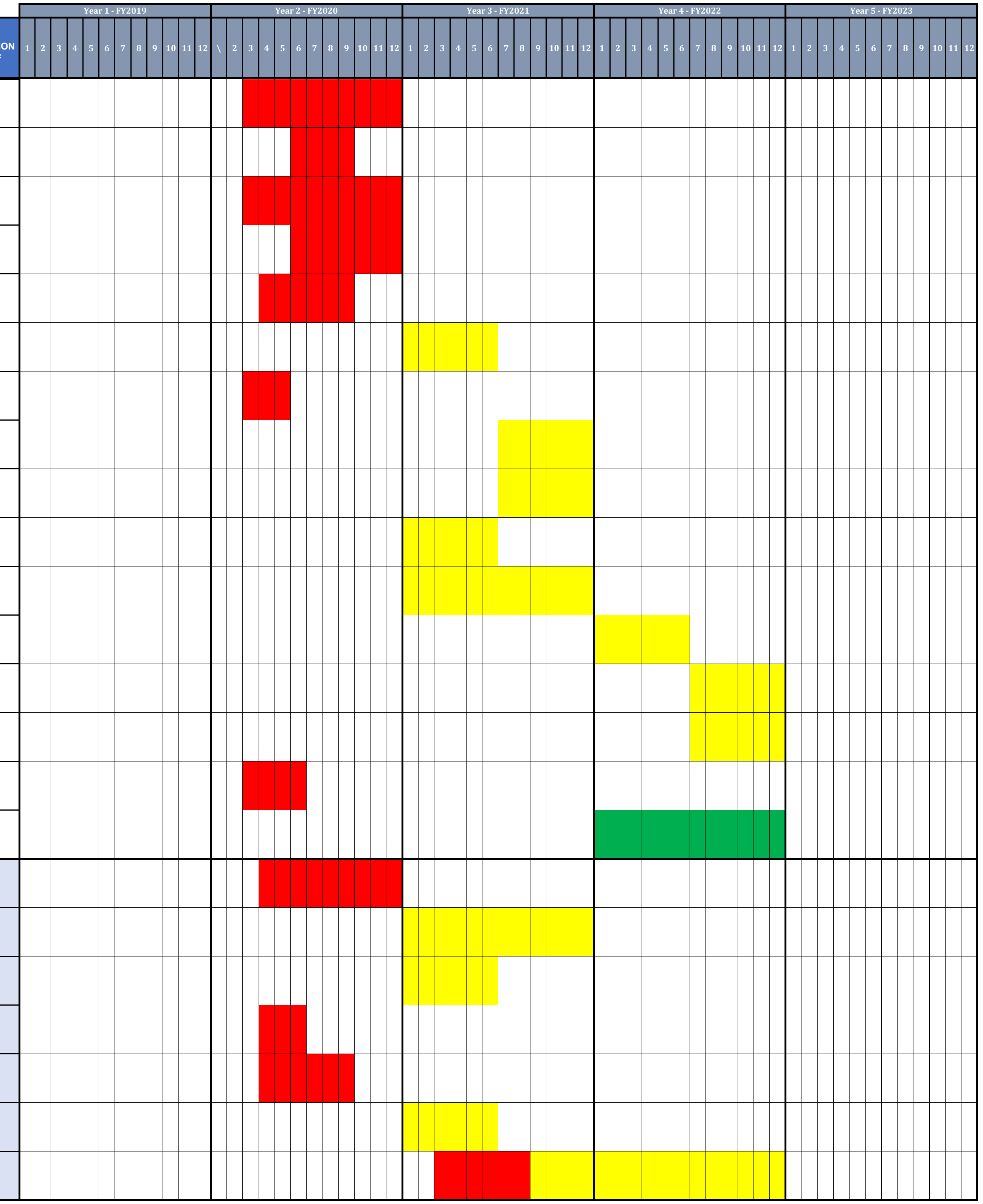
Appendix A - WAMP Initiative Implementation Roadmap and Schedule

IAM SECTION	SECTION NAME	ELEMENT	IAM STANDARD	RECOMMENDATIONS		LEAD	RESOURCES	TIMEFRAME (YEAR/MONTHS)	PRIORITY	OUTSIDE IMPLEMENTATION COSTS RANGE	OUTSIDE IMPLEMENTATION COSTS - HIGH END OF RANGE
1	Strategy and Planning	1	Asset Management Policy	Develop organization-wide Asset Management Policy statement		Executive Leadership	Executive Leadership	Year 2 (Months 1 - 3)	High	$25,001 - $50,000	$50,000
		2	Asset Management Strategy & Objectives	Complete WAMP			AM Steering Committee	Year 1 (Months 9 - 12)	High	$100,001 - $250,000	$250,000
				Leverage the WAMP framework across all asset systems (Water, Sewer, etc.)			AM Steering Committee / External Consultant	Year 2 (Months 1 - 12)	High	$100,001 - $250,000	$250,000
		5	Asset Management Planning	Develop TAMPs for each asset system	Identify		Engineering Planning Manager	Year 3 (Months 1 - 2)	Medium	$25,001 - $50,000	$50,000
					Execute		Engineering Planning Manager	Years 3 and 4 (Months 3 - 12; 1 - 6)	High/Medium	$250,001 - $500,000	$500,000
2	Asset Management Decision Making	6	Capital Investment Decision-Making	Establish capital prioritization and formalized business case evaluation methodology		Asset Management and Capital Planning Steering Committee Chair	AM Steering Committee / External Consultant	Years 1 and 2 (Months 9 - 12; 1 - 2)	High	$50,001 - $100,000	$100,000
		7	O&M Decision-Making	Implement IPSECA Process for O&M			Operations Manager	Years 2 and 3 (Months 7 - 12; 1 - 6)	High	$50,001 - $100,000	$100,000
				Implement problem, cause, remedy codes into Cityworks			IT / GIS	Year 2 (Months 3 - 5)	High	$25,001 - $50,000	$50,000
				Optimize PM scheduling based on risk			Operations Manager	Year 3 (Months 1 - 10)	High	$50,001 - $100,000	$100,000
		8	Lifecycle Value Realization	Track equipment use and associated costs by Work Order			Maintenance Managers	Year 3 (Months 6- 12)	High/Medium	$50,001 - $100,000	$100,000
				Track materials costs by Work Order, and interface with purchasing system			Maintenance Managers	Year 4 (Months 1- 12)	Low	$50,001 - $100,000	$100,000
		9	Resourcing Strategy	Develop Level of Service and risk-based resource plans			Executive Leadership and HR	Year 3 (Months 1 -6)	Medium	$100,001 - $250,000	$250,000
		10	Shutdowns and Outage Strategy	Formalize processes for seasonal process cleaning and emergency O&M			Operations Manager	Year 2 (Months 3 - 9)	High	$25,001 - $50,000	$50,000

Year 1 - FY2019	Year 2 - FY2020	Year 3 - FY2021	Year 4 - FY2022	Year 5 - FY2023
1 2 3 4 5 6 7 8 9 10 11 12	\ 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12

Appendix A - WAMP Initiative Implementation Roadmap and Schedule

IAM SECTION	SECTION NAME	ELEMENT	IAM STANDARD	RECOMMENDATIONS	LEAD	RESOURCES	TIMEFRAME (YEAR/MONTHS)	PRIORITY	OUTSIDE IMPLEMENTATION COSTS RANGE	OUTSIDE IMPLEMENTATION COSTS - HIGH END OF RANGE
3	Asset Lifecycle Management	11	Technical Standards & Legislation	Formalize standards for prioritization of equipment, pipe network, and pump stations	Asset Management Steering Committee Chair	PW Engineering Managers	Year 2 (Months 3 - 9)	High	$50,001 - $100,000	$100,000
		12	Asset Creation & Acquisition	Develop and implement an asset onboarding workflow		IT / GIS	Year 2 (Months 6 - 9)	High	$25,001 - $50,000	$50,000
		13	Systems Engineering	Formalize process and workflow for requirements analysis, design and evaluation of asset systems and components		PW Engineering Managers	Year 2 (Months 3 - 9)	High	$50,001 - $100,000	$100,000
		14	Configuration Management	Determine and implement schedule for attribute update, including using Cityworks/GIS to edit attributes		IT / GIS	Year 2 (Months 6 - 9)	High	$25,001 - $50,000	$50,000
				Review potential for GIS editing in the field in conjunction with QA/QC workflow		IT / GIS	Year 2 (Months 3 - 9)	High	$0 - $25,000	$25,000
		15	Maintenance Delivery	Formalize PMs and CMs		Maintenance Managers	Year 3 (Months 1 - 6)	Medium	$25,001 - $50,000	$50,000
				Develop and implement problem, cause, and remedy codes		Maintenance Managers	Year 2 (Months 3 - 5)	High	$25,001 - $50,000	Included in Rec #7
				Modify Work Order development procedure		PW Managers	Year 3 (Months 7 - 12)	Medium	$0 - $25,000	$25,000
				Implement service request for vertical assets		IT / GIS	Year 3 (Months 7 -12)	Medium	$25,001 - $50,000	$50,000
		16	Reliability Engineering	Formalize procedures for engineering principles throughout lifecycle to ensure asset performance		PW Engineering Managers	Year 3 (Months 1 - 6)	High/Medium	$25,001 - $50,000	$50,000
		17	Asset Operations	Formalize and implement operational changes per new asset management strategy		Maintenance Managers	Year 3 (Months 1 - 12)	Medium	$25,001 - $50,000	$50,000
		18	Resource Management	Assess workforce gaps related to revised PM workload and anticipated corrective and reactive work		Executive Leadership	Year 4 (Months 1 - 6)	Medium	$25,001 - $50,000	$50,000
				Develop strategy to fill resource gaps		Executive Leadership	Year 4 (Months 7 - 12)	Medium	$0 - $25,000	$25,000
		19	Planned Shutdown & Outage Management	Ensure existing emergency response plans are updated to include prioritization of activities based on asset criticality		Operations Manager	Year 4 (Months 7 - 12)	Medium/Low	$25,001 - $50,000	$50,000
		20	Fault & Incident Response	Establish and implement Problem/Cause/Remedy for deeper suite of AM reports and visualizations		Maintenance Managers	Year 2 (Months 3 - 6)	High	$25,001 - $50,000	Included in Rec #7
		21	Asset Decommissioning & Disposal	Develop and implement technical review systematically to decide on assets to be decommissioned and disposed		PW Engineering Planning Manager	Year 4 (Months 1 - 12)	Low	$25,001 - $50,000	$50,000
4	Asset Information	22	Asset Information Strategy	Consolidate to a single instance of Cityworks	Asset Management Steering Committee Chair	IT / GIS	Year 2 (Months 4 - 12)	High	$25,001 - $50,000	$50,000
				Multiple staff / domains supporting specific Public Works departments		IT / GIS HR	Year 3 (Months 1 - 12)	Medium	$25,001 - $50,000	$50,000
		23	Asset Information Standards	Institute QA/QC procedures as part of field data collection		IT / GIS	Year 3 (Months 1 - 6)	Medium	$25,001 - $50,000	$50,000
				Standardize inspection forms		AM Steering Committee / External Consultant	Year 2 (Months 4 - 6)	High	$25,001 - $50,000	$50,000
		24	Asset Information Systems	Develop roadmap to include integration of materials management and financial platform		AM Steering Committee / External Consultant/ IT / GIS (financial integration)	Year 2 (Months 4 - 9)	High	$50,001 - $100,000	$100,000
				Leverage Cityworks in field (tablet mode) for data collection		AM Steering Committee / External Consultant	Year 3 (Months 1 - 6)	High/Medium	$25,001 - $50,000	$50,000
		25	Data and Information Management	Develop AMPs for each asset system		PW Engineering Planning Manager	Year 3 (Months 1 - 12)	Medium	$250,001 - $500,000	Included in Rec #5



Appendix A - WAMP Initiative Implementation Roadmap and Schedule

IAM SECTION	SECTION NAME	ELEMENT	IAM STANDARD	RECOMMENDATIONS	LEAD	RESOURCES	TIMEFRAME (YEAR/MONTHS)	PRIORITY	OUTSIDE IMPLEMENTATION COSTS RANGE	OUTSIDE IMPLEMENTATION COSTS - HIGH END OF RANGE
5	Organization & People	26	Procurement & Supply Chain Management	Pre-align materials and service orders with Work Orders or storeroom (3-way match)	Asset Management Steering Committee Chair	IT / GIS	Year 4 (Months 1 - 6)	Medium/Low	$50,001 - $100,000	$100,000
				Implement Workflow		Maintenance Managers	Year 4 (Months 7 - 12)	Medium/Low	$25,001 - $50,000	$50,000
		27	Asset Management Leadership	Create Asset Management Steering Committee and institute procedures and practices	Executive Leadership	Executive Leadership	Year 2 (Months 1- 3)	High/Medium	$0 - $25,000	$25,000
		28	Organizational Structure	Align and assign asset management roles and responsibilities	Asset Management Steering Committee Chair	AM Steering Committee	Year 2 (Months 3 - 12)	Medium	$25,001 - $50,000	$50,000
		29	Organizational Culture	Implement Levels of Service, aligned KPIs, strategies, and training		AM Steering Committee	Year 2 (Months 1 - 12)	Medium	$50,001 - $100,000	$100,000
				Measure effectiveness and adherence to policies		AM Steering Committee	Year 3 (Months 1 - 12)	Medium	$25,001 - $50,000	$50,000
		30	Competence Management	Compare CM and PM activities against staff skills and capacity		Maintenance Managers	Year 4 (Months 1 - 6)	Medium	$25,001 - $50,000	$50,000
				Assess and fill gaps		Maintenance Managers	Year 4 (Months 7 - 12)	Medium	$25,001 - $50,000	$50,000
6	Risk & Review	31	Risk Assessment & Management	Standardize risk assessment framework across all asset classes	Asset Management Steering Committee Chair	PW Engineering Planning Manager	Year 2 (Months 1 - 6)	Medium	$50,001 - $100,000	$100,000
				Formalize LOS and KPI tracking process and reporting mechanism		PW Engineering Planning Manager	Year 2 (Months 6 - 9)	Medium	$25,001 - $50,000	$50,000
				Implement formalized BRE tool		PW Engineering Planning Manager	Year 2 (Months 9 - 12)	Medium	$50,001 - $100,000	$100,000
		32	Contingency Planning & Resilience Analysis	Ensure business continuity plans (or Emergency Operations Plans) are updated and regularly exercised.		PW Engineering Planning Manager	Year 4 (Months 1 - 12)	Low	$50,001 - $100,000	$100,000
		33	Sustainable Development	Implement triple bottom line (TBL) elements (financial, social, and environmental) into formalized BRE tool	Asset Management and Capital Planning Steering Committee Chair	AM Steering Committee / External Consultant	Year 3 (Months 1 - 6)	High	$0 - $25,000	$25,000
		34	Management of Change	Establish change management procedures for Asset Management Program implementation (organizational alignment and readiness)	Asset Management Steering Committee Chair	AM Steering Committee	Year 3 (Months 1 - 6)	Medium	$25,001 - $50,000	$50,000
		35	Asset Performance & Health Monitoring	Establish AM Program Levels of Service		Executive Leadership	Year 2 (Months 1 - 6)	High	$25,001 - $50,000	Included in Rec #29
				Formalize LOS and KPI tracking process and reporting mechanism		AM Steering Committee	Year 3 (Months 1 - 6)	Medium	$25,001 - $50,000	Included in Rec #31
				Keep asset/system risk profiles current		AM Steering Committee	Year 3 (Months 1 - 6)	Medium	$0 - $25,000	$25,000
		36	Asset Management System Monitoring	Establish AM Program Levels of Service		Executive Leadership	Year 2 (Months 1-3)	High	$25,001 - $50,000	Included in Rec #35
				Formalize LOS and KPI tracking process and reporting mechanism		AM Steering Committee	Year 3 (Months 1 - 6)	Medium	$25,001 - $50,000	Included in Rec #31
		37	Management Review, Audit & Assurance	Ensure continuous improvement processes (Plan-Do-Check-Act) are in place to monitor AM Program success		PW Engineering Planning Manager	Year 4 (Months 1 - 12)	Low	$25,001 - $50,000	$50,000
		38	Asset Costing & Valuation	Track lifecycle costs (up-front capital and all O&M) for each asset/class		AM Steering Committee	Year 4 (Months 1 - 12)	Low	$25,001 - $50,000	$50,000
				Identify Effective Useful Life for all asset classes		AM Steering Committee / External Consultant	Year 2 (Months 4 - 9)	High	$25,001 - $50,000	$50,000
				Keep replacement cost information current		AM Steering Committee	Year 4 (Months 1 - 6)	Medium	$25,001 - $50,000	$50,000
		39	Stakeholder Engagement	Solicit stakeholder feedback on performance relative to Level of Service	Executive Leadership	AM Steering Committee	Years 3 and 4 (Months 1 - 12; 1 - 12)	Medium	$25,001 - $50,000	$50,000
									Total	$4,200,000

	Year 1 - FY2019	Year 2 - FY2020	Year 3 - FY2021	Year 4 - FY2022	Year 5 - FY2023
Months	1 2 3 4 5 6 7 8 9 10 11 12	\ 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12
Total	$316,700	$1,483,300	$1,433,300	$966,700	

Priority	
High	
Medium	
Low	

APPENDIX B: PUBLIC WORKS ORGANIZATIONAL CHART, JANUARY 1, 2019

Appendix B - Public Works Organizational Chart , January 1, 2019

Approved by: Susan Lesage, Business Operations Manager 01/07/2019

APPENDIX C: CITY OF FORT LAUDERDALE TMDL PRIORITIZATION REPORT AND TDML TABLES

City of Fort Lauderdale
NPDES MS4 Permit FLS000017-004
TMDL Prioritization Report – June 2017

I. Introduction

The City of Fort Lauderdale was issued its Cycle 4 National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit FLS000017-004 on 01/05/2017. In order to maintain compliance with Part VIII, Stormwater Discharge Compliance and Water Quality Standards, the City of Fort Lauderdale has developed a Total Maximum Daily Load (TMDL) prioritization report to address impaired waterbodies with an adopted Florida Department of Environmental Protection (DEP) TMDL or an Environmental Protection Agency (EPA) established TMDL but are without an adopted or developing Basin Management Action Plan (BMAP), which serves as a formal restoration guidance document for such impaired waterbodies. The prioritization report includes the City of Fort Lauderdale's prioritized list of impaired waterbodies, an explanation of the prioritization factors, methodology, and the proposed implementation schedule.

Table 1 lists the waterbodies that have either a DEP adopted (EPA approved) or EPA established TMDL in place.

List obtained from FDEP Final TMDL report: Southeast Coast-Biscayne Bay Basins; 3270, 3273, 3274, 3276, 3276A, and 3277A; Fecal Coliform; April 4, 2012.

Table 1. Total Maximum Daily Loads (TMDL) – DEP Adopted (EPA Approved) and EPA Established.

WBID	Waterbody Name	WLA* for NPDES Stormwater (% reduction)	TMDL Status	Pollutant of Concern
3276A	New River (North Fork)	94%	DEP adopted-EPA approved	Bacteria
3277A	New River Canal (South)	69%	DEP adopted-EPA approved	Bacteria
3274	C-13 East (Middle River) Canal	67%	DEP adopted-EPA approved	Bacteria
3226G4	Las Olas Isles	58%	DEP adopted-EPA approved	Bacteria
3276	C-12 Canal	52%	DEP adopted-EPA approved	Bacteria
3270	C-14 (Cypress Creek) Canal	22%	DEP adopted-EPA approved	Bacteria
3273	C-13 West (Middle River) Canal	22%	DEP adopted-EPA approved	Bacteria

* Waste Load Allocation

II. Prioritization Approach

Based on the list of impaired waterbodies in Table 1 that have a DEP adopted (EPA approved) or EPA established TMDL, the City of Fort Lauderdale applied a tier one ranking process for prioritization. The City of Fort Lauderdale applied the recommended prioritization tiered approach as shown in Section 2.1 of "Prioritizing FIB (Fecal Indicator Bacteria)-Impaired Watersheds of the DEP Fecal Indicator Bacteria Toolkit, version October 2016." Fecal Coliform data (01/01/2003-06/30/2010) from each of the FIB

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TMDL waters listed in Table 1 were ranked by both magnitude and frequency of exceedances. As shown in Table 2 with mathematic calculations included in the Appendix.

Criteria: Tier I

Table 2

Water Body Identification	3276A	3277A	3274	3276	3226G4	3270	3273
Total number of data points for the WBID over a 7.5 year period	53	84	153	57	28	144	70
Number of exceedances	39	30	50	13	6	23	11
Median colony count of exceedances	970	1200	800	764	825	620	590
Magnitude exceedance indicator	59	68	50	48	52	35	32
Exceedance frequency indicator	74	27	33	23	21	16	16
Average of indicators	67	48	42	36	37	26	24
Confidence interval	1	1	1	1	0.8	1	1
WBID score	67	48	42	36	30	26	24
Data Prioritization Placement based on Bacteria (1= top priority)	1	2	3	4	5	6	7

Load Reduction needed based on DEP's MS4 WLAs with in TMDL)

The higher the load the more risk the waterbody poses to public health. Because the loads are high, implementation of improved best management practices (BMPs) and more education and outreach focused on bacteria in our water ways should show water quality improvement through monitoring.

Future stormwater improvement projects

Stormwater projects will ultimately reduce transportation of bacteria to surface water and decrease loading. Below is a list of projects contained in our Community Investment Plan 2016-2020 (CIP). The 5 year CIP gets updated annually during the budget cycle effective October 1 of each year.

1137 NE 9th Avenue Stormwater Improvements
1416 SE 11 Court Stormwater Improvements
1436 Ponce De Leon Drive Stormwater Improvements
205 SW 21St Street Stormwater Improvements
2449 Bimini Lane Stormwater Improvements
2505 Riverland Terrace Stormwater Improvements
2625 NE 11th Court Stormwater Improvements
3301 NE 16 Street Stormwater Improvements
3318 SE 6th Avenue Stormwater Improvements
3605 SW 13th Court Stormwater Improvements
4848 NE 23rd Avenue Stormwater Improvements
500 Block SW 9th Terrace Stormwater Improvements
700-1000 West Las Olas Boulevard Stormwater Improvements
777 Bayshore Drive Stormwater Improvements
800-850 SW 21St Terrace Stormwater Improvements
915 NE 3rd Avenue Stormwater Improvements
Citywide Stormwater Model

Dorsey Riverbend Area Stormwater Improvements
Drainage Canal Dredging
Drainage Canal Surveying and Assessment
Durrs Area Stormwater Improvements
Edgewood Area Stormwater Improvements
Hector Park Stormwater Improvements
NE 13th Street Complete Streets Project
NE 25th Street Beach Erosion Improvements
Progresso Area Stormwater Improvements
River Oaks Stormwater Neighborhood and Preserve
SE 6th St., SE 7th St, US1 and 3rd Avenue Storm
Southeast Isles Tidal and Stormwater Improvements
Stormwater Asset Management System
Survey for Citywide Stormwater Model
SW 27 Terrace and Riverland Road Stormwater Improvements
Victoria Park Tidal and Stormwater Improvements

Stakeholder collaboration potential

With larger numbers of stakeholders involved, collaboration among City of Fort Lauderdale, Broward County, Florida Department of Transportation (FDOT), Plantation, City of Lauderhill, and would create savings with project implementation and data collection as well as presenting a complete picture of the waterbody.

III. Final Prioritization List

Based on our criteria, WBID 3276A (North Fork New River) received the highest priority. This waterbody receives direct discharge from the county's MS4 system and has the largest unincorporated residential population. Many stormwater improvement projects have been successfully completed in the last ten years which hopefully will reduce bacteria load to the accepting waterbody. Examples of these projects are the Waterworks 2011 project that installed sewer infrastructure in areas that were on septic and pipe lining projects to minimize gravity sewer leaks. The Waste Load Allocation (WLA) reduction is the highest of the group with a 94% reduction. With such high load reductions, efforts to improve water quality should be visible through monitoring. Stakeholder cooperation would offer a collaborative approach with five major stakeholders contributing to the WBID.

IV. Implementation Schedule

The City of Fort Lauderdale's implementation schedule is summarized below in Table 3.

Table 3. City of Fort Lauderdale Implementation Schedule.

WBID	Waterbody	TMDL Parameter	TMDL Prioritization	Assessment Plan	Source Identification & Monitoring	Bacteria Pollution Control Plan (BPCP)	BPCP/TMDL Implementation
3276A	New River (North Fork)	Bacteria	Jan. 5–June 5, 2017	June 5, 2017–Jan. 5, 2018	Jan. 5, 2018– July 5, 2019	July 6, 2019-July 5, 2020	July 6, 2020-Jan 5, 2021

The schedule is restricted to the current permit cycle (January 5, 2017 through January 5, 2021) and establishes a timeline for the implementation of steps needed to meet Part VIII, Stormwater Discharge Compliance and Water Quality Standards. The City of Fort Lauderdale is proposing to address the top ranking waterbody, North Fork New River, WBID 3276A, during this permit cycle. The remaining waterbodies listed for bacteria TMDL will be re-assessed, prioritized with an implementation schedule in future permit cycles.

V. Summary

Based on the available technical and budgetary resources, the City of Fort Lauderdale believes the proposed prioritization and implementation schedule meets the requirements set forth in Part VIII, Stormwater Discharge Compliance and Water Quality Standards, of its NPDES MS4 permit FLS000017-004. The City of Fort Lauderdale anticipates that implementation of all the listed TMDLs will take a significant length of time and several permit cycles to accomplish the reduction goals required.

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NPDES MS4 Permit FLS000017-004
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Appendix

Waterbody name: North Fork New River

WBID: 3276-A   WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 53 B

Median of exceedances: 970 C

Total number of exceedances: 39 D

Magnitude of exceedances indicator calcuation:

C - A = 570 ÷ C = .588 E

E x 100 = 59 F *(Round F to whole number)*

Frequency of exceedances indicator calculation:

D ÷ B = .74 x 100 = 74 G *(Round G to whole number)*

Average the indicators:

F + G = 133 ÷ 2 = 67 H *(Round H to whole number)*

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 67 J *(Round J to whole number)*

Waterbody name: New River Canal South

WBID: 3277-A   WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 111 B

Median of exceedances: 1250 C

Total number of exceedances: 30 D

Magnitude of exceedances indicator calcuation:

C - A = 850 ÷ C = .68 E

E x 100 = 68 F *(Round F to whole number)*

Frequency of exceedances indicator calculation:

D ÷ B = .27 x 100 = 27 G *(Round G to whole number)*

Average the indicators:

F + G = 95 ÷ 2 = 48 H *(Round H to whole number)*

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 47 J *(Round J to whole number)*

Waterbody name: C-13 East Middle River Canal

WBID: 3274   WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 153 B

Median of exceedances: 800 C

Total number of exceedances: 50 D

Magnitude of exceedances indicator calcuation:

C - A = 400 ÷ C = .50 E

E x 100 = 50 F *(Round F to whole number)*

Frequency of exceedances indicator calculation:

D ÷ B = .33 x 100 = 33 G *(Round G to whole number)*

Average the indicators:

F + G = 83 ÷ 2 = 42 H *(Round H to whole number)*

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 42 J *(Round J to whole number)*

Waterbody name: C-12 Plantation Canal

WBID: 3276   WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 57 B

Median of exceedances: 764 C

Total number of exceedances: 11 D

Magnitude of exceedances indicator calcuation:

C - A = 364 ÷ C = .48 E

E x 100 = 48 F *(Round F to whole number)*

Frequency of exceedances indicator calculation:

D ÷ B = .19 x 100 = 19 G *(Round G to whole number)*

Average the indicators:

F + G = 67 ÷ 2 = 34 H *(Round H to whole number)*

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 34 J *(Round J to whole number)*

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Waterbody name: Las Olas Isles

WBID: 3226 G4 WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 28 B

Median of exceedances: 825 C

Total number of exceedances: 6 D

Magnitude of exceedances indicator calcuation:

C - A = 425 ÷ C = .52 E

E x 100 = 52 F
(Round F to whole number)

Frequency of exceedances indicator calculation:

D ÷ B = .21 x 100 = 21 G
(Round G to whole number)

Average the indicators:

F + G = 73 ÷ 2 = 37 H
(Round H to whole number)

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 30 J
(Round J to whole number)

Waterbody name: C-14 Cypress Creek Canal

WBID: 3270 WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 144 B

Median of exceedances: 620 C

Total number of exceedances: 23 D

Magnitude of exceedances indicator calcuation:

C - A = 220 ÷ C = .35 E

E x 100 = 35 F
(Round F to whole number)

Frequency of exceedances indicator calculation:

D ÷ B = .16 x 100 = 16 G
(Round G to whole number)

Average the indicators:

F + G = 51 ÷ 2 = 26 H
(Round H to whole number)

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 26 J
(Round J to whole number)

Waterbody name: C-13 East Middle River Canal

WBID: 3274 WBID Class: 3

Data period: 1/1/2003 - 6/30/2010
(Insert dates. 7.5 years of data is recommended.)

Appliciable FIB criterion: 400 A

Total Number of Samples: 153 B

Median of exceedances: 800 C

Total number of exceedances: 50 D

Magnitude of exceedances indicator calcuation:

C - A = 400 ÷ C = .50 E

E x 100 = 50 F
(Round F to whole number)

Frequency of exceedances indicator calculation:

D ÷ B = .33 x 100 = 33 G
(Round G to whole number)

Average the indicators:

F + G = 83 ÷ 2 = 42 H
(Round H to whole number)

Calculate the WBID's weighted score:

Number of samples	Confidence compensation weight (I)
5 - 10	0.65
11 - 19	0.75
20 - 29	0.8
30 or more	1.0

H x I = 42 J
(Round J to whole number)

Document Name	DEP District	Group	Waterbody	Impaired WBID	Document Status	Document Status Date	Parameter Group	Basis for Listing	Causative Pollutant	MOS	MOS Value	WLA	SWLA	LA	Total TMDL	Waterbody Type	Waterbody Class
FECAL COLIFORM TMDL FOR LAS OLAS ISLES FINGER CANAL SYSTEM (WBID 3226G4)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	LAS OLAS ISLES FINGER CANAL SYSTEM	3226G4	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	58.0 % RED	58.0 % RED	400.0 COUNT/100ML	Estuary	3M
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	C-11 (EAST)	3281	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	93.0 % RED	93.0 % RED	400.0 COUNT/100ML	Stream	3F
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	C-12	3276	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	52.0 % RED	52.0 % RED	400.0 COUNT/100ML	Stream	3F
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	C-13 EAST (MIDDLE RIVER CANAL)	3274	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	67.0 % RED	67.0 % RED	400.0 COUNT/100ML	Estuary	3M
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	C-13 WEST (MIDDLE RIVER CANAL)	3273	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	22.0 % RED	22.0 % RED	400.0 COUNT/100ML	Stream	3F

Document Name	DEP District	Group	Waterbody	Impaired WBID	Document Status	Document Status Date	Parameter Group	Basis for Listing	Causative Pollutant	MOS	MOS Value	WLA	SWLA	LA	Total TMDL	Waterbody Type	Waterbody Class
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	C-14 (CYPRESS CREEK CANAL/POMPANO CANAL)	3270	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	22.0 % RED	22.0 % RED	400.0 COUNT/100ML	Stream	3F
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	DANIA CUTOFF CANAL	3277E	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	78.0 % RED	78.0 % RED	400.0 COUNT/100ML	Estuary	3M
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	NEW RIVER (NORTH FORK)	3276A	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	94.0 % RED	94.0 % RED	400.0 COUNT/100ML	Estuary	3M
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	NEW RIVER CANAL (SOUTH)	3277A	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	69.0 % RED	69.0 % RED	400.0 COUNT/100ML	Estuary	3M
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	NORTH NEW RIVER CANAL	3277C	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	31.0 % RED	31.0 % RED	400.0 COUNT/100ML	Stream	3F

Document Name	DEP District	Group	Waterbody	Impaired WBID	Document Status	Document Status Date	Parameter Group	Basis for Listing	Causative Pollutant	MOS	MOS Value	WLA	SWLA	LA	Total TMDL	Waterbody Type	Waterbody Class
F. COLIFORM TMDLS FOR C-14 (3270), C-13 WEST (3273), C-13 EAST (3274), C-12 (3276), NEW RIVER (NORTH FORK) (3276A), NEW RIVER CANAL (SOUTH) (3277A), NORTH NEW RIVER (3277C), DANIA CUTOFF CANAL (3277E), SOUTH NEW RIVER CANAL (C-11) (3279) & C-11 EAST (3281)	Southeast	Group 4 - Southeast Coast - Biscayne Bay	SOUTH NEW RIVER CANAL (C-11)	3279	DEP Adopted-EPA Approved	6/25/2012	Bacteria	Fecal Coliform	Fecal Coliform	Implicit		N/A	31.0 % RED	31.0 % RED	400.0 COUNT/100ML	Stream	3F

APPENDIX D: CITY OF FORT LAUDERDALE NEIGHBORHOOD ASSOCIATIONS PER WATERSHED

Appendix D - City Watersheds and Neighborhood Map

APPENDIX E: CITY OF FORT LAUDERDALE TRAININGS

City of Fort Lauderdale Staff Training Completed from 2015 to 2019

Training No.	Training
1	FSA Certication
2	NASSCO
3	FDED Erosion and Sediment Control
4	Cityworks
5	City Department Training
6	Equipment Certifications
7	IAM Certification
8	FWPCOA
9	New Employee Orientation
10	Climate 101
11	Finance Training
12	Cyber Security
13	HIPPA
14	Laudershare
15	ICS-FEMA 100
16	ICS-200 FEMA
17	IS-00279
18	G-300
19	IS-700 FEMA
20	ICS-G402 FEMA
21	ICS-800 FEMA
22	Human Resources Compliance Training
23	Basic FMLA Dynamic Software Demo
24	Boating Safety
25	Back Safety
26	Bloodborne Pathogens
27	Bobcat Operations
28	Confined Space Entry
29	Crystalline Silica
30	Defensive Driving
31	Electrical Safety
32	Excavation and Trenching
33	Fire Extinguisher Training
34	First Aid (CPR)
35	Forlift Safety and Refresher
36	Hazardous Material Handling (HAZWOPER) and Refresher
37	Hazard Communication/GHS
38	Hearing Protection
39	Heavy Equipment
40	Hot Work Safety
41	Lock out/Tagout
42	Manual and Power Tools

City of Fort Lauderdale Staff Training Completed from 2015 to 2019

Training No.	Training
43	OSHA Training - 10 hrs
44	OSHA Fall Protection
45	OSH Scaffold Ladder Safety
46	PPE & Live Safeving Equipment
47	Respiratory Protection
48	Safety Orientation
49	Workplace Safety (PPE, Stairs, Ladders, Power Tools)
50	Work Zone Safety - MOT
51	Working Safety with Poert Cutoff Saws
52	Vacuum Truck Training
53	Coastal Barrier Resources Systems
54	Collaborative Stormwater Mgmt Solutions
55	CPA's NPDED MS4 Permit Program
56	CUES CCTV Vehicle & Equipment Training
57	Drinking Water Operator License C
58	FLDEP ESC
59	FSA Level 1
60	FSA Level 2
61	Florida Stormwater & Erosion & Sediment Control Inspector
62	FWPCOA_STW C
63	FWPCOA_STW B
64	FWPCOA_STW A
65	Green Infrastructure Lab
66	Managing a Successful Stormwater Planned Maintenance Program
67	MARK3 Easement Training System Training
68	NASSCO
69	Sea Turtle Monitoring
70	Stormwater Water Compliance Success
71	Stormwater Goes Green
72	Stormwater Management Class C
73	Stormwater Management Class B
74	Stormwater Pollution Prevention
75	Urban Stormwater/Green Infrastructure Webinar
76	Utility Customer Relations
77	811 Training
78	Accident Investigation Training for Supervisors
79	Blue Print Training
80	Customer Service
81	Discharge /Overflow Control Procedures
82	Fire Hydrant Training
83	Flammable Material Awareness
84	Flood Plain Manager

City of Fort Lauderdale Staff Training Completed from 2015 to 2019

Training No.	Training
85	Florida Marine Debris Workshop
86	Annual Trash Study Results - Go To Webinar
87	Cradle to Cradle Certified - Go To Webinar
88	Basic Stormwater Calculations - Go To Webinar
89	Green Meets Gray: When LOD and Manufactured BMPs Work - Go to Webinar
90	Keeping the Baby in the Bathwater: Integrating Climate Resilience within Existing Water Planning, Design, and Operations - Go To Webinar
91	Plastic Soup Solutions - Go To Webinar
92	Green Infrastructure Plant Selection - Webcast
93	Green Infrastructure Solutions
94	Kronos
95	Low Impact Development
96	Managing Success
97	Material Management with Cityworks Storeroom
98	Pipeline Emergency Response & Damage Prevention
99	Project Management
100	Samsara Product Training: Routes & Dispatch - Webcast
101	Sixth Sigma (Green Belt)
102	Tackling Unconsious Bias in Hiring
103	Web Content Training- Vision Live
104	Workplace Violence
105	Unlocking Multimodality in N. America - Using Bikes to Better Our Transit Systems

APPENDIX F: PRESENT LEVEL OF SERVICE (LoS P) – CITYWIDE

Asset	Total Inventory	Proactive/ Routine Inspection	Frequency	Locations	Reactive Inspection	Frequency	Locations	Proactive Routine / Preventive Maintenance	Frequency	Locations	Reactive / Corrective Maintenance	Frequency	Locations	Replace/ Install Asset Activities	Frequency	Locations	System Renewal
Solid Pipe	183.5 Miles	Respond to failures and complaints on a 1st come first serve basis	Undefined	Undefined	Respond to failures and complaints on a 1st come first serve basis	Undefined	WIP	Clean XX annually	NPDES permit	Undefined	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	WIP	Replace and Install XX annually	NPDES permit	WIP	Undefined
Perforated Pipe	WIP	Respond to failures and complaints on a 1st come first serve basis	Undefined	Undefined	Respond to failures and complaints on a 1st come first serve basis	Undefined	WIP	Clean XX annually	NPDES permit	Undefined	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	WIP	Replace and Install XX annually	NPDES permit	WIP	Undefined
Manholes	1151	Respond to failures and complaints on a 1st come first serve basis	Undefined	Undefined	Respond to failures and complaints on a 1st come first serve basis	Undefined	WIP	Clean XX annually	NPDES permit	Undefined	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	WIP	Replace and Install XX annually	NPDES permit	WIP	Undefined
Inlets	8848	Yes- Semi Annual	Ongoing rotation with in SA time frame	8828	As needed	Undefined	8828	Clean XX annually	NPDES permit	8828	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	8828	Replace and Install XX annually	NPDES permit	8828	Undefined
Inline Tidal Valves	161	Yes- Quarterly	Ongoing rotation with in	163	As needed	Undefined	163	Clean XX annually	Activity referred from	163	Respond to reactive maintenance efforts on a	Activity referred from	163	Respond to BOTH proactive	Activity referred from	163	Undefined
End of Pipe Backflow Devices	5	Yes- Quarterly	Ongoing rotation with in SA time frame	7	As needed	Undefined	7	Clean XX annually	Activity referred from Proactive/Routine Inspection	7	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Activity referred from Proactive/Routine Inspection or Maintenance	7	Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	7	Undefined
Outfalls	1038	Critical Only	Monthly	115	As needed	Undefined	115	Respond to critical outfall maintenance	Activity referred from	115	Respond to reactive maintenance efforts on a	Activity referred from	115	Respond to BOTH proactive	Activity referred from	115	Undefined
Swales	Undefined	Undefined	Undefined	Undefined	As needed	Undefined	Undefined	Respond to maintenance efforts on a 1st come first serve internal referral basis	Activity referred from Proactive/Routine Inspection	Undefined	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Activity referred from Proactive/Routine Inspection or Maintenance	Undefined	Install XX LF of swales annually OR Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	Undefined	Undefined
Unpaved Alleyways	63 locations	Undefined	As resources allow	Undefined	As needed	Undefined	Undefined	Respond to maintenance efforts on a	Activity referred from	Undefined	Respond to reactive maintenance efforts on a	Activity referred from	Undefined	Respond to BOTH proactive	Activity referred from	Undefined	Undefined
Drainage Ditches	40 locations over 1.2 miles	Yes- Monthly / Qtrly/ SA	Rotates: Litter, Mowing, Trimming	40 locations over 1.2 miles	As needed	Undefined	40 locations over 1.2 miles	Respond to maintenance efforts on a 1st come first serve internal referral basis	NPDES permit	40 locations over 1.2 miles	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	40 locations over 1.2 miles	Replace and Install XX annually	NPDES permit	40 locations over 1.2 miles	Undefined
Drainage Canals	Undefined	No	Undefined	Undefined	As needed	Undefined	Undefined	Respond to maintenance efforts on a	Undefined	Undefined	Respond to reactive maintenance efforts on a	Undefined	Undefined	Respond to BOTH proactive	Activity referred from	Undefined	Undefined
Drainage Wells	6	Yes - Quarterly	Quarterly	6	As needed	Undefined	6	Respond to maintenance efforts on a 1st come first serve internal referral basis	Activity referred from Proactive/Routine Inspection	6	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Activity referred from Proactive/Routine Inspection or Maintenance	6	Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	6	Undefined
Culverts	2	Weekly	Weekly	2	As needed	Undefined	2	Respond to maintenance efforts on a 1st come first serve internal referral basis	Activity referred from Proactive/Routine Inspection	2	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Activity referred from Proactive/Routine Inspection or Maintenance	2	Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	2	Undefined
Stormwater Pump Stations 1 &2	2	Twice Weekly	Twice Weekly	2	As needed	Undefined	2	Respond to maintenance efforts on a 1st come first serve internal referral basis	NPDES permit	2	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	2	Replace and Install XX annually	NPDES permit	2	Undefined
Stormwater Pump Stations 4 & 5	2	Quarterly	Quarterly	2	As needed	Undefined	2	Respond to maintenance efforts on a 1st come first serve internal referral basis	NPDES permit	2	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	2	Replace and Install XX annually	NPDES permit	2	Undefined
Pollution Control Devices	2	Quarterly	Quarterly	2	As needed	Undefined	2	Respond to maintenance efforts on a 1st come first serve internal referral basis	NPDES permit	2	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	2	Replace and Install XX annually	NPDES permit	2	Undefined
CCTV Solid Pipe	Undefined	Undefined	Undefined	Undefined	As needed	Undefined	Undefined	Respond to maintenance efforts on a 1st come first serve internal referral basis	Activity referred from Proactive/Routine Inspection	Undefined	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Activity referred from Proactive/Routine Inspection or Maintenance	Undefined	Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	Undefined	Undefined
CCTV Perforated Pipe	Undefined	Undefined	Undefined	Undefined	As needed	Undefined	Undefined	Respond to maintenance efforts on a 1st come first serve internal referral basis	NPDES permit	Undefined	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	Undefined	Replace and Install XX annually	NPDES permit	Undefined	Undefined
Trench Drains	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Respond to maintenance efforts on a 1st come first serve internal referral basis	Undefined	Undefined	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Undefined	Undefined	Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	Undefined	Undefined
Street Sweeping	Miles	Undefined	Undefined	Undefined	As needed	Undefined	WIP	Respond to maintenance efforts on a 1st come first serve internal referral basis	NPDES permit	Undefined	Perform XX Reactive / Corrective Maintenance Annually	NPDES permit	Undefined	Replace and Install XX annually	NPDES permit	Undefined	Undefined
Weirs	11	Semi Annually	Semi Annually	11	As needed	Undefined	11	Respond to maintenance efforts on a 1st come first serve internal referral basis	Activity referred from Proactive/Routine Inspection	11	Respond to reactive maintenance efforts on a 1st come first serve internal referral basis from reactive inspections	Undefined	11	Respond to BOTH proactive and reactive efforts on a 1st come first serve internal referral basis from inspections and / or maintenance activities	Activity referred from Proactive/Routine Inspection or Maintenance	11	Undefined
																	Undefined
FUTURE ASSETS																	
Stormforce Mains	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	Undefined
Bioswales	Undefined	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	Undefined
Retention	Undefined	None at this time	NPDES permit	None at this time	None at this time	NPDES permit	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	Undefined
Detention Areas	Undefined	None at this time	NPDES permit	None at this time	None at this time	NPDES permit	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	Undefined
Pervious Pavers	Undefined	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	Undefined
Seawalls	4.4 miles * per Masterplan	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	None at this time	Undefined

APPENDIX G: PROPOSED LoS TIERS AND KPIs TEMPLATE

Appendix G - Proposed LOS-KPIs Template

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority(3)	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal (2)	Comments
1	Water Quality	% of water bodies impaired per watershed						Environmental, Social, Economic		
2	Water Quality	Receiving waterbody achieves Waste Load Allocations (WLA) for current and future TMDLs).						Environmental, Social, Economic	2	Refer to City's TMDL Prioritization Report - June 2016
		North Fork New River (NFNR)	1	Meet water quality standards within current permit cycle (January 5, 2017 through January 5, 2021)	94%			Environmental, Social, Economic	2	Targets to be confirmed with Todd Hiteshew and Larry Teich
		New River Canal (South)	2(3)	Meet water quality standards in future permit cycle (3).	69%			Environmental, Social, Economic	2	
		C-13 East (Middle River) Canal	2(3)	Meet water quality standards in future permit cycle (3).	67%			Environmental, Social, Economic	2	
		Las Olas Isles	2(3)	Meet water quality standards in future permit cycle (3).	58%			Environmental, Social, Economic	2	
		C-12 Canal	2(3)	Meet water quality standards in future permit cycle (3).	52%			Environmental, Social, Economic	2	
		C-14 (Cypress) Canal	2(3)	Meet water quality standards in future permit cycle (3).	22%			Environmental, Social, Economic	2	
		C-13 West Middle River) Canal	2(3)	Meet water quality standards in future permit cycle (3).	22%			Environmental, Social, Economic	2	
3	Resiliency	% of new infrastructure investments that incorporate green infrastructure approaches and performance		Undefined	20%	10%	5%	Environmental, Social, Economic	3	Targets to be evaluated during implementation phase.
4	Overall Neighbors Satisfaction	% of total calls responded based on identified priority ranking		Undefined	100%	60%	30%	Social, Economic	1,5	Priority ranking and LOS targets will be based on implementation phase adopted priority criteria.
5	Overall Neighbors Satisfaction	% of neighbors who annually rate the overall satisfaction with City prevention of flooding services as "Very Satisfied, 5" or "Satisfied, 4".		24%, 31% (2017, 2016, not asked in 201	40%	30%	24%	Social, Economic	1,4,5	
6	Overall Neighbors Satisfaction	% of neighbors who annually rate the overall satisfaction with City maintenance of streets, sidewalks, and infractructure as "Very Satisfied, 5" or "Satisfied, 4".		38%, 47%, 54% (2017, 2016, 2012)	50%	45%	38%	Social, Environmental, Economic	1,2,3	
7	Overall Neighbors Satisfaction	% of neighbors who annually rate the overall satisfaction with City cleanliness of waterways near home as "Very Satisfied, 5" or "Satisfied, 4".		35%, 27%, 44% (2017, 2016, 2012)	45%	35%	27%	Social, Environmental, Economic	1,2,3,4,5	
8	Be a well-trained, innovative, and neighborcentric workforce	% of stormwater and environmental employees who are trained on each fiscal year per Total Section/Division/Department Employees						Social, Environmental, Economic	3	
		FSA Certication						Social, Environmental, Economic	3	
		NASSCO						Social, Environmental, Economic	3	
		FDED Erosion and Sediment Control						Social, Environmental, Economic	3	
		Cityworks						Social, Environmental, Economic	3	
		City Department Training						Social, Environmental, Economic	3	
		Equipment Certifications						Social, Environmental, Economic	3	
		IAM Certification						Social, Environmental, Economic	3	
		FWPCOA						Social, Environmental, Economic	3	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority[3]	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal [2]	Comments
		New Employee Orientation						Social, Environmental, Economic	3	
		Climate 101						Social, Environmental, Economic	3	
		Finance Training						Social, Environmental, Economic	3	
		Cyber Security						Social, Environmental, Economic	3	
		HIPPA						Social, Environmental, Economic	3	
		Laudershare						Social, Environmental, Economic	3	
		ICS-FEMA 100						Social, Environmental, Economic	3	
		ICS-200 FEMA						Social, Environmental, Economic	3	
		IS-00279						Social, Environmental, Economic	3	
		G-300						Social, Environmental, Economic	3	
		IS-700 FEMA						Social, Environmental, Economic	3	
		ICS-G402 FEMA						Social, Environmental, Economic	3	
		ICS-800 FEMA						Social, Environmental, Economic	3	
		Human Resources Compliance Training						Social, Environmental, Economic	3	
		Basic FMLA Dynamic Software Demo						Social, Environmental, Economic	3	
		Boating Safety						Social, Environmental, Economic	3	
		Back Safety						Social, Environmental, Economic	3	
		Bloodborne Pathogens						Social, Environmental, Economic	3	
		Bobcat Operations						Social, Environmental, Economic	3	
		Confined Space Entry						Social, Environmental, Economic	3	
		Crystalline Silica						Social, Environmental, Economic	3	
		Defensive Driving						Social, Environmental, Economic	3	
		Electrical Safety						Social, Environmental, Economic	3	
		Excavation and Trenching						Social, Environmental, Economic	3	
		Fire Extinguisher Training						Social, Environmental, Economic	3	
		First Aid (CPR)						Social, Environmental, Economic	3	
		Forlift Safety and Refresher						Social, Environmental, Economic	3	
		Hazardous Material Handling (HAZWOPER) and Refresher						Social, Environmental, Economic	3	
		Hazard Communication/GHS						Social, Environmental, Economic	3	
		Hearing Protection						Social, Environmental, Economic	3	
		Heavy Equipment						Social, Environmental, Economic	3	
		Hot Work Safety						Social, Environmental, Economic	3	
		Lock out/Tagout						Social, Environmental, Economic	3	
		Manual and Power Tools						Social, Environmental, Economic	3	
		OSHA Training - 10 hrs						Social, Environmental, Economic	3	
		OSHA Fall Protection						Social, Environmental, Economic	3	
		OSH Scaffold Ladder Safety						Social, Environmental, Economic	3	
		PPE & Live Safeving Equipment						Social, Environmental, Economic	3	
		Respiratory Protection						Social, Environmental, Economic	3	
		Safety Orientation						Social, Environmental, Economic	3	
		Workplace Safety (PPE, Stairs, Ladders, Power Tools)						Social, Environmental, Economic	3	
		Work Zone Safety - MOT						Social, Environmental, Economic	3	
		Working Safety with Poert Cutoff Saws						Social, Environmental, Economic	3	
		Vacuum Truck Training						Social, Environmental, Economic	3	
		Coastal Barrier Resources Systems						Social, Environmental, Economic	3	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority[3]	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal [2]	Comments
		Collaborative Stormwater Mgmt Solutions						Social, Environmental, Economic	3	
		CPA's NPDED MS4 Permit Program						Social, Environmental, Economic	3	
		CUES CCTV Vehicle & Equipment Training						Social, Environmental, Economic	3	
		Drinking Water Operator License C						Social, Environmental, Economic	3	
		FLDEP ESC						Social, Environmental, Economic	3	
		FSA Level 1						Social, Environmental, Economic	3	
		FSA Level 2						Social, Environmental, Economic	3	
		Florida Stormwater & Erosion & Sediment Control Inspector						Social, Environmental, Economic	3	
		FWPCOA_STW C						Social, Environmental, Economic	3	
		FWPCOA_STW B						Social, Environmental, Economic	3	
		FWPCOA_STW A						Social, Environmental, Economic	3	
		Green Infrastructure Lab						Social, Environmental, Economic	3	
		Program						Social, Environmental, Economic	3	
		MARK3 Easement Training System Training						Social, Environmental, Economic	3	
		NASSCO						Social, Environmental, Economic	3	
		Sea Turtle Monitoring						Social, Environmental, Economic	3	
		Stormwater Water Compliance Success						Social, Environmental, Economic	3	
		Stormwater Goes Green						Social, Environmental, Economic	3	
		Stormwater Management Class C						Social, Environmental, Economic	3	
		Stormwater Management Class B						Social, Environmental, Economic	3	
		Stormwater Pollution Prevention						Social, Environmental, Economic	3	
		Urban Stormwater/Green Infrastructure Webinar						Social, Environmental, Economic	3	
		Utility Customer Relations						Social, Environmental, Economic	3	
		811 Training						Social, Environmental, Economic	3	
		Accident Investigation Training for Supervisors						Social, Environmental, Economic	3	
		Blue Print Training						Social, Environmental, Economic	3	
		Customer Service						Social, Environmental, Economic	3	
		Discharge /Overflow Control Procedures						Social, Environmental, Economic	3	
		Fire Hydrant Training						Social, Environmental, Economic	3	
		Flammable Material Awareness						Social, Environmental, Economic	3	
		Flood Plain Manager						Social, Environmental, Economic	3	
		Florida Marine Debris Workshop						Social, Environmental, Economic	3	
		Annual Trash Study Results - Go To Webinar						Social, Environmental, Economic	3	
		Cradle to Cradle Certified - Go To Webinar						Social, Environmental, Economic	3	
		Basic Stormwater Calculations - Go To Webinar						Social, Environmental, Economic	3	
		Go to Webinar						Social, Environmental, Economic	3	
		Keeping the Baby in the Bathwater: Integrating Climate Resilience within Existing Water Planning, Design, and Operations - Go To Webinar						Social, Environmental, Economic	3	
		Plastic Soup Solutions - Go To Webinar						Social, Environmental, Economic	3	
		Green Infrastructure Plant Selection - Webcast						Social, Environmental, Economic	3	
		Green Infrastructure Solutions						Social, Environmental, Economic	3	
		Kronos						Social, Environmental, Economic	3	
		Low Impact Development						Social, Environmental, Economic	3	
		Managing Success						Social, Environmental, Economic	3	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority[3]	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal [2]	Comments
		Material Management with Cityworks Storeroom						Social, Environmental, Economic	3	
		Pipeline Emergency Response & Damage Prevention						Social, Environmental, Economic	3	
		Project Management						Social, Environmental, Economic	3	
		Samsara Product Training: Routes & Dispatch - Webcast						Social, Environmental, Economic	3	
		Sixth Sigma (Green Belt)						Social, Environmental, Economic	3	
		Tackling Unconsious Bias in Hiring						Social, Environmental, Economic	3	
		Web Content Training- Vision Live						Social, Environmental, Economic	3	
		Workplace Violence						Social, Environmental, Economic	3	
		Transit Systems						Social, Environmental, Economic	3	
9	Financial Viability	% of stormwater CIP projects delivered on time and within budget each fiscal year			80%	65%	50%	Economic	1,3	
10	Financial Viability	% of environmental CIP projects delivered on time and within budget each fiscal year			80%	65%	50%	Economic	1,3	
11	Financial Viability	% of cost overrun of Stormwater CIP projects delivered each fiscal year						Economic	1,3	To be tracked during Year 2 or 3 of the WAMP Implementation
12	Financial Viability	% of cost overrun of Environmental CIP projects delivered each fiscal year						Economic	1,3	To be tracked during Year 2 or 3 of the WAMP Implementation
13	Asset Condition Assessment [5]	% of condition assessment performed on City-Owned assets over X years.						Economic	3	Watershed asset priorities will be set first - during WAMP Implementation
		Culvert		Unknown				Economic	3	
		Discharge Point (Outfall)		Unknown				Economic	3	
		Ditch (Open Drain)		Unknown				Economic	3	
		Drainage Well		Unknown				Economic	3	
		Exfiltration Trench		Unknown				Economic	3	
		Trench Drains		Unknown						
		Gravity Main		Unknown				Economic	3	
		Inlet (Catch Basin)		Unknown				Economic	3	
		Network Structure		Unknown				Economic	3	
		Pollution Control Device (PRB)		Unknown				Economic	3	
		Pollution Control Structure		Unknown				Economic	3	
		Pond (Detention/Retention)		Unknown				Economic	3	
		Pressure Pipe		Unknown				Economic	3	
		Right of Way		Unknown				Economic	3	
		Seawall		Unknown				Economic	3	
		SW Manhole		Unknown				Economic	3	
		SW Pump Station		Unknown				Economic	3	
		Swale		Unknown				Economic	3	
		Control Valve (Tidal Valves)		Unknown				Economic	3	
		Weir Structure		Unknown				Economic	3	
14	System renewal / Replacement rate	% of assets replaced for each asset class per fiscal year						Economic	1,2,3	
		Culvert						Economic	1,2,3	
		Discharge Point (Outfall)						Economic	1,2,3	
		Ditch (Open Drain)						Economic	1,2,3	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority[3]	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal [2]	Comments
		Drainage Well						Economic	1,2,3	
		Exfiltration Trench						Economic	1,2,3	
		Trench Drains								
		Gravity Main						Economic	1,2,3	
		Inlet (Catch Basin)						Economic	1,2,3	
		Network Structure						Economic	1,2,3	
		Pollution Control Device (PRB)						Economic	1,2,3	
		Pollution Control Structure						Economic	1,2,3	
		Pond (Detention/Retention)						Economic	1,2,3	
		Pressure Pipe						Economic	1,2,3	
		Right of Way						Economic	1,2,3	
		Seawall						Economic	1,2,3	
		SW Manhole						Economic	1,2,3	
		SW Pump Station						Economic	1,2,3	
		Swale						Economic	1,2,3	
		Control Valve (Tidal Valves)						Economic	1,2,3	
		Weir Structure						Economic	1,2,3	
15	Infrastructure Reliability	Number of inspections completed as a % of total assets						Economic	1,2,3	
		Culvert						Economic	1,2,3	
		Discharge Point (Outfall)						Economic	1,2,3	
		Ditch (Open Drain)						Economic	1,2,3	
		Drainage Well						Economic	1,2,3	
		Exfiltration Trench						Economic	1,2,3	
		Trench Drains								
		Gravity Main						Economic	1,2,3	
		Inlet (Catch Basin)						Economic	1,2,3	
		Network Structure						Economic	1,2,3	
		Pollution Control Device (PRB)						Economic	1,2,3	
		Pollution Control Structure						Economic	1,2,3	
		Pond (Detention/Retention)						Economic	1,2,3	
		Pressure Pipe						Economic	1,2,3	
		Right of Way						Economic	1,2,3	
		Seawall						Economic	1,2,3	
		SW Manhole						Economic	1,2,3	
		SW Pump Station						Economic	1,2,3	
		Swale						Economic	1,2,3	
		Control Valve (Tidal Valves)						Economic	1,2,3	
		Weir Structure						Economic	1,2,3	
16	System Integrity	Total # of system requiring repairs per 100 miles of SW system piping per watershed						Economic	1,2,3	
		Cypress Creek						Economic	1,2,3	
		Fort Lauderdale Executive Airport S36						Economic	1,2,3	
		ICW South						Economic	1,2,3	
		ICW North						Economic	1,2,3	
		Middle River						Economic	1,2,3	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority(3)	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal (2)	Comments
		New River						Economic	1,2,3	
		NFNR						Economic	1,2,3	
		Prospect Recharge						Economic	1,2,3	
		SFNR						Economic	1,2,3	
		Uptown S37A						Economic	1,2,3	
	System Integrity	Total # of system requiring inspection per 100 miles of SW system piping per watershed						Economic	1,2,3	
		Cypress Creek						Economic	1,2,3	
		Fort Lauderdale Executive Airport S36						Economic	1,2,3	
		ICW South						Economic	1,2,3	
		ICW North						Economic	1,2,3	
		Middle River						Economic	1,2,3	
		New River						Economic	1,2,3	
		NFNR						Economic	1,2,3	
		Prospect Recharge						Economic	1,2,3	
		SFNR						Economic	1,2,3	
		Uptown S37A						Economic	1,2,3	
17	System Integrity	% of system that can be repaired based on staffing level						Economic	1,2,3	
		Culvert						Economic	1,2,3	
		Discharge Point (Outfall)						Economic	1,2,3	
		Ditch (Open Drain)						Economic	1,2,3	
		Drainage Well						Economic	1,2,3	
		Exfiltration Trench						Economic	1,2,3	
		Trench Drains								
		Gravity Main						Economic	1,2,3	
		Inlet (Catch Basin)						Economic	1,2,3	
		Network Structure						Economic	1,2,3	
		Pollution Control Device (PRB)						Economic	1,2,3	
		Pollution Control Structure						Economic	1,2,3	
		Pond (Detention/Retention)						Economic	1,2,3	
		Pressure Pipe						Economic	1,2,3	
		Right of Way						Economic	1,2,3	
		Seawall						Economic	1,2,3	
		SW Manhole						Economic	1,2,3	
		SW Pump Station						Economic	1,2,3	
		Swale						Economic	1,2,3	
		Control Valve (Tidal Valves)						Economic	1,2,3	
		Weir Structure						Economic	1,2,3	
18	Flood Reduction	% of total reduction of locations with serious flood as defined by FEMA in the CRS Manual						Economic	1,3,4	To be determined after CRS evaluation results.
19	Energy Use	Total energy use per run times based on volume collected (kWH/MG)						Economic	3	
20	O&M Expenditures	O&M of expenditures as a % of total operating budget						Economic	3	To be confirmed with Glen Hadwen

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority(3)	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal (2)	Comments
21	O&M Expenditures	Ratio of annual net income/total value of assets (O&M/Total Value)						Economic	3	
22	Capital Expenditures	Community Investment (capital investment) for Stormwater Infrastructure Projects to meet the adopted City Flood Protection Criteria within X years (including funding for Stormwater Master Plan Implementation Projects)			X, 25 years	X, 15 years	X, 5 years	Environmental, Social, Economic	1,2,3,4,5	Refer to CIP 2020-2014
23	Soft Asset Management Program	Capital and operations investment for developing, adopting, and monitoring soft assets needed to facilitate meeting the WAMP goals and objectives								
		Asset Management Policy								
		City Flood Resilience and Environmental Groups Goals								
		City Policies and Procedures								
		Regulatory Permitting Policies								
		Ordinances								
		Building Codes and Land Development Regulations								
		City Planning Documents								
		Non-Structural BMPs								
		Goodwill Relationships and Public Credibility								
		Goodwill Relationships and Cooperation with All City Departments, Staff, and Advisory Boards								
		Goodwill Relationships with Regional Partners								
		Human Resources Policies and Procedures								
		Human Behavior and Compliance								
		GIS Inventory								
24	Community Outreach and Stakeholder Engagement Program	Community Investment for developing, adopting, and monitoring Community Outreach and Stakeholder Engagement Program to facilitate meeting the WAMP goals and objectives with X fiscal years.						Economic, Social		
25	Flood Reduction	Total number of repetitive flood losses properties in each watershed						Economic	1,4,5	
		Cypress Creek						Economic	1,4,5	
		Fort Lauderdale Executive Airport S36						Economic	1,4,5	
		ICW South						Economic	1,4,5	
		ICW North						Economic	1,4,5	
		Middle River						Economic	1,4,5	
		New River						Economic	1,4,5	
		NFNR						Economic	1,4,5	
		Prospect Recharge						Economic	1,4,5	
		SFNR						Economic	1,4,5	
		Uptown S37A						Economic	1,4,5	
26	Flood Reduction	Total # of claims per watershed per year						Economic	1,4,5	
		Cypress Creek						Economic	1,4,5	
		Fort Lauderdale Executive Airport S36						Economic	1,4,5	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority(3)	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal (2)	Comments
		ICW South						Economic	1,4,5	
		ICW North						Economic	1,4,5	
		Middle River						Economic	1,4,5	
		New River						Economic	1,4,5	
		NFNR						Economic	1,4,5	
		Prospect Recharge						Economic	1,4,5	
		SFNR						Economic	1,4,5	
		Uptown S37A						Economic	1,4,5	
27	Partnerships	Total # of utility partnerships with regional stakeholders to protect and enhance the watershed						Economic/Social/Environmental	1,5	A separate LOS template will be created for all soft assets. This LOS will be moved to that template.
		Cypress Creek						Economic/Social/Environmental	1,5	
		Fort Lauderdale Executive Airport S36						Economic/Social/Environmental	1,5	
		ICW South						Economic/Social/Environmental	1,5	
		ICW North						Economic/Social/Environmental	1,5	
		Middle River						Economic/Social/Environmental	1,5	
		New River						Economic/Social/Environmental	1,5	
		NFNR						Economic/Social/Environmental	1,5	
		Prospect Recharge						Economic/Social/Environmental	1,5	
		SFNR						Economic/Social/Environmental	1,5	
		Uptown S37A						Economic/Social/Environmental	1,5	
28	City-Owned Stormwater System GIS Inventory	% of City-Owned assets added to the stormwater geodatabase and/or asset data verified per asset class as percent of total assets every X years.						Economic	3	
		Culvert	2	Undefined				Economic	3	
		Discharge Point (Outfall)	1	Undefined				Economic	3	
		Ditch (Open Drain)	3	Undefined				Economic	3	
		Drainage Well	2	Undefined				Economic	3	
		Exfiltration Trench	1	Undefined				Economic	3	
		Trench Drain		Undefined						
		Gravity Main	1	Undefined				Economic	3	
		Inlet (Catch Basin)	1	Undefined				Economic	3	
		Network Structure	3	Undefined				Economic	3	
		Pollution Control Device (PRB)	2	Undefined				Economic	3	
		Pollution Control Structure	2	Undefined				Economic	3	
		Pond (Detention/Retention)	2	Undefined				Economic	3	
		Pressure Pipe		Undefined				Economic	3	Add from As-built drawings from Stormwater Master Plan Projects
		Right of Way		Undefined				Economic	3	including easement inventory
		Seawall		Undefined				Economic	3	Stormwater Geodatabase, use location and elevation data from Seawall Master Plan
		SW Manhole		Undefined				Economic	3	
		SW Pump Station		Undefined				Economic	3	
		Swale		Undefined				Economic	3	

Triple Bottom Line LOS and KPIs

Measure No.	LoS Measure	Key Performance Indicator (KPIs)	Priority[3]	Baseline LoS (LoS P)	Target LoS A	Target LoS B	Target LoS C	Triple Bottom Line	City Goal [2]	Comments
		Control Valve (Tidal Valves)		Undefined				Economic	3	
		Weir Structure		Undefined				Economic	3	
		Natural Assets		Undefined				Economic	3	Ownership and location only
29	Privately-Owned Stormwater System GIS Inventory	% of Privately-Owned assets added to the stormwater geodatabase and/or data verified per asset class as percent of total assets every X years.						Economic	3	
		Culvert		Undefined				Economic	3	Ownership and location only
		Discharge Point (Outfall)		Undefined				Economic	3	Ownership and location only
		Ditch (Open Drain)		Undefined				Economic	3	Ownership and location only
		Drainage Well		Undefined				Economic	3	Ownership and location only
		Exfiltration Trench		Undefined				Economic	3	Ownership and location only
		Trench Drain		Undefined						
		Gravity Main		Undefined				Economic	3	Ownership and location only
		Inlet (Catch Basin)		Undefined				Economic	3	Ownership and location only
		Network Structure		Undefined				Economic	3	Ownership and location only
		Pollution Control Device (PRB)		Undefined				Economic	3	Ownership and location only
		Pollution Control Structure		Undefined				Economic	3	Ownership and location only
		Pond (Detention/Retention)		Undefined				Economic	3	Ownership and location only
		Pressure Pipe		Undefined				Economic	3	Ownership and location only
		Right of Way		Undefined				Economic	3	Ownership and location only
		Seawall		Undefined				Economic	3	Ownership and location only
		SW Manhole		Undefined				Economic	3	Ownership and location only
		SW Pump Station		Undefined				Economic	3	Ownership and location only
		Swale		Undefined				Economic	3	Ownership and location only
		Control Valve (Tidal Valves)		Undefined				Economic	3	Ownership and location only
		Weir Structure		Undefined				Economic	3	Ownership and location only

Notes:

(1) The Team will provide Total Cost of Service calculation procedures on the WAMP Document.

(2) City of Fort Lauderdale Flood Resilience and Environmetal Goals:
Goal 1: Reduce Flooding and Adapt to Sea Level Rise
Goal 2: Improve water quality and our natural resources
Goal 3: Proactively maintain the City stormwater infrastructure
Goal 4: Maintain & improve the Community's Rating System (CRS) score
Goal 5: Collaborate with stakeholders to mutually understand & address our community's flooding risks

(3) The implementation prioritization and implemenation schedule will be analyzed during the Implementation Phase of the WAMP. An example of prioritization is shown on each watershed section for a subset of the assets.

(4) Preliminary LOS tiers not provided on the document will be provided on the Draft WAMP Document

Preliminary LoS Tiers at Hard Asset Level

Hard Asset Class	Currently a Layer in GIS (Yes, No)	Total No. of City Owned Assets [1] GIS/STW OPS Report	Work Description	Category	CoF [2]	LoF [3]	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments
CULVERT	No	Unknown/2	CULVERT - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Unknown	1,3	
CULVERT	No	Unknown/2	CULVERT - INSPECT	PREVENTIVE			Inspect culvert inlets and outlet after storm events within X days	Weekly	1,3	
CULVERT	No	Unknown/2	CULVERT - INSPECT	REACTIVE			Respond to service requests within X days	As needed		
CULVERT	No	Unknown/2	CULVERT - INSTALL	REACTIVE/CORRECTIVE			Install X number of culverts	Undefined	1,3	
CULVERT	No	Unknown/2	CULVERT - PM - WEEKLY	PREVENTIVE/PREDICTIVE			Remove accumulated sediments and debris at the inlet, outlet, and within outlet every X years	Respond to Maintenance efforts on a first come first serve internal referral basis	1,3	
CULVERT	No	Unknown/2	CULVERT - REMOVE	REACTIVE/CORRECTIVE			Remove any obstruction to flow within X days	Respond to reactive maintenance efforts on a first come first serve internal referral basis from reactive inspections	1,3	
CULVERT	No	Unknown/2	CULVERT - REPAIR	REACTIVE/CORRECTIVE			Repair any erosion damage at the culvert's inlet and outlet with in X days; Repair X % of assets within fiscal year	Respond to reactive maintenance efforts on a first come first serve internal referral basis from reactive inspections	1,3	
CULVERT	No	Unknown/2	CULVERT - REPLACE	REACTIVE/CORRECTIVE				Respond to reactive maintenance efforts on a first come first serve internal referral basis from reactive inspections	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - INSPECT	PREVENTIVE			Inspect all outfalls every X years per watershed	Critical only	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - INSPECT	REACTIVE			Respond to service requests within X days	As needed	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - INSTALL	REACTIVE/CORRECTIVE			Percentage of assets inspected each year	As needed	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - PM - MONTHLY	PREVENTIVE/PREDICTIVE			Percetage of defective assets restored to performanance standards each fiscal year	Respond to critical outfall	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - REMOVE	REACTIVE/CORRECTIVE			Percent of outfalls on top worst condition cleaned from barnicles and blockage every fiscal year	Undefined	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - REPAIR	REACTIVE/CORRECTIVE			Percentage of assets repairs completed with in X calendar days of notification.	Respond to Reactive Maintenance efforts	1,3	
DISCHARGE POINT (OUTFALL)	Yes	1049/1038	DISCHARGE POINT - REPLACE	REACTIVE/CORRECTIVE			Percetage of assets with useful life at ___ replaced each year.	Respond to Reactive Maintenance efforts	1,3	
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - ABANDON	CORRECTIVE				Undefined	1,2,3	
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - INSPECT	PREVENTIVE			Inspect X percentage of ditch every year	Undefined	1,2,3	
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - INSPECT	REACTIVE			Respond to service requests within X days	Undefined		
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - INSTALL	REACTIVE/CORRECTIVE				Undefined	1,2,3	
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - PM	PREVENTIVE/PREDICTIVE				Undefined		
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - REMOVE	REACTIVE/CORRECTIVE				Undefined	1,2,3	
DITCH (OPEN DRAIN)	No	Undefined/40	DITCH - REPAIR	REACTIVE/CORRECTIVE				Undefined	1,2,3	
DRAINAGE WELL	Yes	10/6	DRAINAGEWELL - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	There are 9 drainage wells total not 10
DRAINAGE WELL	Yes	10/6	DRAINAGEWELL - INSPECT / TEST	PREVENTIVE			Inspect X percentage of drainage wells on X basis	Quarerly	1,3	
DRAINAGE WELL	Yes	10/6	DRAINAGEWELL - INSPECT	REACTIVE			Respond to service requests within X days	As needed	1,3	
DRAINAGE WELL	Yes	10/6	DRAINAGE WELL - PM - QUARTERLY	PREVENTIVE			Clean drainage structure on X basis	Respond to Maintenance efforts on a first come first serve internal referral basis	1,3	
DRAINAGE WELL	Yes	10/6	DRAINAGEWELL - ABANDON IN PLACE	CORRECTIVE			As needed.	Respond to Maintenance efforts on a first come first serve internal referral basis	1,3	
DRAINAGE WELL	Yes	10/6	DRAINAGEWELL - REPAIR	REACTIVE/CORRECTIVE			Repair the top X percentage of worst condition each fiscal year.	Respond to Maintenance efforts on a first come first serve internal referral basis	1,3	
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - INSPECT / TEST	PREVENTIVE			Percentage of assets inspected per year	Undefined	1,2,3	
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - INSPECT	REACTIVE			Respond to service request within X days			
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - INSTALL	REACTIVE			Install X LF of Exfiltration Trenches per year	Undefined	1,2,3	
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - PM - CCTV MONTHLY	PREVENTIVE/PREDICTIVE				Respond to Maintenance efforts on a first come first serve internal referral basis	1,2,3	
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - REMOVE	REACTIVE/CORRECTIVE				Undefined	1,2,3	

Preliminary LoS Tiers at Hard Asset Level

Hard Asset Class	Currently a Layer in GIS (Yes, No)	Total No. of City Owned Assets [1] GIS/STW OPS Report	Work Description	Category	CoF [2]	LoF [3]	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - REPAIR	REACTIVE/CORRECTIVE				Respond to Maintenance efforts on a first come first serve internal referral basis	1,2,3	
EXFILTRATION TRENCH	Yes	Undefined	EXFILTRATION TRENCH - REPLACE	REACTIVE/CORRECTIVE				Undefined	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - INSPECT / TEST	PREVENTIVE			Percentage of assets inspected per year	Undefined	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - INSPECT	REACTIVE			Respond to service request within X days			
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - INSTALL	REACTIVE			Install X LF of Trench Drains per year	Undefined	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - PM - CCTV MONTHLY	PREVENTIVE/PREDICTIVE				Respond to Maintenance efforts on a first come first serve internal referral basis	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - REMOVE	REACTIVE/CORRECTIVE				Undefined	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - REPAIR	REACTIVE/CORRECTIVE				Respond to Maintenance efforts on a first come first serve internal referral basis	1,2,3	
TRENCH DRAIN	No	Undefined	TRENCH DRAIN - REPLACE	REACTIVE/CORRECTIVE				Undefined	1,2,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - CCTV	PREVENTIVE					1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - INSPECT / TEST	PREVENTIVE				Respond to maintenance efforts on a first come first serve basis	1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - INSPECT	REACTIVE			Respond to service request within X days	Respond to maintenance efforts on a first come first serve basis	1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - INSTALL	REACTIVE/CORRECTIVE					1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - PM	PREVENTIVE/PREDICTIVE				Clean XX Annually	1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - REMOVE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - REPAIR	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
GRAVITY MAIN	Yes	183.8/185.5 Miles	GRAVITY MAIN - REPLACE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - CCTV					Undefined	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - GIS UPATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - INSPECT / TEST	PREVENTIVE			Respond to service request within X days	As needed	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - INSPECT	REACTIVE			Percentage of assets inspected per year	Semi-Annual	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - PM	PREVENTIVE/PREDICTIVE			Remove sediments and debris from the bottom of the basin and inlet grates X times per year for X % of the assets	Clean XX Annually	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - REMOVE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - REPAIR	REACTIVE/CORRECTIVE			X % of asset repairs completed within X calendar days of notification	Perform XX Reactive / Corrective Maintenance Annually	1,3	
INLET (CATCH BASIN)	Yes	8950/8848	INLET - REPLACE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - INSPECT/TEST	PREVENTIVE				Undefined	1,3	
		592	NETWORK STRUCTURE - INSPECT	REACTIVE			Respond to service request within X days			
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - INSTALL	REACTIVE/CORRECTIVE				Undefined	1,3	
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - PM	PREVENTIVE				Undefined	1,3	
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - REMOVE	REACTIVE/CORRECTIVE				Undefined	1,3	
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - REPAIR	REACTIVE/CORRECTIVE				Undefined	1,3	
NETWORK STRUCTURE	Yes	592	NETWORK STRUCTURE - REPLACE	REACTIVE/CORRECTIVE				Undefined	1,3	
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - INSPECT / TEST	PREVENTIVE			Once a quartly	As needed	1,2,3	
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - INSPECT	REACTIVE			Respond to service request within X days	Quarterly	1,2,3	
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - INSTALL	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,2,3	There are a lot more than 76 PRBs. It
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - PM	PREVENTIVE/PREDICTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis	1,2,3	
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - REMOVE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,2,3	

Preliminary LoS Tiers at Hard Asset Level

Hard Asset Class	Currently a Layer in GIS (Yes, No)	Total No. of City Owned Assets [1] GIS/STW OPS Report	Work Description	Category	CoF [2]	LoF [3]	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - REPAIR	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,2,3	
POLLUTION CONTROL DEVICE (PRB)	Yes	76/2	POLLUTION CONTROL DEVICE - REPLACE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - INSPECT / TEST	PREVENTIVE				As needed	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - INSPECT	REACTIVE			Respond to service request within X days	Quarterly	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - INSTALL	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - INSPECT	PREVENTIVE						
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - INSPECT	REACTIVE			Respond to service request within X days			
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - PM - QUARTERLY	PREVENTIVE/PREDICTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - REMOVE	REACTIVE/CORRECTIVE			Remove and dispose of sediments and debris with the control structure X times per year	Perform XX Reactive / Corrective Maintenance Annually	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - REPAIR	REACTIVE/CORRECTIVE			Repair any damage to control structure X times per year to X % of the pollution control structure	Perform XX Reactive / Corrective Maintenance Annually	1,2,3	
POLLUTION CONTROL STRUCTURE	Yes	Undefined	POLLUTION CONTROL STRUCTURE - REPLACE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,2,3	
POND (DETENTION/RETENTION)	Yes	Undefined	POND - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
POND (DETENTION/RETENTION)	Yes	Undefined	POND - CLEAN	PREVENTIVE			Remove floatables, trash, dead vegetation and sediments X times per year.	Undefined	1,2,3	
POND (DETENTION/RETENTION)	Yes	Undefined	POND - ENVIRONMENTAL REQUEST	REACTIVE				Undefined	1,2,3	
POND (DETENTION/RETENTION)	Yes	Undefined	POND - INSPECT	PREVENTIVE				Undefined	1,2,3	
POND (DETENTION/RETENTION)	Yes	Undefined	POND - INSPECT	REACTIVE/CORRECTIVE				Undefined		
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - INSPECT / TEST	PREVENTIVE				Undefined	1,3	
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - INSPECT / TEST	REACTIVE			Respond to service request within X days			
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - INSTALL	REACTIVE				Undefined	1,3	
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - PM	PREVENTIVE/PREDICTIVE				Undefined	1,3	
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - REMOVE	REACTIVE/CORRECTIVE				Undefined	1,3	
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - REPAIR	REACTIVE/CORRECTIVE				Undefined	1,3	
PRESSURE PIPE	No	Undefined	PRESSURE PIPE - REPLACE	REACTIVE/CORRECTIVE				Undefined	1,3	
DRAINAGE EASEMENT	No	Undefined	RIGHT OF WAY - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
DRAINAGE EASEMENT	No	Undefined	RIGHT OF WAY - MAINTAIN	REACTIVE/CORRECTIVE				Undefined	1,3	
SEAWALL	No	4.4 miles per Master Plan	SEAWALL - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3,5	
SEAWALL	No	4.4 miles per Master Plan	SEAWALL - INSPECT	PREVENTIVE			Percentage of City-Owned seawalls inspected before, during and after king tide events	Undefined	1,3,5	
SEAWALL	No	4.4 miles per Master Plan	SEAWALL - INSPECT	REACTIVE			Respond to service request within X days	Perform XX Reactive / Corrective Maintenance Annually	1,3,5	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - ABANDON	REACTIVE/CORRECTIVE				Undefined	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - CCTV	PREVENTIVE				Respond to Maintenance Efforts on a First Come First Serve basis	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - GIS UPDATE	CORRECTIVE				Undefined	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - INSPECT / TEST	REACTIVE			Update Stormwater Geodatabase within X days	As needed	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - INSPECT	PREVENTIVE				Respond to inspection efforts on a first come first serve basis	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - INSTALL	REACTIVE/CORRECTIVE			Respond to service request within X days	Respond to maintenance efforts on a first come first serve basis	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - PM - ANNUAL	PREVENTIVE/PREDICTIVE				Respond to maintenance efforts on a first come first serve basis	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - REPAIR	REACTIVE				Respond to maintenance efforts on a first come first serve basis	1,3	
SW MANHOLE	Yes	1,192 /1,151	STORMWATER MANHOLE - REPLACE	REACTIVE/CORRECTIVE				Respond to maintenance efforts on a first come first serve basis	1,3	

Preliminary LoS Tiers at Hard Asset Level

Hard Asset Class	Currently a Layer in GIS (Yes, No)	Total No. of City Owned Assets [1] GIS/STW OPS Report	Work Description	Category	CoF [2]	LoF [3]	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - CLEANING PM - WEEKLY	PREVENTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - INSPECT / TEST	PREVENTIVE				As needed	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - INSPECT	REACTIVE			Respond to service request within X days	Twice Weekly	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - INSTALL	REACTIVE/CORRECTIVE				As needed	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - REMOVE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - REPAIR	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
SW PUMP STATION	Yes	9/4	STORMWATER PUMP STATION - REPLACE	REACTIVE/CORRECTIVE				Perform XX Reactive / Corrective Maintenance Annually	1,3	
SWALE	No	Undefined	SWALE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,2,3	
SWALE	No	Undefined	SWALE - INSPECT	PREVENTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis from Reactive Inspections	1,2,3	
SWALE	No	Undefined	SWALE - INSPECT	REACTIVE				As needed	1,2,3	
SWALE	No	Undefined	SWALE - INSTALL	REACTIVE/CORRECTIVE				Undefined	1,2,3	
SWALE	No	Undefined	SWALE - PM	PREVENTIVE			Remove sediments and debris every X times per year.	Respond to Maintenance Efforts on a First Come First Serve internal referral basis	1,2,3	
SWALE	No	Undefined	SWALE - REPAIR	REACTIVE/CORRECTIVE			Repair grade to ensure proper drainage and/or Resod to prevent erosion every X years.	Undefined	1,2,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - INSPECT / CLEAN	PREVENTIVE			Inspect all tidal valves on X basis	Quarterly	1,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - INSTALL	REACTIVE			Respond to service requests within X days	As needed	1,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - PM - QUARTERLY	PREVENTIVE			Percetage of assets restored to performanance standards each year	NPDES Permit: Clean XX Annually	1,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - REMOVE	REACTIVE/CORRECTIVE				Respond to Reactive Maintenance Efforts	1,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - REPAIR	REACTIVE/CORRECTIVE			Percentage of assets repairs completed (worst condition) with in X calendar days of notification.	Respond to Reactive Maintenance Efforts	1,3	
CONTROL VALVE (TIDAL VALVE)	Yes	152/161	TIDAL VALVE - REPLACE	REACTIVE/CORRECTIVE			Percetage of assets with useful life at ___ replaced each year.	Respond to Reactive Maintenance Efforts	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - GIS UPDATE	CORRECTIVE			Update Stormwater Geodatabase within X days	Undefined	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - INSPECT	PREVENTIVE				As needed	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - INSPECT	REACTIVE			Respond to service request within X days	Semi-Annual	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - INSTALL	REACTIVE/CORRECTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - PM - 6 MONTHS	PREVENTIVE				Semi-Annual	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - REMOVE	REACTIVE/CORRECTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis from Reactive Inspections	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - REPAIR	REACTIVE/CORRECTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis from Reactive Inspections	1,3	
WEIR STRUCTURE	Yes	35/11	WEIR STRUCTURE - REPLACE	REACTIVE/CORRECTIVE				Respond to Maintenance Efforts on a First Come First Serve internal referral basis from Reactive Inspections	1,3	

Notes:

[1] Total City Owned assets do not include assets identified as "NULL" in the stormwater geodatabase.

[2] The Hazen Team will identify and apply additional analysis to determine the CoF for the respective assets during implementation of the WAMP

[3] LoF will be determine during the implemenation phase. The LoF of each asset determines the type of Maint. Strategy that will be used.

Preliminary LoS Tiers at Hard Asset Level

Hard Asset Class	Currently a Layer in GIS (Yes, No)	Total No. of City Owned Assets [1] GIS/STW OPS Report	Work Description	Category	CoF [2]	LoF [3]	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments

[4] The Team will provide Total Cost of Service calculation procedures on the WAMP Document.

Goal 1: Reduce Flooding and Adapt to Sea Level Rise
Goal 2: Improve water quality and our natural resources
Goal 3: Proactively maintain the City stormwater infrastructure
Goal 4: Maintain & improve the Community's Rating System (CRS) score
Goal 5: Collaborate with stakeholders to mutually understand & address our community's flooding risks

Preliminary LoS Designation at Watershed Level

Asset Class	Layer in GIS (Yes, No)	Cypress Creek LoS (2)	Fort Lauderdale Executive Airport S36 LoS (2)	ICW South LoS (2)	ICW North LoS (2)	Middle River LoS (2)	New River LoS (2)	NFNR LoS (2)	Prospect Recharge LoS (2)	SFNR LoS (2)	Uptown S37A LoS (2)	Total Cost of Service LoS A (4)	Total Cost of Service LoS B (4)	Total Cost of Service LoS C (4)
CULVERT	No													
DISCHARGE POINT (OUTFALL)	Yes													
DITCH (OPEN DRAIN)	No													
DRAINAGE WELL	Yes													
EXFILTRATION TRENCH	Yes													
TRENCH DRAIN														
GRAVITY MAIN	Yes													
INLET (CATCH BASIN)	Yes													
NETWORK STRUCTURE	Yes													
POLLUTION CONTROL DEVICE (PRB)	Yes													
POLLUTION CONTROL STRUCTURE	Yes													
POND (DETENTION/RETENTION)	Yes													
PRESSURE PIPE	No													
RIGHT OF WAY	No													
SEAWALL	No													
SW MANHOLE	Yes													
SW PUMP STATION	Yes													
STREET SWEEPING	No													
SWALE	No													
CONTROL VALVE (TIDAL VALVE)	Yes													
WEIR STRUCTURE	Yes													
DRAINAGE CANALS	No													

Notes:

(1) Preliminary LoS tier will be discussed with the City and provided on the Draft WAMP Document.

(2) The Team will provide Total Cost of Service calculation procedures on the WAMP Document.

Preliminary LoS Tiers at Soft Asset Level

Soft Asset Class	Layer in GIS (Yes, No)	Work Description	Category	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments
Policies and Procedures for tracking street sweeping activities	No					-	
Plocies and Procedures for tracking alleyway regrading and maintenance	No						
ALLEYWAY	No						
Alleways Policies	No						
Right-of-Way Policies	No						
City Policies & Procedures	No						
Regulatory Permitting Policies	No						
Ordinances	No						
Building Codes and Land Development Regulations	No						
City Planning Documents	No						
Non-Structural BMPs	No						
Good Will Relationships & Public Credibility with Neighbors	No						
Goodwill Relationships with Government Partners	No						
Goodwill Relationships with Regional Partners	No						
Goodwill Relationships and Cooperation with All City Departments, Staff, and Advisory Boards	No						
Human Resources Policies and Procedures	No						
Human Resources – Staff Training	No						
Human Behavior and Compliance	No						
GIS Inventory	No						

Notes:

[1] Total City Owned assets do not include assets identified as "NULL" in the stormwater geodatabase.

[2] The Hazen Team will identify and apply additional analysis to determine the CoF for the respective assets during implementation of the WAMP

[3] LoF will be determine during the implemenation phase. The LoF of each asset determines the type of Maint. Strategy that will be used.

[4] The Team will provide Total Cost of Service calculation procedures on the WAMP Document.

[5] City of Fort Lauderdale Flood Resilience and Environmetal Goals:
Goal 1: Reduce Flooding and Adapt to Sea Level Rise
Goal 2: Improve water quality and our natural resources
Goal 3: Proactively maintain the City stormwater infrastructure
Goal 4: Maintain & improve the Community's Rating System (CRS) score
Goal 5: Collaborate with stakeholders to mutually understand & address our community's flooding risks

Preliminary LoS Tiers at Natural Asset Level

Soft Asset Class	Layer in GIS (Yes, No)	Total No. of City Owned Assets [1] GIS/STW OPS Report	Work Description	Category	LoS (or Key Performance Indicator (KPIs))	Baseline LoS (LoS P)	City Goal [5]	Comments
Waterways	No						2	
Beach	No						2	
Ocean	No						2	
Canals	No						2	
Lakes	No						2	
Creeks	No						2	
Reservoirs	No						2	
Mangroves	No						2	
Trees	No						2	

Notes:

[1] Total City Owned assets do not include assets identified as "NULL" in the stormwater geodatabase.

[2] The Hazen Team will identify and apply additional analysis to determine the CoF for the respective assets during implementation of the WAMP

[3] LoF will be determine during the implemenation phase. The LoF of each asset determines the type of Maint. Strategy that will be used.

[4] The Team will provide Total Cost of Service calculation procedures on the WAMP Document.

[5] City of Fort Lauderdale Flood Resilience and Environmetal Goals:
Goal 1: Reduce Flooding and Adapt to Sea Level Rise
Goal 2: Improve water quality and our natural resources
Goal 3: Proactively maintain the City stormwater infrastructure
Goal 4: Maintain & improve the Community's Rating System (CRS) score
Goal 5: Collaborate with stakeholders to mutually understand & address our community's flooding risks

APPENDIX H: STORMWATER DATA DICTIONARY

Geodatabase Documentation

Date: Thursday, August 8, 2019
Time: 2:52:02 PM

Summary Information and Links

1 Feature Dataset and 14 Feature Classes
No Topology Datasets
No Geometric Networks
No Rasters
17 Tables (Object Classes)
39 Relationship Classes
36 Domains

Feature Datasets and Child Classes

Stormwater - Feature Dataset

swControlValve - Simple
swDischargePoint - Simple
swDrainageWell - Simple
swExfiltrationTrench - Simple
swGravityMain - Simple
swInlet - Simple
swManhole - Simple
swNetworkStructure - Simple
swPollutionControlDevice - Simple
swPollutionControlStructure - Simple
swPond - Simple
swPumpStation - Simple
swUnknownPoint - Simple
swWeirStructure - Simple

Rasters

Workspace-Level Tables and Feature Classes
FileNumberRecInfo - Table
ProjectInfo - Table
swControlValveReference - Table
swDischargePointReference - Table
swDrainageWellReference - Table
swExfiltrationTrenchReference - Table
swGravityMainReference - Table
swInletReference - Table
swManholeReference - Table
swNetworkStructureReference - Table
swPollutionControlDeviceReference - Table
swPollutionControlStructureReference - Table
swPondReference - Table
swPumpStationReference - Table
swUnknownPointReference - Table
swWeirStructureReference - Table
WorkOrderRecInfo - Table

Relationship Classes
swREFFileNumberToControlValve
swREFFileNumberToDischargePoint
swREFFileNumberToDrainageWell
swREFFileNumberToExfiltrationTrench

Domains

Stormwater - FeatureDataset

Name	Stormwater
Description	Dataset containing the City of Ft. Lauderdale's stormwater infrastructure geodata
Tags	Ft. lauderdale, Stormwater

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swControlValve - FeatureClass

Name	swControlValve
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Control Valves
HasM	false
HasZ	false
HasAttachments	false
Description	Stormwater network valves that have a flow control mechanism.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
VALVETYPE	String	30	Valve Type	Type of control valve	piControlValveType		true		
DIAMETER	Double	8	Diameter	The diameter of the asset	piPipeDiameter		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date				true		

				Date the feature was located by a surveyor					
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated	piConditionPACP		true		

				within a Cityworks Inspection and updated from there to GIS.					
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent			true		

				maintenance activity					
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset	swManufacturer		true		
SERIALNUM	String	30	Serial Number	The manufacturer assigned serial number of the asset. Warranties are tied to serial numbers for Tidal Valves.			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
TOPELEV	Double	8	Top Elevation	The Top Invert Elevation			true		
BOTTOMELEV	Double	8	Bottom Elevation	The Bottom Invert Elevation			true		
ORIENTATION	String	20	Directional Orientation	The cardinal direction of flow	Direction		true		
INVSOURCE	String	25	Inventory Source	The inventory source for 7 neighborhood master plan project			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
ROTATION	Double	8	Rotation	Map symbol rotation value			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments			true		

				relevant to the asset					
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swDischargePoint - FeatureClass

Name	swDischargePoint
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Discharge Points
HasM	false
HasZ	false
HasAttachments	false
Description	Stormwater discharge points.
Tags	Stormwater

Field	**DataType**	**Length**	**AliasName**	**Description**	**Domain**	**DefaultValue**	**IsNullable**	**Precision**	**Scale**
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
DISCHRGTYP	String	50	Discharge Type	The type of stormwater discharge	piDischargePointType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date				true		

				The date the asset was installed					
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks			true		

				Inspection to the GIS.					
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number				true		

				The City's File Number used to store the as-built documents for the asset					
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
DIAMETER	Double	8	Diameter	The diameter of the asset	piPipeDiameter		true		
GRATE	String	3	Grate?	Identifies whether the outfall has a grate	YesNo		true		
OUTFALLLOC	String	15	Outfall Location	Location of the outfall relative to its connected drainage asset	swOutfallLocation		true		
DISCHID	String	20	Discharge Identifier	Discharge Identifier			true		
AVGDISCH	String	10	Average Discharge	Average Discharge			true		
PEAKDISCH	String	10	Peak Discharge	Peak Discharge			true		
PERMIT	String	30	Permitted	A flag used to indicate whether the discharge point is permitted	YesNo		true		
PERMITID	String	20	Permit Identifier	Unique permit identifier			true		
DEBRIS	String	20	Debris	The severity of blockage observed within the asset	SeverityIndicator		true		
COLLASPE	String	20	Collapse	The severity of structural collapse observed within the asset	SeverityIndicator		true		
CONDITIONHAZEN	String	10	Condition	CONDITION			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
ROTATION	Double	8	Rotation	Map symbol rotation value			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments			true		

				relevant to the asset					
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swDrainageWell - FeatureClass

Name	swDrainageWell
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Drainage Wells
HasM	false
HasZ	false
HasAttachments	false
Description	Stormwater drainage wells.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
DISCHRGTYP	String	50	Discharge Type	The type of stormwater discharge	piDischargePointType		true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date				true		

Appendix H - Stormwater Data Dictionary (2019)

				The date the asset was installed					
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks			true		

				Inspection to the GIS.					
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		

WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
DISCHID	String	20	Discharge Identifier	Discharge Identifier			true		
AVGDISCH	String	10	Average Discharge	Average Discharge			true		
PEAKDISCH	String	10	Peak Discharge	Peak Discharge			true		
PERMIT	String	30	Permitted	A flag used to indicate whether the discharge point is permitted	YesNo		true		
PERMITID	String	20	Permit Identifier	Unique permit identifier			true		
DIAMETER	Double	8	Diameter	The diameter of the asset	piPipeDiameter		true		
TOPCASEELEV	Double	8	Top Casing Elevation	The top of casing elevation			true		
SOLIDDEPTH	Double	8	Solid Pipe Depth	The solid pipe depth of the well			true		
PERFDEPTH	Double	8	Perforated Depth	The perforated pipe depth of the well			true		
BOTTOMDEPTH	Double	8	Bottom Depth	The bottom elevation of the well			true		
STRUCTWIDTH	Double	8	Structure Width	The width of the well structure			true		
STRUCTLENGTH	Double	8	Structure Length	The length of the well structure			true		
STRUCTDEPTH	Double	8	Structure Depth	The depth of the well structure			true		
RECCHAMWIDTH	Double	8	Receiving Chamber Width	The width of the receiving chamber of the well			true		
WELLCHAMWIDTH	Double	8	Well Chamber Width	The width of the well chamber			true		
WELLCHAMDIAM	Double	8	Well Chamber Diameter	The diameter of the well chamber			true		
ACCESSRECSHAPE	String	20	Receiving Access Shape	The shape of the receiving chamber access point	swWellAccessShape		true		
ACCESSRECDIAM	Double	8	Receiving Chamber Diameter	The diameter of the receiving chamber for circular access points			true		
ACCESSRECWIDTH	Double	8	Receiving Access Width	The width of the receiving chamber access point			true		
ACCESSRECLENGTH	Double	8	Receiving Access Length	The length of the receiving chamber access point			true		
ACCESSWELLSHAPE	String	20	Well Access Shape	The shape of the receiving	swWellAccessShape		true		

				chamber access point					
ACCESSCHAMDIAM	Double	8	Well Chamber Diameter	The diameter of the receiving chamber for circular access points			true		
ACCESSWELLWIDTH	Double	8	Well Access Width	The width of the receiving chamber access point			true		
ACCESSWELLLENGTH	Double	8	Well Access Length	The length of the receiving chamber access point			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swExfiltrationTrench - FeatureClass

Name	swExfiltrationTrench
ShapeType	Polygon
FeatureType	Simple
AliasName	Stormwater Exfiltration Trenches
HasM	false
HasZ	false
HasAttachments	false
Description	A stormwater exfiltration trench, also known as french drains. These typically collect water from manholes, inlets and into the ground.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		

FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still			true		

				under warranty, asset record will show up pink on the Cityworks work order.					
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the			true		

				predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.					
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
BEDMATERIAL	String	50	Bed Material	The material on the bed of the trench			true		
LENGTH	Double	8	Length	The length of the trench			true		
DEPTH	Double	8	Depth	The depth of the trench			true		
WIDTH	Double	8	Width	The width of the trench			true		
VOLUME	Double	8	Volume	The volume of the trench			true		
BOTTOMELEV	Double	8	Invert Elevation	The bottom elevation			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments			true		

				relevant to the asset					
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swGravityMain - FeatureClass

Name	swGravityMain
ShapeType	Polyline
FeatureType	Simple
AliasName	Stormwater Gravity Mains
HasM	true
HasZ	false
HasAttachments	false
Description	swGravityMain

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FROMMH	String	20	From Manhole	The unique idendentifier of the From Manhole (upstream manhole)			true		
TOMH	String	20	To Manhole	The unique idendentifier of the To Manhole (downstream manhole)			true		
PIPETYPE	String	50	Pipe Type	The type of pipe	swPipeType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By		AssetOwner	1	true		

				Indicates which organization owns the asset					
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and	piConditionPACP		true		

				updated from there to GIS.					
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10					true		

			City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed					
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
MATERIAL	String	20	Material	The construction material of the asset	piPipeMaterial		true		
MAINSHAPE	String	50	Main Shape	The shape of the main	piPipeShape		true		
DIAMETER	Double	8	Diameter	The diameter of the asset	piPipeDiameter		true		
WIDTH	Double	8	Width	The width of the asset	piPipeDiameter		true		
UPELEV	Double	8	Upstream Elevation	The upstream invert elevation of the pipe			true		
DOWNELEV	Double	8	Downstream Elevation	The downstream invert elevation of the pipe			true		
SLOPE	Double	8	Slope	The slope of the pipe.			true		
BAFFLE	String	3	Baffle?	Identifies whether a baffle is associated with the pipe	YesNo		true		
SUMFLOW	Double	8	Flow Summary	The sum of flow			true		
LINEDYEAR	String	4	Year Lined	The year the pipe was last lined			true		
LINERTYPE	String	20	Liner Type	The method used to line the pipe	piLiningMethod		true		
CONDITIONHAZEN	String	10	Condition	The condition rating of the asset as inspected by Hazen and Sawyer consulting			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		

created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swInlet - FeatureClass

Name	swInlet
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Inlets
HasM	false
HasZ	false
HasAttachments	false
Description	Stormwater inlets typically found along the side or roads or in drainage swales.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
INLETTYPE	String	50	Inlet Type	The type of stormwater inlet	piInletTypes		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the			true		

				geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.					
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically			true		

				capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.					
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for			true		

				performing work on the asset (Cityworks, Qalert, etc)					
FDOTTYPE	String	50	FDOT Type	The Florida Department of Transporation manhole structure type			true		
MANUFACTYPE	String	50	Manufacturer Type	The manufacturer model type of the manhole structure			true		
CVTYPE	String	50	Cover Type	The type of stormwater manhole cover	piManholeCoverType		true		
ACCESSTYPE	String	20	Access Type	Method for accessing the opening	piAccessType	Grate	true		
ACCESSDIAM	Double	8	Access Diameter	Access diameter for the inlet	piAccessDiameter		true		
ACCESSMAT	String	20	Access Material	The material used to construct the access cover	piPipeMaterial		true		
RIMELEV	Double	8	Rim Elevation	The elevation of the inlet rim			true		
BOTTOMELEV	Double	8	Bottom Elevation	The elevation of the bottom of the inlet.			true		
INLETLENGTH	SmallInteger	2	Inlet Length	The length of the inlet			true		
INLETWIDTH	SmallInteger	2	Inlet Width	The width of the inlet			true		
INLETDEPTH	SmallInteger	2	Inlet Height	The depth of the inlet			true		
INVERT1ELEV	Double	8	Invert1 Elevation	The invert elevation			true		
INVERT1MAT	String	20	Invert1 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT1SHAPE	String	50	Invert1 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT1DIAM	Double	8	Invert1 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT1WIDTH	Double	8	Invert1 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT1UPPIPE	String	20	Invert 1 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT1DWNPIPE	String	20	Invert 1 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT2ELEV	Double	8	Invert2 Elevation	The invert elevation			true		
INVERT2MAT	String	20	Invert2 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT2SHAPE	String	50	Invert2 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT2DIAM	Double	8	Invert2 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT2WIDTH	Double	8	Invert2 Pipe Width	The width of the invert pipe	piPipeDiameter		true		

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INVERT2UPPIPE	String	20	Invert 2 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT2DWNPIPE	String	20	Invert 2 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT3ELEV	Double	8	Invert 3 Elevation	The invert elevation			true		
INVERT3MAT	String	20	Invert 3 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT3SHAPE	String	50	Invert 3 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT3DIAM	Double	8	Invert 3 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT3WIDTH	Double	8	Invert 3 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT3UPPIPE	String	20	Invert 3 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT3DWNPIPE	String	20	Invert 3 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT4ELEV	Double	8	Invert 4 Elevation	The invert elevation			true		
INVERT4MAT	String	20	Invert 4 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT4SHAPE	String	50	Invert 4 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT4DIAM	Double	8	Invert 4 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT4WIDTH	Double	8	Invert 4 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT4UPPIPE	String	20	Invert 4 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT4DWNPIPE	String	20	Invert 4 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT5ELEV	Double	8	Invert 5 Elevation	The invert elevation			true		
INVERT5MAT	String	20	Invert 5 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT5SHAPE	String	50	Invert 5 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT5DIAM	Double	8	Invert 5 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT5WIDTH	Double	8	Invert 5 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT5UPPIPE	String	20	Invert 5 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT5DWNPIPE	String	20	Invert 5 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT6ELEV	Double	8	Invert 6 Elevation	The invert elevation			true		
INVERT6MAT	String	20	Invert 6 Pipe Material	The construction	piPipeMaterial		true		

				material of the invert pipe					
INVERT6SHAPE	String	50	Invert 6 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT6DIAM	Double	8	Invert 6 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT6WIDTH	Double	8	Invert 6 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT6UPPIPE	String	20	Invert 6 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT6DWNPIPE	String	20	Invert 6 Down Pipe	The unique identifier of the downstream pipe			true		
NUMOFBAFFLE	SmallInteger	2	Number of Baffles	Identifies the number of baffles			true		
SUMPHEIGHT	Double	8	Sump Height	Identifies the height of the sump in inches			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
CONDITIONHAZEN	String	10	Condition	The condition rating of the asset as inspected by Hazen and Sawyer consulting			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swManhole - FeatureClass

Name	swManhole
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Manholes
HasM	false
HasZ	false
HasAttachments	false

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Description Manhole features connect two or more pipes and control the flow of water in the network through pipe elevations. Manhole invert elevations are stored on the pipes, instead of the manholes themselves.

Tags Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
MHTYPE	String	15	Manhole Type	The type of manhole	piManholeType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks			true		

				work order Address field when attached to a work order.					
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be			true		

				heavily relied upon for asset management analysis.				
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
MANUFACTYPE	String	50	Manufacturer Type	The manufacturer model type of the manhole structure			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
CVSHAPE	String	50	Cover Shape	The shape of the manhole cover	piManholeCoverShape		true		
CVTYPE	String	50	Cover Type	The type of stormwater manhole cover	piManholeCoverType		true		

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FDOTTYPE	String	50	FDOT Type	The Florida Department of Transporation manhole structure type			true		
WALLMAT	String	25	Wall Material	The material used to construct the manhole wall	piPipeMaterial		true		
HAZCONDITION	String	10	Manhole Condition	The condition of the asset			true		
CUTDEPTH	Double	8	Pavement Cut Depth	Pavement cut depth			true		
LINED	String	3	Lined	Indicates if the manhole is lined	YesNo		true		
SUMFLOW	Double	8	Flow Summary	The sum of flow			true		
FLOWDIR	String	25	Flow Direction	Defines the direction of flow using geometric flow direction values	Direction		true		
RIMELEV	Double	8	Rim Elevation	The elevation of the manhole rim			true		
HIGHELEV	Double	8	High Pipe Elevation	High pipe elevation inside manhole			true		
BOTTOMELEV	Double	8	Bottom Elevation	The bottom elevation of the manhole			true		
INVERT1ELEV	Double	8	Invert1 Elevation	The invert elevation			true		
INVERT1MAT	String	20	Invert1 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT1SHAPE	String	50	Invert1 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT1DIAM	Double	8	Invert1 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT1WIDTH	Double	8	Invert1 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT1UPPIPE	String	20	Invert 1 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT1DWNPIPE	String	20	Invert 1 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT2ELEV	Double	8	Invert2 Elevation	The invert elevation			true		
INVERT2MAT	String	20	Invert2 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT2SHAPE	String	50	Invert2 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT2DIAM	Double	8	Invert2 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT2WIDTH	Double	8	Invert2 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT2UPPIPE	String	20	Invert 2 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT2DWNPIPE	String	20	Invert 2 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT3ELEV	Double	8	Invert 3 Elevation	The invert elevation			true		

INVERT3MAT	String	20	Invert 3 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT3SHAPE	String	50	Invert 3 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT3DIAM	Double	8	Invert 3 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT3WIDTH	Double	8	Invert 3 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT3UPPIPE	String	20	Invert 3 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT3DWNPIPE	String	20	Invert 3 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT4ELEV	Double	8	Invert 4 Elevation	The invert elevation			true		
INVERT4MAT	String	20	Invert 4 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT4SHAPE	String	50	Invert 4 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT4DIAM	Double	8	Invert 4 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT4WIDTH	Double	8	Invert 4 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT4UPPIPE	String	20	Invert 4 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT4DWNPIPE	String	20	Invert 4 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT5ELEV	Double	8	Invert 5 Elevation	The invert elevation			true		
INVERT5MAT	String	20	Invert 5 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT5SHAPE	String	50	Invert 5 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT5DIAM	Double	8	Invert 5 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT5WIDTH	Double	8	Invert 5 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT5UPPIPE	String	20	Invert 5 Up Pipe	The unique identifier of the upstream pipe			true		
INVERT5DWNPIPE	String	20	Invert 5 Down Pipe	The unique identifier of the downstream pipe			true		
INVERT6ELEV	Double	8	Invert 6 Elevation	The invert elevation			true		
INVERT6MAT	String	20	Invert 6 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT6SHAPE	String	50	Invert 6 Pipe Shape	The shape of the invert pipe	piPipeShape		true		
INVERT6DIAM	Double	8	Invert 6 Pipe Diameter	The diameter of the invert pipe	piPipeDiameter		true		
INVERT6WIDTH	Double	8	Invert 6 Pipe Width	The width of the invert pipe	piPipeDiameter		true		
INVERT6UPPIPE	String	20	Invert 6 Up Pipe				true		

				The unique identifier of the upstream pipe					
INVERT6DWNPIPE	String	20	Invert 6 Down Pipe	The unique identifier of the downstream pipe			true		
WEIRPRESENT	String	10	Weir Present?	Identifies whether there is a weir present	YesNo		true		
NUMOFBAFFLE	SmallInteger	2	Number of Baffles	Identifies the number of baffles			true		
SUMPHEIGHT	Double	8	Sump Height	Identifies the height of the sump in inches			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swNetworkStructure - FeatureClass

Name	swNetworkStructure
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Network Structures
HasM	false
HasZ	false
HasAttachments	false
Description	Stormwater network structures such as pump stations or pipe ends.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		

FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
STRUCTTYPE	String	30	Structure Type	Type of network structure	swNetworkStructureType	Endpoint	true		
NAME	String	20	Name	The name of the structure			true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty			true		

				expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.					
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2					true		

			Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.					
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
OPDATE	Date	8	Operational Date	Date the facility was put into service			true		
ANCILLARYROLE	SmallInteger	2	ANCILLARYROLE	Identifies whether the asset participates in a geometric network as either a source or a sink			true		
ROTATION	Double	8	Rotation	Map symbol rotation value			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that			true		

				are relevant to the asset					
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

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swPollutionControlDevice - FeatureClass

Name	swPollutionControlDevice
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Pollution Control Device
HasM	false
HasZ	false
HasAttachments	false
Description	Baffles are a form of stormwater pollution control devices.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
TYPE	String	30	Device Type	The type of pollution control device	swPollControlDeviceType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization	AssetManager	1	true		

				maintains the asset					
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment.			true		

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				Can be updated from Cityworks Inspection to the GIS.					
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		

FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
DIAMETER	Double	8	Diameter	The diameter of the asset	piPipeDiameter		true		
OPENPOSITION	String	20	Opening Position	The opening position	swOpenPosition		true		
TOPELEV	Double	8	Top Elevation	The Top Invert Elevation			true		
BOTTOMELEV	Double	8	Bottom Elevation	The Bottom Invert Elevation			true		
STRUCTID	String	20	Structure ID	The unique identifier of the associated structure as a string. Structure could be a Pollution Control Structure, a manhole, an inlet or a drainage well chamber.			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
ROTATION	Double	8	Rotation	Map symbol rotation value			true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swPollutionControlStructure - FeatureClass

Name	swPollutionControlStructure
ShapeType	Point
FeatureType	Simple

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AliasName Stormwater Pollution Control Structures
HasM false
HasZ false
HasAttachments false
Description Stormwater pollution control devices such as baffles and vortexes. They allow sediments and pollution to settle out of the stormwater runoff.
Tags Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
STRUCTTYPE	String	50	Device Type	The type of pollution control structure	swPollControlStructureType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when			true		

				attached to a work order.					
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2					true		

			Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.					
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset	swManufacturer		true		
SERIALNUM	String	30	Serial Number	The manufacturer assigned serial number of the asset. Warranties are tied to serial numbers for Tidal Valves.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to			true		

				store the as-built documents for the asset					
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
NUMOFWEIR	SmallInteger	2	Number of Weirs	The number of weirs			true		
NUMOFCHAM	SmallInteger	2	Number of Chambers	The number of chambers			true		
NUMOFBAFFLE	SmallInteger	2	Number of Baffles	Identifies the number of baffles			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
ROTATION	Double	8	Rotation	Map symbol rotation value			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swPond - FeatureClass

Name	swPond
ShapeType	Polygon
FeatureType	Simple
AliasName	Stormwater Ponds
HasM	false
HasZ	false
HasAttachments	false
Description	Stormwater detention and retention features, sometimes referred to as stormwater ponds.
Tags	Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by			true		

				database admin created database trigger					
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PONDTYPE	String	20	swPondType	The type of stormwater pond	swPondType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		

WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact			true		

				due to asset failure.					
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)		true	true		
BEDMATERIAL	String	50	Bed Material	The material on the bed of the retention area	piPipeMaterial		true		
BNKMATERIAL	String	50	Bank Material	The material on the bank of the retention area	piPipeMaterial		true		
VOLUME	Double	8	Volume	The volume of detention area			true		
DEPTH	Double	8	Depth	The depth of the retention area			true		
TOPAREA	Double	8	Top Area	The top area			true		
BOTTOMELEV	Double	8	Invert Elevation	The bottom elevation			true		
BOTTOMAREA	Double	8	Bottom Area	The bottom area			true		
OUTFLWELEV	Double	8	Outflow Elevation	Outflow elevation			true		
WATERELEV	Double	8	Water Elevation				true		

				The water elevation					
TOPBANKELV	Double	8	Top of Bank Elevation	The Top of bank elevation			true		
BOTTOMBANKELEV	Double	8	Bottom of Bank Elevation	The bottom of bank elevation			true		
SIDESLOPE	Double	8	Slope	The slope on the side of the retention area			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

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swPumpStation - FeatureClass

Name swPumpStation
ShapeType Point
FeatureType Simple
AliasName Stormwater Pump Stations
HasM false
HasZ false
HasAttachments false
Description Stormwater pump stations (formerly included in the swNetworkStructure feature class).

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
NAME	String	20	Name	The name of the structure			true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or	piActiveStatus	Active	true		

				removed from the ground					
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		

CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range			true		

				from 1 (low risk) to 100 (high risk) and is used to prioritize investments.					
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
PROJECTNUM	String	10	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
OPDATE	Date	8	Operational Date	Date the facility was put into service			true		
ANCILLARYROLE	SmallInteger	2	ANCILLARYROLE	Identifies whether the asset participates in a geometric network as either a source or a sink			true		
ROTATION	Double	8	Rotation	Map symbol rotation value			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swUnknownPoint - FeatureClass

Name	swUnknownPoint
ShapeType	Point
FeatureType	Simple
AliasName	Unknown Stormwater Points
HasM	false
HasZ	false

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HasAttachments false
Description Assets believed to be stormwater points where the asset type, and/or owner information are not clearly known
Tags Stormwater

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	-99	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	-99	true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL			true		

				State Plane-East)					
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset			true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

swWeirStructure - FeatureClass

Name	swWeirStructure
ShapeType	Point
FeatureType	Simple
AliasName	Stormwater Weir Structures
HasM	true
HasZ	false
HasAttachments	false
Description	Walls used to alter the flow of water, prevent flooding, and measure discharge.
Tags	Stormwater

Field	**DataType**	**Length**	**AliasName**	**Description**	**Domain**	**DefaultValue**	**IsNullable**	**Precision**	**Scale**
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger			true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
WEIRTYPE	String	50	Weir Type	The type of weir	swWeirType		true		
ACTIVESTATUS	String	10	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		

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COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Managed By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Text description of the geographic location (e.g. 10' west of sidewalk along Broward Blvd). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Closest Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order.			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.			true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated	piConditionPACP		true		

				within a Cityworks Inspection and updated from there to GIS.					
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.			true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.			true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.			true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.			true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent			true		

				maintenance activity					
PROJECTNUM	String	10	City Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
WORKORDERNUM	String	10	WORKORDERNUM	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
WMATERIAL	String	50	Material	The material used to construct the weir	piPipeMaterial		true		
WEIRSHAPE	String	50	Shape	The shape of the weir	swWeirShape		true		
LENGTH	Double	8	Length	The length of the weir			true		
ORIFICE	String	5	Orifice?	Indicates whether the weir has an orifice	YesNo		true		
NUMNOTCH	Integer	4	Number of Notches	The number of notches on the weir			true		
WINGWALL	String	5	Wing Walls?	Indicates whether the weir has wing walls	YesNo		true		
SKIMMER	String	5	Skimmer?	Indicates whether the weir has a skimmer	YesNo		true		
RISE	Double	8	Rise	The top of the weir elevation			true		
INVERTELEV	Double	8	Invert Elevation	The invert elevation			true		
TOPCLIP	Double	8	Top Clip	The top elevation of the notch			true		
BTMCLIP	Double	8	Bottom Clip	The bottom elevation of the notch			true		
TOPWIDTH	Double	8	Top Width	The top width of the notch			true		
BTMWIDTH	Double	8	Bottom Width	The bottom with of the notch			true		
ORIENTATION	String	20	Directional Orientation	The cardinal direction of flow	Direction		true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)			true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)			true		
ZCOORD	Double	8	Z Coordinate				true		

				Z-Coordinate of the asset					
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network	BooleanDomain		true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	255	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	Created User	created_user			true		
created_date	Date	8	Created Date	created_date			true		
last_edited_user	String	255	Last Edited User	last_edited_user			true		
last_edited_date	Date	8	Last Edited Date	last_edited_date			true		

FileNumberRecInfo - Table

Name FileNumberRecInfo
AliasName File Number Records
HasAttachments false
Description Logs Information pertaining to utility File Number records

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FILENUM	String	10	City File Number	The City's File Number used to store the as-built documents for the asset			true		
PROJECTNUM	String	10	Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
INSTALLEDBY	SmallInteger	2	Installed By	Indicates which organization installed the assets	AssetOwner	1	true		
SURVEYOR	String	50	Surveyor	Identifies the surveyor who signed off on the as-builts			true		
SURVEYCOMP	String	50	Survey Company	The agency in which the surveyor was employed			true		
COORDSYS	String	50	Coordinate System	Idenitifies the horizontal coordinate system under which assets were digitally captured and represented		NAD 1983 StatePlane Florida East FIPS 0901 (US Feet)	true		
VDATUM	String	8	Vertical Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		

HORIZACC	Double	8	Horizontal Accuracy	The horizontal accuracy in feet			true		
VERTACC	Double	8	Vertical Accuracy	The vertical accuracy in feet			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		

ProjectInfo - Table

Name ProjectInfo
AliasName Project Information
HasAttachments false
Description Describes key information for utilit assets installation projects

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
PROJECTNUM	String	10	Project Number	The City's Project Number, DE Number, or Improvement Number under which the asset was installed			true		
PROJECTNAME	String	50	Project Name	The name of the project			true		
PROJMANAGER	String	50	Project Manager	The Project Manager			true		
PROJDATE	Date	8	Project Date	The date the project was considered completed by the City			true		
PROJNOTES	String	225	Project Notes	Relevant notes recorded for the project, its assets or its document records			true		

swControlValveReference - Table

Name swControlValveReference
AliasName Stormwater Control Valve Reference
HasAttachments false
Description swControlValveReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		

FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swDischargePointReference - Table

Name swDischargePointReference
AliasName Stormwater Discharge Point Reference
HasAttachments false
Description swDischargePointReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image			true		

				showing the asset					
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swDrainageWellReference - Table

Name swDrainageWellReference
AliasName Stormwater Drainage Well Reference
HasAttachments false
Description swDrainageWellReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swExfiltrationTrenchReference - Table

Name swExfiltrationTrenchReference
AliasName Stormwater Exfiltration Trench Reference
HasAttachments false
Description swExfiltrationTrenchReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swGravityMainReference - Table

Name swGravityMainReference
AliasName Stormwater Gravity Main Reference
HasAttachments false
Description swGravityMainReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier			true		

				populated by database admin created database trigger					
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swInletReference - Table

Name swInletReference
AliasName Stormwater Inlet Reference
HasAttachments false
Description swInletReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		

FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swManholeReference - Table

Name swManholeReference
AliasName Stormwater Manhole Reference
HasAttachments false
Description swManholeReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image			true		

				showing the asset					
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swNetworkStructureReference - Table

Name	swNetworkStructureReference
AliasName	Stormwater Network Structure Reference
HasAttachments	false
Description	swNetworkStructureReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swPollutionControlDeviceReference - Table

Name swPollutionControlDeviceReference
AliasName Stormwater Pollution Control Device Reference
HasAttachments false
Description swPollutionControlDeviceReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swPollutionControlStructureReference - Table

Name swPollutionControlStructureReference
AliasName Stormwater Pollution Control Structure Reference
HasAttachments false
Description swPollutionControlDeviceReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier			true		

				populated by database admin created database trigger					
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swPondReference - Table

Name swPondReference
AliasName Stormwater Pond Reference
HasAttachments false
Description swPondReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		

FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swPumpStationReference - Table

Name	swPumpStationReference
AliasName	Pump Station Reference
HasAttachments	false
Description	swPumpStationReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image			true		

				showing the asset					
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swUnknownPointReference - Table

Name swUnknownPointReference
AliasName Unknown Point Reference
HasAttachments false
Description swUnknownPointReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

swWeirStructureReference - Table

Name swWeirStructureReference
AliasName Weir Structure Reference
HasAttachments false
Description swWeirStructureReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGE1	String	255	Image 1	The location of the 1st image showing the asset			true		
IMAGE2	String	255	Image 2	The location of the 2nd image showing the asset			true		
IMAGE3	String	255	Image 3	The location of the 3rd image showing the asset			true		
INTDETAIL	String	32	City Intersection Detail	The City's Intersection Detail			true		

WorkOrderRecInfo - Table

Name WorkOrderRecInfo
AliasName Work Order Records
HasAttachments false
Description Logs information pertaining to utility repair and replacement Work Order records

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
WORKORDERNUM	String	10	Work Order Number	The work order number under which the asset was installed			true		

				(Cityworks, Qalert, etc)					
WOASBUILTLOC	String	255	Work Order As-built	The URL or filepath to the electronic as-built document from a work order			true		

swREFFileNumberToControlValve - RelationshipClass

Name swREFFileNumberToControlValve
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swControlValve
BackwardPathLabel FileNumberRecInfo
Description swREFFileNumberToControlValve

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swControlValve		

swREFFileNumberToDischargePoint - RelationshipClass

Name swREFFileNumberToDischargePoint
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swDischargePoint
BackwardPathLabel FileNumberRecInfo
Description swREFFileNumberToDischargePoint

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swDischargePoint		

swREFFileNumberToDrainageWell - RelationshipClass

Name swREFFileNumberToDrainageWell
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swDrainageWell
BackwardPathLabel FileNumberRecInfo
Description swREFFileNumberToDrainageWell

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swDrainageWell		

swREFFileNumberToExfiltrationTrench - RelationshipClass

Name	swREFFileNumberToExfiltrationTrench
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swExfiltrationTrench
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToExfiltrationTrench

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swExfiltrationTrench		

swREFFileNumberToGravityMain - RelationshipClass

Name	swREFFileNumberToGravityMain
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swGravityMain
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToGravityMain

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swGravityMain		

swREFFileNumberToInlet - RelationshipClass

Name	swREFFileNumberToInlet
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swInlet
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToInlet

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swInlet		

swREFFileNumberToManhole - RelationshipClass

Name	swREFFileNumberToManhole
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swManhole
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToManhole

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swManhole		

swREFFileNumberToNetworkStructure - RelationshipClass

Name	swREFFileNumberToNetworkStructure
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swNetworkStructure
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToNetworkStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swNetworkStructure		

swREFFileNumberToPollutionControlDevice - RelationshipClass

Name	swREFFileNumberToPollutionControlDevice
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swPollutionControlDevice
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToPollutionControlDevice

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPollutionControlDevice		

swREFFileNumberToPollutionControlStructure - RelationshipClass

Name	swREFFileNumberToPollutionControlStructure
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swPollutionControlStructure
BackwardPathLabel	FileNumberRecInfo
Description	swREFFileNumberToPollutionControlStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPollutionControlStructure		

swREFFileNumberToPond - RelationshipClass

Name	swREFFileNumberToPond
Cardinality	OneToMany
IsAttributed	false

IsComposite false
ForwardPathLabel swPond
BackwardPathLabel FileNumberRecInfo
Description swREFFileNumberToPond

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPond		

swREFFileNumberToPumpStation - RelationshipClass

Name swREFFileNumberToPumpStation
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPumpStation
BackwardPathLabel FileNumberRecInfo
Description swREFFileNumberToPumpStation

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPumpStation		

swREFFileNumberToWeirStructure - RelationshipClass

Name swREFFileNumberToWeirStructure
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swWeirStructure
BackwardPathLabel FileNumberRecInfo
Description swREFFileNumberToWeirStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
FileNumberRecInfo	FILENUM	FILENUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swWeirStructure		

swREFProjectNumberToControlValve - RelationshipClass

Name swREFProjectNumberToControlValve
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swControlValve
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToControlValve

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key

swControlValve		

swREFProjectNumberToDischargePoint - RelationshipClass

Name	swREFProjectNumberToDischargePoint
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swDischargePoint
BackwardPathLabel	ProjectInfo
Description	swREFProjectNumberToDischargePoint

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swDischargePoint		

swREFProjectNumberToDrainageWell - RelationshipClass

Name	swREFProjectNumberToDrainageWell
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swDrainageWell
BackwardPathLabel	ProjectInfo
Description	swREFProjectNumberToDrainageWell

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swDrainageWell		

swREFProjectNumberToExfiltrationTrench - RelationshipClass

Name	swREFProjectNumberToExfiltrationTrench
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swExfiltrationTrench
BackwardPathLabel	ProjectInfo
Description	swREFProjectNumberToExfiltrationTrench

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swExfiltrationTrench		

swREFProjectNumberToGravityMain - RelationshipClass

Name	swREFProjectNumberToGravityMain
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swGravityMain
BackwardPathLabel	ProjectInfo

Description swREFProjectNumberToGravityMain

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swGravityMain		

swREFProjectNumberToInlet - RelationshipClass

Name swREFProjectNumberToInlet
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swInlet
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToInlet

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swInlet		

swREFProjectNumberToManhole - RelationshipClass

Name swREFProjectNumberToManhole
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swManhole
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToManhole

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swManhole		

swREFProjectNumberToNetworkStructure - RelationshipClass

Name swREFProjectNumberToNetworkStructure
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swNetworkStructure
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToNetworkStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swNetworkStructure		

swREFProjectNumberToPollutionControlDevice - RelationshipClass

Name swREFProjectNumberToPollutionControlDevice
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPollutionControlDevice
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToPollutionControlDevice

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPollutionControlDevice		

swREFProjectNumberToPollutionControlStructure - RelationshipClass

Name swREFProjectNumberToPollutionControlStructure
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPollutionControlStructure
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToPollutionControlStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPollutionControlStructure		

swREFProjectNumberToPond - RelationshipClass

Name swREFProjectNumberToPond
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPond
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToPond

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPond		

swREFProjectNumberToPumpStation - RelationshipClass

Name swREFProjectNumberToPumpStation
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPumpStation
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToPumpStation

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPumpStation		

swREFProjectNumberToWeirStructure - RelationshipClass

Name swREFProjectNumberToWeirStructure
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swWeirStructure
BackwardPathLabel ProjectInfo
Description swREFProjectNumberToWeirStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
ProjectInfo	PROJECTNUM	PROJECTNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swWeirStructure		

swREFWorkOrderToControlValve - RelationshipClass

Name swREFWorkOrderToControlValve
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swControlValve
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToControlValve

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swControlValve		

swREFWorkOrderToDischargePoint - RelationshipClass

Name swREFWorkOrderToDischargePoint
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swDischargePoint
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToDischargePoint

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swDischargePoint		

swREFWorkOrderToDrainageWell - RelationshipClass

Name swREFWorkOrderToDrainageWell
Cardinality OneToMany
IsAttributed false

IsComposite false
ForwardPathLabel swDrainageWell
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToDrainageWell

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swDrainageWell		

swREFWorkOrderToExfiltrationTrench - RelationshipClass

Name swREFWorkOrderToExfiltrationTrench
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swExfiltrationTrench
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToExfiltrationTrench

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swExfiltrationTrench		

swREFWorkOrderToGravityMain - RelationshipClass

Name swREFWorkOrderToGravityMain
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swGravityMain
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToGravityMain

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swGravityMain		

swREFWorkOrderToInlet - RelationshipClass

Name swREFWorkOrderToInlet
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swInlet
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToInlet

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key

swInlet		

swREFWorkOrderToManhole - RelationshipClass

Name	swREFWorkOrderToManhole
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swManhole
BackwardPathLabel	WorkOrderRecInfo
Description	swREFWorkOrderToManhole

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swManhole		

swREFWorkOrderToNetworkStructure - RelationshipClass

Name	swREFWorkOrderToNetworkStructure
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swNetworkStructure
BackwardPathLabel	WorkOrderRecInfo
Description	swREFWorkOrderToNetworkStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swNetworkStructure		

swREFWorkOrderToPollutionControlDevice - RelationshipClass

Name	swREFWorkOrderToPollutionControlDevice
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swPollutionControlDevice
BackwardPathLabel	WorkOrderRecInfo
Description	swREFWorkOrderToPollutionControlDevice

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPollutionControlDevice		

swREFWOrkOrderToPollutionControlStructure - RelationshipClass

Name	swREFWOrkOrderToPollutionControlStructure
Cardinality	OneToMany
IsAttributed	false
IsComposite	false
ForwardPathLabel	swPollutionControlStructure
BackwardPathLabel	WorkOrderRecInfo

Description swREFWOrkOrderToPollutionControlStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPollutionControlStructure		

swREFWorkOrderToPond - RelationshipClass

Name swREFWorkOrderToPond
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPond
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToPond

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPond		

swREFWorkOrderToPumpStation - RelationshipClass

Name swREFWorkOrderToPumpStation
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swPumpStation
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToPumpStation

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swPumpStation		

swREFWorkOrderToWeirStructure - RelationshipClass

Name swREFWorkOrderToWeirStructure
Cardinality OneToMany
IsAttributed false
IsComposite false
ForwardPathLabel swWeirStructure
BackwardPathLabel WorkOrderRecInfo
Description swREFWorkOrderToWeirStructure

Origin Class Name	Origin Primary Key	Origin Foreign Key
WorkOrderRecInfo	WORKORDERNUM	WORKORDERNUM

Destination Class Name	Destination Primary Key	Destination Foreign Key
swWeirStructure		

AssetManager - Domain

DomainName	AssetManager
Description	Indicates the manager of the asset
FieldType	SmallInteger
Domain Type	CodedValue

Code	Name
1	City
2	County
3	State
4	Private
5	Other
-99	Unknown

AssetOwner - Domain

DomainName	AssetOwner
Description	Indicates the owner of the asset
FieldType	SmallInteger
Domain Type	CodedValue

Code	Name
1	City
2	County
3	State
4	Private
5	Other
-99	Unknown

BooleanDomain - Domain

DomainName	BooleanDomain
Description	A 0/1 boolean domain
FieldType	SmallInteger
Domain Type	CodedValue

Code	Name
0	False
1	True

BooleanSymbolValue - Domain

DomainName	BooleanSymbolValue
Description	Valid values are Yes and No
FieldType	SmallInteger
Domain Type	CodedValue

Code	Name
1	Yes
0	No

Datum - Domain

DomainName	Datum
Description	Verical Datum for Elevation Data (COFL Domain)
FieldType	String
Domain Type	CodedValue

Code	Name
29	NGVD 29

88	NAVD 88

Direction - Domain

DomainName	Direction
Description	A general description of cardinal direction
FieldType	String
Domain Type	CodedValue

Code	Name
East	East
North	North
South	South
West	West
Northeast	Northeast
Northwest	Northwest
Southeast	Southeast
Southwest	Southwest
North/South	North/South
East/West	East/West
Northeast/Northwest	Northeast/Northwest
Southeast/Southwest	Southeast/Southwest
Northeast/Southwest	Northeast/Southwest
Northwest/Southeast	Northwest/Southeast

HorizontalAlignment - Domain

DomainName	HorizontalAlignment
Description	Valid horizontal symbol alignment values
FieldType	SmallInteger
Domain Type	CodedValue

Code	Name
0	Left
1	Center
2	Right
3	Full

InventoryClass - Domain

DomainName	InventoryClass
Description	Source of the location of the asset (COFL Domain)
FieldType	String
Domain Type	CodedValue

Code	Name
DGPS	DGPS (1-meter)
GIS	GIS Entry
GPS	GPS (< 1-foot)
GPS-Converted	GPS Asbuilt Converted (< 1-foot)
Obscured-GPS	GPS Obscured
Obscured-Radio	Radio Obscured
Inaccessible-Impeded	Inaccessible/Impeded
Not Found	Not Found

piAccessDiameter - Domain

DomainName	piAccessDiameter
Description	Valid range of infrastructure access diameters

FieldType Double
Domain Type Range

Minimum Value	Maximum Value
0	72

piAccessType - Domain

DomainName piAccessType
Description List of infrastructure access types
FieldType String
Domain Type CodedValue

Code	Name
Door	Door
Grate	Grate
Cover	Cover
Hand	Hand
Lid	Lid
Unknown	Unknown

piActiveStatus - Domain

DomainName piActiveStatus
Description Identifies whether the asset is in use, not in use or removed from the ground
FieldType String
Domain Type CodedValue

Code	Name
Active	Active
Abandoned	Abandoned
Inactive	Inactive
Removed	Removed

piConditionPACP - Domain

DomainName piConditionPACP
Description NASSCO Pipeline Assessment Certification Program (PACP) condition rating
FieldType SmallInteger
Domain Type CodedValue

Code	Name
1	Severity 1 - Minor defects, failure unlikely in foreseeable future
2	Severity 2 - Minor defects, unlikely to fail for at least 20 years
3	Severity 3 - Moderate defects, deterioation may continue in 10 to 20 years
4	Severity 4 - Severe defects, risk of failure within 5 to 10 years
5	Severity 5 - Failed or likely to fail within 5 years

piControlValveType - Domain

DomainName piControlValveType
Description List of infrastructure Control Valve Types
FieldType String
Domain Type CodedValue

Code	Name
Altitude	Altitude
Blowoff	Blowoff
Combination	Combination

Vacuum	Vacuum
Air Control	Air Control
Air Gap	Air Gap
Air Release	Air Release
Atmospheric Vacuum	Atmospheric Vacuum
Backflow Control	Backflow Control
Double Check	Double Check
Pressure Vacuum	Pressure Vacuum
Pressure Reducer	Pressure Reducer
Simple Check	Simple Check
Vacuum Breaker	Vacuum Breaker
Vacuum Release	Vacuum Release
Surge Relief	Surge Relief
Snubber	Snubber
CLA	CLA
RPZ	Reduced Pressure Zone
Tidal	Tidal
Other	Other
Unknown	Unknown

piDischargePointType - Domain

DomainName piDischargePointType
Description List of infrastructure Discharge Point Types
FieldType String
Domain Type CodedValue

Code	Name
Outfall	Outfall
Overflow	Overflow
Standard Outlet	Standard Outlet
Well - Pressurized	Well - Pressurized
Well - Unpressurized	Well - Unpressurized
Other	Other
Unknown	Unknown

piInletTypes - Domain

DomainName piInletTypes
Description List of inlet types
FieldType String
Domain Type CodedValue

Code	Name
Catchbasin	Catchbasin
Closed Lid Manhole	Closed Lid Manhole
Combination	Combination
Curb	Curb
DryWell	DryWell
Grate	Grate
Open Lid Manhole	Open Lid Manhole
Rear Yard	Rear Yard
Roof	Roof
Standard	Standard
Unknown	Unknown
Valley	Valley
Other	Other

piLiningMethod - Domain

DomainName	piLiningMethod
Description	The pipe lining method based on LACP and PACP standards
FieldType	String
Domain Type	CodedValue

Code	Name
NONE	None
CCPP	Centrifugally Cast Concrete Pipe Liner
CP	Cured in Place
FF	Fold and Form or Deform/Reform
SN	Segmented Panel
SP	Segmented Pipe
SW	Spiral Wound
OTH	Other

piManholeCoverShape - Domain

DomainName	piManholeCoverShape
Description	List of infrastructure Manhole Cover Types
FieldType	String
Domain Type	CodedValue

Code	Name
Code	Name
Curb Cover	Curb Cover
Rectangular	Rectangular
Round	Round
Valley Cover	Valley Cover
Other	Other
Unknown	Unknown

piManholeCoverType - Domain

DomainName	piManholeCoverType
Description	List of infrastructure Manhole Cover Types
FieldType	String
Domain Type	CodedValue

Code	Name
ADA Compliant	ADA Compliant
Grated-City	Grated-City
Grated-FDOT	Grated-FDOT
Solid-City	Solid-City
Solid-FDOT	Solid-FDOT
Unknown	Unknown

piManholeType - Domain

DomainName	piManholeType
Description	List of infrastructure Manhole Types
FieldType	String
Domain Type	CodedValue

Code	Name
STD	Standard
DRP	Drop
SPL	Split

DIV	Diversion
SED	Sedimentation
OTH	Other
UNK	Unknown
CON	Conflict
TRM	Terminal

piPipeDiameter - Domain

DomainName	piPipeDiameter
Description	A list of pipe diameters
FieldType	Double
Domain Type	CodedValue

Code	Name
0.75	3/4"
1	1"
1.25	1 1/4"
1.5	1 1/2"
2	2"
2.5	2 1/2"
3	3"
4	4"
6	6"
8	8"
10	10"
12	12"
14	14"
15	15"
16	16"
18	18"
20	20"
24	24"
30	30"
36	36"
40	40"
42	42"
48	48"
54	54"
60	60"
66	66"
72	72"
75	75"
-1	Other
11	11"
13	13"
19	19"
21	21"
22	22"
23	23"
27	27"
33	33"
45	45"
84	84"
96	96"
102	102"
-99	Unknown
-88	Not Applicable
41	41"

52	52"

piPipeMaterial - Domain

DomainName	piPipeMaterial
Description	The list of pipe materials types based on the NASSCO standards
FieldType	String
Domain Type	CodedValue

Code	Name
ABS	ABS Plastic
ASP	Asphalt
BR	Brick
CT	Clay Tile
CSB	Concrete Segments (Bolted)
CSU	Concrete Segments (Unbolted)
CMP	Corrugated Metal
CIPP	Cured In Place
DIP	Ductile Iron
FRP	Fiberglass Reinforced
EARGEO	Earth & Geotextile
EAR	Earthen
GEO	Geotextile
GRC	Glass Reinforced Cement
OB	Pitch Fiber (Orangeburg)
PSC	Plastic/Steel Composite
PP	Polypropylene
PVC	Polyvinyl Chloride
PCCP	Pre-Stressed Concrete Cylinder
RCP	Reinforced Concrete
RPM	Reinforced Plastic (Truss)
SB	Segmented Block
SP	Steel
TTE	Transite
VCP	Vitrified Clay
WD	Wood
BMP	Brick Masonry
HDPE	High Density Polyethylene
STL	Stainless Steel
RCPC	Reinforced concrete pipe w/ cylinder
PBL	Polybutylene
CSTL	Corrugated Steel
CAL	Corrugated Aluminum
CPEL	Corrugated Polyethylene
ALU	Aluminum pipe
CONC	Concrete (Non-Reinforced)
ACP	Asbestos Cement
CIP	Cast Iron
CUP	Copper
GIP	Galvanized Pipe
PEL	Polyethylene
OTH	Other
UN	Unknown

piPipeShape - Domain

DomainName	piPipeShape
Description	Sanitary and stormwater pipe shapes
FieldType	String

Domain Type CodedValue

Code	Name
AR	Arched
EL	Elliptical
CR	Circular
RC	Rectangular
SQ	Square
UN	Unknown

SeverityIndicator - Domain

DomainName SeverityIndicator
Description Indicates the serverity of blockage and/or structural collapse observed within the asset
FieldType String
Domain Type CodedValue

Code	Name
N	None
P	Partial
C	Complete
U	Unknown/Inaccessible

swManufacturer - Domain

DomainName swManufacturer
Description List of manufacturers of stormwater assets
FieldType String
Domain Type CodedValue

Code	Name
CheckMate	CheckMate
LayFlat	LayFlat
RedValve	RedValve
Suntree	Suntree
TideFlex	TideFlex
WaStop	WaStop

swNetworkStructureType - Domain

DomainName swNetworkStructureType
Description Stormwater network structure types
FieldType String
Domain Type CodedValue

Code	Name
Discharge Structure	Discharge Structure
Diversion Chamber	Diversion Chamber
Diversion Point	Diversion Point
Junction Chamber	Junction Chamber
Lift Station	Lift Station
Endpoint	Pipe End
Split Manhole	Split Manhole
Storage Basin	Storage Basin
Tide Chamber	Tide Chamber
Virtual Junction	Virtual Junction
Other	Other
Unknown	Unknown

swOpenPosition - Domain

DomainName	swOpenPosition
Description	The opening position of a stormwater control baffle
FieldType	String
Domain Type	CodedValue

Code	Name
Bottom Opening	Bottom Opening
Top Opening	Top Opening

swOutfallLocation - Domain

DomainName	swOutfallLocation
Description	Indicates the location of an outfall asset (COFL Domain)
FieldType	String
Domain Type	CodedValue

Code	Name
Bottom of Headwall	Bottom of Headwall
Bottom Seawall	Bottom of Seawall
Bottom Pipe	Bottom Pipe
Invert	Invert
Middle of Headwall	Middle of Headwall
Middle of Seawall	Middle of Seawall
Natural Bank	Natural Bank
Top of Headwall	Top of Headwall
Top of Pipe	Top of Pipe
Top of Seawall	Top of Seawall
UN	Unknown

swPipeType - Domain

DomainName	swPipeType
Description	Indicates the type of stormwater pipe (COFL Domain)
FieldType	String
Domain Type	CodedValue

Code	Name
PERF	Perforated
SOLID	Solid
UNK	Unknown

swPollControlDeviceType - Domain

DomainName	swPollControlDeviceType
Description	Lists the type of pollution control device
FieldType	String
Domain Type	CodedValue

Code	Name
Aluminum Baffle	Aluminum Baffle
Fiber Glass Snout	Fiber Glass Snout

swPollControlStructureType - Domain

DomainName	swPollControlStructureType
Description	Lists the type of pollution control structure
FieldType	String

Domain Type CodedValue

Code	Name
Nutrient Separating Baffle Box	Nutrient Separating Baffle Box
Upflow Filtration System	Upflow Filtration System
Wetlands Biofilter	Wetlands Biofilter

swPondType - Domain

DomainName	swPondType
Description	Indicates the type of stormwater pond (COFL Domain)
FieldType	String
Domain Type	CodedValue

Code	Name
Detention	Detention
Retention	Retention

swWeirShape - Domain

DomainName	swWeirShape
Description	The shape of the stormwater weir
FieldType	String
Domain Type	CodedValue

Code	Name
Adjustable Weir	Adjustable Weir
Circular	Circular
Compound	Compound
Irregular	Irregular
Rectagular	Rectagular
Trapezoid	Trapezoid
V-Notched	V-Notched
Other	Other

swWeirType - Domain

DomainName	swWeirType
Description	The type of weir
FieldType	String
Domain Type	CodedValue

Code	Name
Broad-Crested	Broad-Crested
Combination	Combination
Horizontial	Horizontial
Labyrinth	Labyrinth
Minimum Energy Loss	Minimum Energy Loss
Sharp-Crested	Sharp-Crested
Vertical	Vertical
V-Notch	V-Notch
Other	Other

swWellAccessShape - Domain

DomainName	swWellAccessShape
Description	The shape of a stormwater access point
FieldType	String
Domain Type	CodedValue

Code	Name
Circle	Circle
Rectangle	Rectangle
Square	Square
Unknown	Unknown

VerticalAlignment - Domain

DomainName	VerticalAlignment
Description	Valid symbol vertical alignment values
FieldType	SmallInteger
Domain Type	CodedValue

Code	Name
0	Top
1	Center
2	Baseline
3	Bottom

YesNo - Domain

DomainName	YesNo
Description	A yes/no indicator
FieldType	String
Domain Type	CodedValue

Code	Name
Y	Yes
N	No

APPENDIX I: WAMP GRANT FUNDING SOURCES

Overview of Funding Program Opportunities for City of Fort Lauderdale WAMP

Note: Tier 1 = top opportunities, More details can be found on Detailed Funding Program Opportunities for City of Fort Lauderdale WAMP

ID	Tier	Abbrev.	Program Administrator	Program Budget	Funding Limit / Applicant	Eligible Projects	Funding Cycle / Application Deadline	Restrictions
G1	1	319 Grant	Florida Department of Environmental Protection (FDEP)	$5-6M	Project Specific	•Demonstration and evaluation of best management practices (BMPs) •Nonpoint pollution reduction in priority watersheds •Green Infrastructure/Low Impact Development for stormwater •Ground water protection from nonpoint sources •Public education programs on nonpoint source management ("319 Grant" only) •Septic to sewer projects ("319 Grant" only)	Project proposals may be submitted anytime throughout the year.	SWAG funding is intended for "shovel ready" capital improvement construction projects treating waters not attaining standards (i.e., impaired). •"No pipes or ditches" - Section 319(h) Grants cannot be used for any project that EPA considers a point source. •"Any project listed as a requirement under an MS4 permit is not eligible for Federal funding. •"Monitoring required" - Federal funding requires an evaluation of project effectiveness.
G2	1	CWSRF	Florida Department of Environmental Protection (FDEP) in cooperation with the US Environmental Protection Agency (EPA)	$2.6 Billion	Project Specific	Loans are available for planning, design & construction of wastewater, stormwater and nonpoint source pollution control BMPs	No deadline	Several Federal Restrictions: See SRF 101 https://ofmpub.epa.gov/WFCfiles/SRF_101/index.html
G3	1	PDM	Funded by FEMA and administered through a partnership with the Florida Division of Emergency Management (FDEM).	Not specified	$4M Mitigation project $400K Mitigation plans $300K Multijurisdictional plan updates $150K Single jurisdiction updates	Property Acquisition and Structure Demolition or Relocation; Structure Elevation; Mitigation Reconstruction; Dry Floodproofing; Generators; Localized/Non-localized Flood Control Projects; Structural Retrofitting and Non-structural Retrofitting of Existing Buildings and Facilities; Construction of safe rooms; Wind Retrofitting for Family Residences; Infrastructure Retrofit; Soil Stabilization; Wildfire Mitigation; Resilient Infrastructure; Advance Assistance; Hazard Mitigation Planning	The application period is September 30, 2019 through January 31, 2020. The Notice of Funding Opportunity (NOFO) is posted on www.Grants.gov	The traditional FEMA-approved software-based BCA Flood Modules to determine the cost effectiveness of a project must be used. Subapplicants must use a FEMA approved methodology to perform a BCA. Only project subapplications that demonstrate cost-effectiveness through a benefit cost ratio of 1.0 or greater will be considered. The BCA must be attached to the subapplicant's application. The FEMA approved BCA Toolkit, which includes the Flood Modules, may be downloaded at no cost at https://www.fema.gov/benefit-cost-analysis.
G4	1	FMA	Federal Emergency Management Agency (FEMA)	$70 million for community flood mitigation $90 million for other FMA priorities.	$25K $4M	Acquisition and Relocation of Floodprone Structures; Acquisition of Floodprone Properties; Drainage/ Stormwater Management Project; Elevation of Floodprone Structures; Protective Measures Retrofit Projects for Utility, Water, and Sanitary Systems and Infrastructure; Seismic Structural and Non-Structural Retrofit Projects; Wind Retrofit Projects	The application period is September 30, 2019 through January 31, 2020. The Notice of Funding Opportunity (NOFO) is posted on www.Grants.gov.	
G5	2	LRGP	Florida Department of Environmental Protection (DEP) on behalf of the U.S. Department of the Interior, National Park Service (NPS)	Not specified $3.9M funded in 17/18 cycle	$400K	Outdoor recreation areas and facilities such as beaches, picnic areas, trails, ball fields, tennis and basketball courts and playgrounds, along with associated support facilities such as lighting, parking, restrooms and landscaping.	Historically mid January - February - not announced for 2020 yet	Sites must be dedicated to public use in perpetuity; land acquisitions may not begin until grant is awarded

Overview of Funding Program Opportunities for City of Fort Lauderdale WAMP

Note: Tier 1 = top opportunities, More details can be found on Detailed Funding Program Opportunities for City of Fort Lauderdale WAMP

ID	Tier	Abbrev.	Program Administrator	Program Budget	Funding Limit / Applicant	Eligible Projects	Funding Cycle / Application Deadline	Restrictions
G6	2	CRGP	National Oceanic Atmospheric Administration	$28.9 million in 2018	$100K - $2M	1) Strengthening Coastal Communities: activities that improve capacity of multiple coastal jurisdictions (states, counties, municipalities, territories and tribes) to prepare and plan for, absorb impacts of, recover from, and/or adapt to extreme weather events and climate-related hazards; or2) Habitat Restoration: activities that restore habitat to strengthen the resilience of coastal ecosystems and decrease the vulnerability of coastal communities to extreme weather events and climate-related hazards.		
G7	3	CPI	Florida Department of Environmental Protection (FDEP) on behalf of National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce	Not specified	$10-75K Construction $10-30K Planning	The Coastal Partnership Initiative was developed to promote the protection and effective management of Florida's coastal resources in four specific priority areas: • Resilient Communities • Coastal Resource Stewardship • Access to Coastal Resources • Working Waterfronts	Applications are accepted once a year in response to a "Notice of Availability of Funds" published in the Florida Administrative Register. CPI grant applications close at 4 p.m. EDT on Oct. 1, 2019. The funding year typically begins July 1 and ends Dec. 31; however, this timeframe may be shifted if the grant cycle is delayed or postponed. Projects are to be completed within 18 months, no matter when the funding cycle begins.	Non-profit groups are not eligible to receive funds for construction projects, invasive exotic plant removal, habitat restoration, or land acquisition. Applications submitted by non-profit groups that propose these activities (as listed in 62S-4.004(2)(c)) will be disqualified.
G8	3	DWSRF	Florida Department of Environmental Protection (FDEP) in cooperation with the US Environmental Protection Agency (EPA)	EPA Budget $1.6 Billion	Project Specific	The project is part of a public water system as defined in 62-552.200(27), F.A.C., and may include drinking water supply, storage, transmission, treatment, disinfection, distribution, residuals management, and appurtenant facilities. Asset management plans will be an eligible cost.	Each fiscal year, a priority list adoption meeting is held on the second Wednesday of August for obligating funding for eligible projects. Any remaining funds will be obligated at quarterly priority list management meetings thereafter until funds are exhausted. All documents must be received 45 days prior to each public listing meeting to guarantee being considered.	Project sponsors will no longer be limited to one grant per lifetime, but instead be limited to one open grant at a time.
G9	3	HMGP	Federal Emergency Management Agency (FEMA)	TBD - specific to event	Project Specific	The purpose of the HMGP program is to help communities implement hazard mitigation measures following a Presidential major disaster declaration. Hazard mitigation is any action taken to reduce or eliminate long term risk to people and property from natural hazards.	Applications announced by the State as a result of Presidential Disaster Declaration. Announcement will set application deadline.	All projects are required to undergo an environmental and historic preservation review and must comply with the National Environmental Policy (NEPA) and associated Federal, State, Tribal & Local statutues No work can be done prior to the NEPA review process.

Overview of Funding Program Opportunities for City of Fort Lauderdale WAMP

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ID	Tier	Abbrev.	Program Administrator	Program Budget	Funding Limit / Applicant	Eligible Projects	Funding Cycle / Application Deadline	Restrictions
G10	3	NAWCA	US Fish & Wildlife Services	2018 Grant Funds $46.5M	Up to $1M (over $1M w/ justification of need)	Public-private partnerships carrying out projects in the United States that further the goals of the North American Wetlands Conservation Act (NAWCA). These projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitats for the benefit of all wetlands-associated migratory birds.	February 22, 2019: U.S. Standard Grants, Cycle 1 July 3, 2019: U.S. Standard Grants, Cycle 2 October 17, 2019: U.S. Small Grants	Projects must meet Atlantic Coast Joint Venture's mission