TALLAHASSEE MASTER PLAN – SURFACE WATER (TMaPS): VOLUME 7

CITY OF TALLAHASSEE

NON-STRUCTURAL AND STRUCTURAL PROJECT DEVELOPMENT

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May 2024

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engineers | scientists | innovators

TMaPS: VOLUME 7

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CITY OF TALLAHASSEE

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Project Number: FW7714

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The engineering material and data contained within the enclosed report was prepared by Geosyntec Consultants, Inc. for sole use by the City of Tallahassee. This report was prepared under the supervision and direction of the respective undersigned, whose seal as a registered professional engineer is affixed below.

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Tallahassee Master Plan – Surface Water (TMaPS)

Volume 1: Executive Summary

Volume 2: Background & Approach

Volume 3: Lake Munson Basin

Volume 4: Lake Jackson Basin

Volume 5: Lake Lafayette Basin

Volume 6: Wakulla Springs and Lake Talquin

Volume 7: Non-Structural and Structural Project Development

Volume 8: Regulatory Review

TABLE OF CONTENTS

7 NON-STRUCTURAL AND STRUCTURAL PROJECT DEVELOPMENT 7-1
7.1 Introduction 7-1
7.2 Volume Outline 7-1
7.3 Non-Structural Practices 7-2
7.3.1 Land Development Code 7-2
7.3.2 Comprehensive Plan 7-3
7.3.3 Think About Personal Pollution Campaign 7-5
7.3.4 Street Sweeping Program 7-5
7.3.5 Fertilizer Ordinance 7-6
7.3.6 Pet Waste Ordinance (Chapter 4, Sec 4-11) 7-7
7.3.7 Minor MS4 Enhancements 7-7
7.3.8 Summary and Recommendations 7-8
7.4 Septic to Sanitary Conversion 7-12
7.4.1 Septic to Sanitary Conversion Area Identification 7-13
7.4.1.1 Areas Identified in Previous Studies 7-13
7.4.1.2 Areas Newly Identified in Current Study 7-14
7.4.1.3 Prioritization Methodology 7-15
7.4.2 Prioritized Septic to Sanitary Target Areas 7-15
7.5 Structural Practices 7-16
7.5.1 Structural Practice Approaches 7-16
7.5.1.1 Enhancement of Existing Stormwater Ponds with Baffles and BAM 7-16
7.5.1.2 Stormwater Pond/Surface Waterbody Dredging 7-17
7.5.1.3 Wetland Reversion 7-18
7.5.1.4 Channel Hard Armoring 7-18
7.5.1.5 Nutrient Separating Baffle Box 7-19
7.5.1.6 Regional Passive Baseflow Treatment Systems 7-19
7.5.1.7 Regional Baseflow Treatment Systems 7-19
7.5.2 Summary of Structural Practices 7-20
7.6 Top Project Concepts 7-23
7.6.1 Projects Currently Underway 7-23
7.6.1.1 Project C, Wetland Reversion 7-23
7.6.1.2 Project Y, Pond Enhancement 7-23
7.6.1.3 Project F, Erosion Control Project 7-23
7.6.1.4 Project S, Erosion Control Project 7-24
7.6.2 Projects for Immediate Consideration 7-24
7.6.2.1 Project N, Regional Passive Baseflow Treatment System 7-24

7.6.2.1.1 Water Quality Improvement Concept 7-24
7.6.2.1.2 Pollutant Reduction Evaluation 7-24
7.6.2.1.3 Maintenance Considerations 7-25
7.6.2.1.4 Permitting Considerations 7-25
7.6.2.1.5 Cost Benefit Analysis 7-25
7.6.2.2 Project M, Regional Passive Baseflow Treatment System 7-27
7.6.2.2.1 Water Quality Improvement Concept 7-27
7.6.2.2.2 Pollutant Reduction Evaluation 7-27
7.6.2.2.3 Maintenance Considerations 7-27
7.6.2.2.4 Permitting Considerations 7-27
7.6.2.2.5 Cost Benefit Analysis 7-27
7.6.2.3 Project H, Pond Enhancement 7-30
7.6.2.3.1 Water Quality Improvement Concept 7-30
7.6.2.3.2 Pollutant Reduction Evaluation 7-30
7.6.2.3.3 Maintenance Considerations 7-30
7.6.2.3.4 Permitting Considerations 7-30
7.6.2.3.5 Cost Benefit Analysis 7-31
7.6.2.4 Project I, Pond Enhancement 7-33
7.6.2.4.1 Water Quality Improvement Concept 7-33
7.6.2.4.2 Pollutant Reduction Evaluation 7-33
7.6.2.4.3 Maintenance Considerations 7-33
7.6.2.4.4 Permitting Considerations 7-33
7.6.2.4.5 Cost Benefit Analysis 7-33
7.6.2.5 Project Q, Regional Baseflow Treatment System 7-36
7.6.2.5.1 Water Quality Improvement Concept 7-36
7.6.2.5.2 Pollutant Reduction Evaluation 7-36
7.6.2.5.3 Maintenance Considerations 7-36
7.6.2.5.4 Permitting Considerations 7-36
7.6.2.5.5 Cost Benefit Analysis 7-36
7.6.2.6 Project R, Pond Enhancement 7-39
7.6.2.6.1 Water Quality Improvement Concept 7-39
7.6.2.6.2 Pollutant Reduction Evaluation 7-39
7.6.2.6.3 Maintenance Considerations 7-39
7.6.2.6.4 Permitting Considerations 7-39
7.6.2.6.5 Cost Benefit Analysis 7-39
7.6.3 Future Priority Projects 7-42
7.6.3.1 Project A, Pond Enhancement 7-42
7.6.3.2 Project D, Pond Enhancement 7-42
7.6.3.3 Project E, Dredging 7-42
7.6.3.4 Project P, Channel Hard Armoring 7-43
7.6.3.5 Project W, Channel Hard Armoring 7-43
7.6.3.6 Project G, Channel Hard Armoring 7-43
7.6.3.7 Project O, Channel Hard Armoring 7-44

7.6.3.8 Project T, Channel Hard Armoring 7-44

LIST OF TABLES

Table 7-1: Summary Table of Existing and New Non-Structural Practices 7-9
Table 7-2: Decision Matrix for Determining the Top 10 Priority Projects................................ 7-22
Table 7-3: Project N Regional Passive Baseflow Treatment System Cost Benefit................... 7-25
Table 7-4: Project M Regional Passive Baseflow Treatment System Cost Benefit 7-28
Table 7-5: Project H Pond Enhancement Cost Benefit.. 7-31
Table 7-6: Project I Pond Enhancement Cost Benefit 7-34
Table 7-7: Project Q Regional Baseflow Treatment System Cost Benefit................................ 7-37
Table 7-8: Project R Pond Enhancement Cost Benefit... 7-40

LIST OF FIGURES

Figure 7-1: Project N – Regional Passive Baseflow Treatment System.................................... 7-26
Figure 7-2: Project M – Regional Passive Baseflow Treatment System 7-29
Figure 7-3: Project H – Pond Enhancement 7-32
Figure 7-4: Project I – Pond Enhancement... 7-35
Figure 7-5: Project Q – Regional Baseflow Treatment System.. 7-38
Figure 7-6: Project R – Pond Enhancement.. 7-41

LIST OF EXHIBITS

Exhibit 7-1: Wakulla Springs Recharge Areas and Septic Sites.. 7-46
Exhibit 7-2: Septic to Sanitary Projects 7-47
Exhibit 7-3: Structural BMP Projects 7-48

ACRONYMS AND ABBREVIATIONS

BMAP	Basin Management Action Plan
BMP	Best Management Practices
CDA	Concentrated Discharge Areas
COT	City of Tallahassee
DEM	Digital Elevation Model
DMMA	Dredge Materials Management Area
ERP	Environmental Resource Permit
FAMU	Florida Agricultural and Mechanical (A&M) University
FDEP	Florida Department of Environmental Protection
FFL	Florida-Friendly Landscaping
FIB	Fecal Indicator Bacteria
FSU	Florida State University
ft	Feet
lb/yr	Pounds per Year
LDC	Land Development Code
LID	Low Impact Development
MARS	Megginnis Arm Regional Stormwater
mg/L	Milligrams per Liter
MS4	Municipal Separate Storm Sewer Systems
MST	Microbial Source Tracking
NAVD88	North American Vertical Datum of 1988
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
NRCS	Natural Resource Conservation Service
NSBB	Nutrient Separating Baffle Box
NWFWMD	Northwest Florida Water Management District
OSTDS	Onsite Sewage Treatment and Disposal Systems
SWMF	Stormwater Management Facilities
SWFWMD	Southwest Florida Water Management District
TAPP	Think About Personal Pollution

TMaPS	Tallahassee Master Plan - Surface Water
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
ULL-NRF	Upper Lake Lafayette Nutrient Reduction Facility
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WBID	Waterbody Identification
WSA	Water and Sewer Interlocal Agreement

7 Non-Structural and Structural Project Development

A summary of recommendations to help improve water quality within the subject waterbodies are presented within this section. Non-structural practices, septic to sanitary conversions, and structural best management practices (BMPs) are discussed and proposed for implementation within the City of Tallahassee (COT).

7.1 Introduction

Non-structural practices are often referred to as source control practices and are typically implemented during planning. These types of practices tend to take a preventative approach to minimize nutrient loading from stormwater and often take the form of regulations, such as comprehensive plans, land development codes, or ordinances, such as fertilizer ordinances or pet waste ordinances. However, not all non-structural practices are regulatory.

Septic to sanitary sewer conversions reduce nutrient loads from septic tanks, especially improperly maintained ones. The conversion takes the septic tank offline and connects the lot to the municipal sewer system which provides treatment and a regulated point of discharge.

Structural practices are used to mitigate the changes in stormwater quantity and quality caused by urban development. They are often organized into retention, detention, or filtration practices. Examples include enhancements to existing stormwater ponds, creating new stormwater ponds, installing inlet baskets or nutrient separating baffle boxes (NSBB), and hard armoring channels, to name a few.

7.2 Volume Outline

The sections that follow present an overview of non-structural and structural BMPs recommended for implementation throughout the City. A breakdown of the specific practice discussions are as follows:

- Non-Structural Practices
    - Identification and review of existing practices,
    - Recommendations on how to improve the existing practices,
    - Recommendations of potential non-programmatic.
- Identification of Septic to Sanitary Sewer conversions.
- Structural Practices
    - Identification of the top locations across all drainage basins to implement structural BMPs for water quality improvement based on the hot spot analysis performed in **Volumes 3**, **4**, and **5**.
    - Evaluation of the top 10 BMP sites based on feedback from the City for specific BMP concepts and/or pilot projects.
    - Discussion of BMP sites that have potential for future implementation.

Section 7.3 presents the non-structural practices discussion, **Section 7.4** presents the septic to sanitary conversion projects discussion, **Section 7.5** presents the structural practices discussion, **Section 7.6.1** presents the top 10 projects that are currently under way, **Section 7.6.2** presents the top 10 projects that are for immediate consideration, and **Section 7.6.3** presents the future priority projects.

7.3 Non-Structural Practices

This section identifies and reviews practices that the City currently has implemented and makes recommendations on how to improve the practice, as well as recommending new practices for the City to implement.

7.3.1 Land Development Code

The City Land Development Code (LDC) is intended to promote the public health, safety, comfort, convenience, and general welfare of the community. The current LDC, which was last updated March 2023, includes requirements for general provisions, administration, buildings and building regulations, concurrency management, environmental management (includes erosion and sediment control), flood damage protection, sign code, streets and sidewalks, subdivision and site plans, and zoning (including cluster development). Incorporation of practices that promote the protection of water quality and the environment in general into the LDC represents a clear opportunity to promote good water quality practices.

A review of the LDC prior to the 2023 update was completed in 2021 as part of this project and detailed recommendations can be found in **Volume 8** of this water quality master plan. A high-level overview of the recommendations is provided below. However, this review was completed prior to ratification of the new statewide stormwater rule developed in response to Chapter 2020-150, Laws of Florida. The recommended stormwater quality requirements have been accomplished through the 2024 ratification of the statewide stormwater rule and such burden no longer falls to City regulations.

- Incorporate BMP and low impact development (LID) language changes throughout the LDC.
    - Currently the definition of BMP focuses on turf and landscaping practices. It is suggested that the definition be updated to emphasize stormwater management practices from both a quantity and quality perspective.
    - Encourage the use of Florida-Friendly Landscaping (FFL), especially in large-scale developments and re-developments.
- Incorporate definition updates.
    - Existing definitions should be revised to provide consistency with statewide definitions and emphasize stormwater management.
    - The definitions list should be updated to include new terms such as the following:
        - Alternative Restoration Plan
        - Basin Management Action Plan (BMAP)
        - Best Management Practices (BMPs)
        - First Flush (FF)
        - Florida-Friendly Landscaping (FFL)

        - Impaired Waterbody
        - Low Impact Development (LID)
        - Total Maximum Daily Load (TMDL)
        - Utility
        - Wet Detention
- Incorporate Stormwater Quality Requirements. (Provided in Ratified Statewide Rule)
    - Recommend that the City require stormwater pollutant loading calculations.
    - Demonstrate that the required level of treatment is being met by using loading calculations.
    - Set forth the minimum levels of stormwater treatment.

7.3.2 Comprehensive Plan

The City's comprehensive plan is a joint Tallahassee-Leon County Comprehensive Plan adopted on July 16, 1990, and is currently under scheduled revision at the time of this report. The purpose of the comprehensive plan is to preserve, protect, and enhance the quality of life for all citizens. The Comprehensive Plan is aimed to guide the economic, social, physical, and environmental development of the community and has specific goals set for each element, which include the following:

- Land Use Element
- Mobility Element
- Utilities Element:
    - Solid Waste
    - Aquifer Recharge
    - Potable Water
    - Sanitary Sewer
    - Stormwater Management
- Conservation Element
- Parks and Recreation Element
- Joint Housing Element
- Housing Element
- Historic Preservation Element
- Intergovernmental Coordination

- Capital Improvements Element
- Economic Development Element
- Public School Facilities Element
- Property Rights Element

The Comprehensive Plan mentions BMPs for agriculture and silviculture activities, grading/construction, disconnection of impervious surfaces, and increased removal of nutrients from stormwater discharges.

A review of the comprehensive plan was completed as part of this project and detailed recommendations can be found in **Volume 8** of this water quality master plan. A high-level overview of the recommendations is presented below:

- Incorporate definition update recommendations.
    - Existing definitions should be revised to provide consistency with statewide definitions and emphasize stormwater management, such as the term BMP.
    - Updating the definitions list to include new terms such as:
        - Florida-Friendly Landscaping
        - Low Impact Development
        - Net Improvement
- Incorporate the following general updates.
    - Expand discussion on stormwater treatment standards by requiring stormwater pollutant loading calculations to demonstrate that the required level of treatment is being met.
    - Widen the potential uses and applications of BMPs by updating the LDC to promote LID principles and encourage the use of BMPs and FFL, especially in large-scale developments and re-developments.
    - Include references to discussions on the different pollutant removal mechanisms and what pollutants the BMPs are effective at removing.
        - The Statewide BMP Efficiencies for Non-Point Source Management of Surface Waters [Florida Department of Environmental Protection (FDEP), 2018] document can be referenced.
        - The BMPTrains tool can also be referenced when determining removal efficiencies for various BMPs.
        - An overview of nutrients, forms present, transformations cycles, and removal methods should be included.
    - Reference the new statewide stormwater rule, should it be ratified into law.

7.3.3 Think About Personal Pollution Campaign

The Think About Personal Pollution Campaign (TAPP) is a multi-media public educational outreach program focused on non-point source pollution. Topics covered include lawn care practices, pet waste practices, car washing practices, septic systems, and illicit discharges. The TAPP campaign helps educate individuals on small personal changes in home and yard care practices that can help keep local lakes, sinks, and streams cleaner. The program is intended to help residents understand their impact on stormwater and waterbody water quality and encourage action, typically through adoption of slightly different approaches to everyday tasks.

TAPP offers educational materials and seminars that provide information on this program to local neighborhood and civic groups. Events are offered in nearly any venue or group size. The total funding amount from 2020 – 2024 is approximately $1,000,000. The yearly average funding amount is approximately $200,000. After a review of the TAPP campaign, the following recommendations to improve the campaign were identified:

- Evaluate different ways the City is reaching out to the community and determine what appears to be the most and least effective methods.
    - Those outreach methods identified as less effective should be tweaked to be more impactful or resources could be redirected to more effective methods.
    - Any specific campaign improvements would be based on the results of this assessment.
- Evaluate the communication/distribution methods gaps and potential new approaches based on current societal and social media trends.
- Install more pet waste stations in areas that have high dog traffic.

7.3.4 Street Sweeping Program

Street sweeping is a source control method that removes and disposes of sediments, vegetative matter, and other nutrient-laden materials so that they are not washed into receiving waterbodies by stormwater. It is far more cost effective to prevent pollutants from entering waterbodies than it is to remove them from waterbodies (Berretta et al., 2011). This cost advantage makes source control practices popular with municipalities trying to restore impaired waters or protect other waterbodies.

The City's current street sweeping program has an average annual cost of $1,800,000 and sweeps all the City owned curbed streets in the program an average of 11 times per year. The average annual miles swept is approximately 6,200 miles resulting in approximately 2,000 tons of street debris collected. The result is an average annual removal of 2,140 pounds (lb) of total nitrogen (TN) and 1,370 lb of total phosphorus (TP) from the City's streets prior to entering local waterbodies. The cost benefit of the City's existing program is approximately $840/lb of TN and $1,300/lb of TP.

While the current street sweeping program appears to provide a reasonably good cost benefit for nutrient removal, several recent street sweeping studies performed in Florida report better cost benefits ranging from $28 to $95/lb of TN and $73 to $267/lb of TP. The City of Lakeland, Pinellas County, and the City of Largo, have demonstrated that the characteristics of the street debris can significantly impact the cost benefit of the practice. Specifically, areas with high tree canopy (such as Tallahassee) tend to have a higher organic, and thus nutrient content than those areas that do not. Studies have found that the statewide nutrient content data used in the National Pollutant Discharge Elimination System (NPDES) reporting can significantly underestimate the true values for street segments with high tree canopy and during periods of leaf and pollen drop (Geosyntec, 2020) (Geosyntec, 2023a) (Geosyntec, 2023b).

Recommendations for program enhancement are presented below.

- Perform a street sweeping program optimization analysis to characterize the nutrient content of street debris based on land use type, proximity to impaired waters basin, extent of tree canopy cover, during leaf drop conditions, and during pollen drop conditions.
    - These updated values would be used in NPDES reporting.
- Prioritize street segments that have high tree canopy coverage, do not drain to a stormwater BMP, or are within impaired waters basins with more frequent sweeping compared to those that do not.

7.3.5 Fertilizer Ordinance

Fertilizer ordinances are tools used to reduce sources of nutrients that come from urban landscapes. They often provide information on the proper use of fertilizer, training and license requirements of fertilizer applicators, and educate citizens on the negative effects associated with the misuse of fertilizer.

The current fertilizer ordinance (08-O-72AA) regulates the use of fertilizer within the City limits. The ordinance provides definitions, enforcement guidance, a framework for assessing penalties, severability and resolving conflicts, and provides the effective date January 28, 2009. As of 2021, more than 700 certified applicators have received at least 1 certification, at least 340 applicators have received more than 1 certification, and over 1,000 total certifications have been issued. The City does not track operating costs for the fertilizer ordinance, so no cost information was available.

A review of the fertilizer ordinance was completed as part of this project and detailed recommendations can be found in **Volume 8** of this water quality master plan. A high-level overview of the recommendations is provided below.

- Currently, 6 foot (ft) low maintenance zones (no fertilizer, minimize watering, no mowing, and promoting native beneficial vegetation) surrounding surface waterbodies are strongly recommended. It is recommended to increase these zones to 10 ft.
- Modify landscape regulations to be consistent with the Model Ordinance for Florida-Friendly Fertilizer Use on Urban Landscapes (FDEP, 2015) to obtain a 3 percent TN credit on all FDEP TMDLs and BMAPs.
- Update existing definitions and add new terms, such as those presented below. More details can be found in **Volume 8**.

- Existing definitions:
  - Commercial Fertilizer Applicator
  - Low Maintenance Zone
  - Readily Available Nitrogen
- New terms:
  - Saturated Soil
  - Slow Release, Controlled Release, Timed Release, Slowly Available, Water Insoluble Nitrogen
  - Urban Landscape

7.3.6 Pet Waste Ordinance (Chapter 4, Sec 4-11)

Pet waste management programs can have several benefits for Florida municipalities. One of the most significant benefits is the improvement of water quality in urban streams and waterways. Pet waste contains bacteria that can contaminate a watershed, posing health risks to humans and other animals, potentially causing the spread of disease, such as Giardia and *E. coli* [Southwest Florida Water Management District (SWFWMD), n.d.]. Educating the public about the dangers of improperly managed pet waste is imperative to preventing urban pollution (EPA, 2023).

In general, the City's pet waste ordinance (08-O-23AA) states that the owner of any animal shall be responsible for the removal and proper disposal of any fecal matter deposited by the animal in public spaces. A violation of the ordinance is a civil infraction.

Several recommendations to improve pet waste removal were identified below.

- At sites where regular fecal indicator bacteria (FIB) exceedances occur, perform FIB forensic investigation using advanced detection techniques such as microbial source tracking (MST).
- Increase the number of pet waste stations.
- Encourage residents to report violators to the Illicit Discharge Hotline.

7.3.7 Minor MS4 Enhancements

Another non-structural practice can be the wide-spread implementation of enhancements to the City's municipal separate storm sewer system (MS4), which typically include relatively small-scale BMPs. Individually, these will not provide sufficient treatment to meet water quality criteria, but when implemented over a large area the combined effect can be significant. These enhancements focus on the removal of large organic materials and particulates, which can be a significant source of pollutants to waterbodies. Watersheds that typically generate lots of sediments and organic materials should be targeted for these kinds of practices. Examples of minor MS4 enhancements are discussed further below.

- Inlet baskets can be implemented within areas with high tree canopy coverage or areas vulnerable to soil erosion. Inlet baskets can be used in curb inlets to filter stormwater as it flows into the drainage infrastructure. They are fitted with screens to capture pollutants and debris, but provide bypass to allow water to drain should the basket become clogged. Some inlet baskets include media filters to provide some dissolved pollutant removal as well. It is recommended that these BMPs be implemented on outfalls that have no current treatment.

- NSBBs are typically installed online with traditional drainage systems as far downstream as possible to provide treatment to as much of the watershed as possible. These systems are intended for large debris and sediment removal from stormwater. NSBBs leverage physical straining and settling of particulates in a metal mesh basket followed by baffled settled chambers to remove large organic and inorganic debris. They are not expected to provide removal of dissolved pollutants, however a filter media upflow filter can be added which does provide some dissolved pollutant removal. Due to the online or offline nature of these systems, they can provide treatment for larger contributing areas then an inlet basket. It is recommended that these BMPs be implemented on outfalls that have no current treatment, catchments with high deciduous tree canopy coverage, or areas where erosion and sedimentation appear to be issues.
- Stormceptors, or cyclone separators, are hydrodynamic separators that are designed to remove pollutants from stormwater. Like other hydrodynamic separators, they allow oils and debris to rise, and sediments to settle for later removal. Stormceptors can be installed in typical inlet structures or at the downstream end of a drainage conveyance. They can function on their own or provide pre-treatment for downstream stormwater BMPs. It is recommended that these BMPs be implemented on outfalls that have no current treatment, catchments with high deciduous tree canopy coverage, or areas where erosion and sedimentation appear to be issues.

For inlet baskets, NSBBs, and Stormceptors, the anticipated cost benefit ranges from approximately $240 - $3,020/lb TN and $1,640 - $7,450/lb TP (Geosyntec (Draft), 2023c; Berretta et al., 2011). However, during this review the City noted maintenance concerns related to these enhancements. The City has previously tested multiple varieties of these technologies and found the maintenance burden to be overly prohibitive relative to the potential pollutant load removal. For example, the City installed inlet baskets of a few varieties and observed many of the baskets would fill after only one storm events due to the high amount of leaf litter common to Tallahassee. All of the inlet baskets were ultimately removed from operation. The City has also installed hydrodynamic separators and observed monthly cleanings to be insufficient under some conditions, which are suspected to be related to the build-up/wash-off phenomena.

7.3.8 Summary and Recommendations

A summary of the practices and recommendations can be found in **Table 7-1**.

Table 7-1: Summary Table of Existing and New Non-Structural Practices

Practice	Current City Practice?	Summary of Existing/Proposed	Recommendations for Existing/Proposed	Cost
LDC	Yes	The City's LDC is intended to promote the public health, safety, comfort, convenience, and general welfare of the community. It promotes good water quality practices and provides guidelines on how land can be used and developed and often follows the goals set by the Comprehensive Plan.	Include more language on BMPs and LID in a way that promotes the LID principles and encourages use of BMPs with a focus on water quality treatment. Update existing definitions to be consistent with statewide definitions and emphasize stormwater management. Incorporate stormwater quality requirements.	N/A
Comprehensive Plan	Yes	The Comprehensive Plan is a document designed to preserve, protect, and enhance the quality of life for all citizens. It aims to guide the economic, social, physical, and environmental development of the community.	Add new and update existing definitions to be consistent with statewide definitions and emphasize stormwater management. Promote LID principles and encourage use of BMPs with a focus on water quality treatment. Reference new statewide stormwater rule, if ratified. Provide high-level discussion on	N/A

Practice	Current City Practice?	Summary of Existing/Proposed	Recommendations for Existing/Proposed	Cost
			pollutant removal mechanisms. Require stormwater pollutant loading calculations.	
TAPP	Yes	TAPP is an educational outreach campaign that helps educate individuals on ways that small personal changes can keep waterways clean.	Determine most impactful way of reaching out to the community. Evaluate gaps in communication methods and potential new approaches. Install more pet waste stations in areas with high dog traffic.	Funding amount 2020-2024: $975,000 Yearly average: $195,000
Street Sweeping Program	Yes	The City's existing street sweeping program removes and disposes of sediments, vegetative matter, and other nutrient-laden materials so that they are not washed into receiving waterbodies by stormwater. Based on collected annually between Feb 2004 - April 2023: • Average Annual Frequency: 11 sweeping events per year • Average Annual Miles Swept: 6,200 miles	Conduct an optimization analysis to evaluate the grouping of street segments and frequency of sweeping based on the extent of tree canopy coverage. Properly characterize street debris nutrient characteristics for high tree canopy street segments during leaf drop conditions and during pollen drop conditions. Use optimization analysis results for NPDES reporting.	Current annual cost and cost per pound of TN and TP: • Average annual program cost: $1,800,000 • $840/lb TN removed • $1,300/lb TP removed Optimized costs from similar municipal efforts: • $28 – $95 per pound of TN

Practice	Current City Practice?	Summary of Existing/Proposed	Recommendations for Existing/Proposed	Cost
		• Average Annual Weight of TN removed: 2,140 lb • Average Annual Weight of TP removed: 1,370 lb		• $73 – $267 per pound of TP
Fertilizer Ordinance	Yes	The current fertilizer ordinance 08-O-72AA regulates the use of fertilizer within the City limits. As of 2021, 722 employees have received at least 1 certification, 345 employees have received more than 1 certification, and over 1,000 total certifications have been issued.	Increase low maintenance zones from 6 ft to 10 ft. Modify landscape regulations to be consistent with the FFL model ordinance. Updates to definitions within the fertilizer ordinance to promote BMPs and FFL.	No annual operating cost tracked for the City's Fertilizer Ordinance.
Pet Waste Ordinance	Yes	The current pet waste ordinance 08-O-23AA states that owners are responsible for the removal of their pets' excreta anywhere other than the premises of the owner of the animal. The ordinance is enforced by citation without notice as a class I violation. The penalty for the first offense is $50 and for the second offense it is $100. The third offense results in a mandatory court hearing with fines up to $500.	Where regular FIB exceedances occur, perform FIB forensic investigation using advanced detection techniques. Encourage residents to report violators using the illicit discharge reporting hotline.	No annual operating cost is tracked for the City's Pet Waste Ordinance.

Practice	Current City Practice?	Summary of Existing/Proposed	Recommendations for Existing/Proposed	Cost
Minor MS4 Enhancements	Yes	Inlet baskets can be used in existing curb inlets to capture pollutants and debris, and allow filtered water to leave the basket and enter the drainage conveyance. NSBB systems can be used to leverage physical straining and settling of particulates in a metal mesh basket followed by baffled settling chambers to remove large organic and inorganic debris. Stormceptors can be used to capture pollutants and allow oil and debris to rise and sediments to settle.	These minor MS4 enhancements are recommended to be implemented on outfalls that have no current treatment, inlet catchments with high deciduous tree canopy coverage, or areas where erosion and sedimentation appear to be an issue.	Inlet Baskets, NSBB/ Stormceptors: $240 - $3,020/lb TN $1,640 - $7,450/lb TP

7.4 Septic to Sanitary Conversion

The way septic systems function is by receiving the wastewater from the house into an underground tank where the wastewater is held long enough for solids to settle and oils/greases to float to the top. Aerobic and anaerobic bacteria work to break down solids, typically converting them to dissolved inorganic nutrients. The effluent then exits the tank and goes into the drainfield where it is filtered through the soil and ultimately enters the groundwater. Septic tanks can be a source of nutrients to waterbodies and springs, especially systems that are improperly maintained or failing. For the purposes of this volume, the terms onsite sewage treatment and disposal systems (OSTDS) and septic are the same, and the term septic will be used in the rest of this volume.

The Florida Springs and Aquifer Protection Act passed during Florida's 2016 legislative session, identified 30 Outstanding Florida Springs that require additional protections to ensure their conservation—including Wakulla Springs. The protections are to be outlined in the BMAPs, which are plans focused on reducing nutrient pollution that impacts the quality of the springs. It is noted that per the Wakulla Spring BMAP, septic removal receives a 95 percent credit for load removal.

Septic to sanitary sewer conversion consists of switching from private septic systems to a municipal sewer system. From a water quality perspective, areas where nutrient leaching from septic systems is a high risk to a surface waterbody or spring should be prioritized for septic to sanitary conversion. The hot spot analyses presented in **Volumes 3**, **4**, and **5** identified target areas for septic to sewer conversion. Much of the incorporated area of the City is serviced by sanitary sewer; however, there are some pockets where septic systems are still used. Since southern part of the City is within the Wakulla Springs BMAP primary protection zone, conversion to sanitary sewer in this area would benefit the spring.

Additionally, there are extensive unincorporated parts of the County that are serviced by septic systems. An evaluation of the septic systems relative to the subject waterbodies of this study is presented in **Volumes 3**, **4**, and **5**. The methods used to identify the highest benefit septic to sanitary conversion projects are further discussed in the following sections. Only TN loading was considered for this analysis. TP is not typically mobile in the water column as it readily adsorbs to soil particles and therefore is typically not as much of a concern relative to groundwater loading.

7.4.1 Septic to Sanitary Conversion Area Identification

To identify sites or areas that should be considered for septic to sanitary conversion, previous evaluations were reviewed, most notably the 2035 Master Sewer Plan Update (COT, 2016). In addition to previously identified areas, new areas were identified as part of this effort based on the septic loading evaluation completed for the hot spot analyses presented in **Volumes 3**, **4**, and **5**. All the areas identified were prioritized based on expected cost benefit of each proposed conversion area.

7.4.1.1 Areas Identified in Previous Studies

The 2035 Master Sewer Plan Update (COT, 2016) identified a total of 13 unsewered areas for septic to sanitary conversion within the Wakulla Springs springshed. A detailed analysis was presented which determined the approximate cost to provide central sewer to the identified areas. The amount of potential sanitary sewer connections, cost per connection, study area population percent increase, and estimated project cost were included in the analyses. Geosyntec reviewed these areas and identified 13 that were within the Wakulla Springs springshed. These 13 areas were evaluated for project prioritization in **Section 7.4.2**.

The SPIL method was used to calculate TN loadings relative to the subject waterbodies of this study. This includes both surface water impacts as well as spring impacts to Wakulla Springs. The surface water impacts were calculated in septic load sections of **Volumes 3**, **4**, and **5**. The loadings to Wakulla Springs are calculated as described in this section. The total water quality impact was determined by adding up the loading removed due to septic to sanitary conversion relative to both surface waterbodies and the Wakulla Spring. The costs were estimated based on data provided in the 2035 Master Sewer Plan Update which was then used to calculate a cost benefit for each project. The individual steps are presented below.

1. As described in the septic load section in **Volumes 3**, **4**, and **5**, only the septic tanks within 200 meters of a priority waterbody were assumed to have a loading impact on the waterbody. As such, these are the only septic tanks that were assumed to have a water

quality benefit for being converted to sanitary. The number of said septic tanks were counted for each project area.

2. The number of septic tanks within 200 meters of a priority waterbody (Step 1) was then multiplied by the loading per septic tank, which was calculated in **Volumes 3**, **4**, and **5**. This results in the surface water quality benefit of converting septic systems to sanitary.
3. The groundwater loading removed was calculated as the project areas determined to be either within a medium recharge area or a high recharge area within the Wakulla Springs BMAP (**Exhibit 7-1**). The applicable recharge percentage for the Wakulla Springs BMAP (40 percent for medium recharge, 90 percent for high recharge) was multiplied by the total sewer tanks in the project area and the loading per septic tank, found in **Volumes 3**, **4**, and **5**.
4. The groundwater loading (Step 3) was multiplied by 95 percent to account for the septic removal credit based on the Wakulla Springs BMAP. This was then added to the surface water quality benefit (Step 2) to calculate the total load reduction, or water quality benefit.
5. The cost per connection was based on the 2035 Master Sewer Plan Update (COT, 2016). Since the project areas in the 2035 Master Sewer Plan Update were identified in 2015, a cost adjustment was done to convert the 2015 costs to present (2023) costs. This was done by taking the 2015 costs and multiplying by a conversion rate of 1.292955 provided by the City of Tallahassee.
6. The total net present value (NPV) project cost for the study area was calculated by multiplying the total proposed septic to sanitary conversion connections by the NPV of the cost per connection.
7. The cost benefit is calculated by taking the total project cost (Step 6) and dividing by the total water quality benefit (Step 4).

Of the 13 previously identified study areas, three study areas did not have any septic parcels within 200 meters of a priority waterbody. However, they did have groundwater loading removed, which is important for the Wakulla Springs BMAP. A summary table of the proposed septic to sanitary conversions can be found in **Exhibit 7-2**.

7.4.1.2 Areas Newly Identified in Current Study

Project areas that were not previously identified by the 2035 Master Sewer Plan Update were identified by looking for clusters of unsewered areas within highly-ranking Concentrated Discharge Areas (CDA) loads, as identified in the hot spot Analysis in **Volumes 3**, **4**, and **5**. The areas that were newly identified were determined by utilizing the neighborhood shapefile and drawing polygons around clusters of septic tanks that were within 200 meters of a priority waterbody and within a high-ranked CDA. If these identified clusters were within a neighborhood, the entire neighborhood boundary was recommended for conversion. CDA septic loading information included the TN loading to both surface and ground waters in lb TN/year. It is noted that only the septic tanks that were within the 200-meter buffer produced TN loading to the associated surface waterbody and some septic sites may be recommended that fall outside of the 200-meter buffer. While these septic sites are proposed to be removed, they do not represent a water quality benefit to a surface waterbody. However, all septic tanks converted to sanitary represent a water quality benefit to the groundwater, namely Wakulla Springs.

Once the new project areas were drawn, the SPIL method was again used to determine the cost benefit of converting septic tanks to sanitary sewer systems. The only change in approach from the previously identified areas was the cost estimate. The change to step 5 is provided below.

5. The cost per connection was calculated by taking the average of the cost per connection (in 2023 dollars) from the previously identified project areas in **Section 7.4.1.1**. The average cost per connection was $24,525.

A summary table of the cost benefit of converting the newly identified areas can be found in **Exhibit 7-2**.

7.4.1.3 Prioritization Methodology

A total of 27 septic to sanitary target areas were identified and ranked. Thirteen were previously identified in the 2035 Master Sewer Plan Update and 14 were newly identified as part of this effort. Prioritization of the proposed septic to sanitary projects was completed by giving the most favorable cost benefit (lowest dollar amount) the highest rank (number 1) and the least favorable cost benefit (highest dollar amount) the lowest rank (number 27). The top ranked septic to sanitary target area had a total cost benefit of $1,425/lb TN and the lowest ranked project had a total cost benefit of $12,173/lb TN.

7.4.2 Prioritized Septic to Sanitary Target Areas

The top 10 septic to sanitary target areas based on the most favorable cost benefit can be found in **Exhibit 7-2** and include two areas that were previously identified in the 2035 Master Sewer Plan Update (COT, 2016) (Study Area 5: Lake Munson and Study Area 6: Woodville) and eight newly identified areas based on the criteria used in this effort. It is noted that Study Area 6: Woodville, did not have any septic tanks within 200 meters of a priority waterbody but would have a significant Wakulla Spring benefit, which is why it ranked so highly. Four of the five target areas that are within the high groundwater recharge area are ranked in the top 10.

The project cost for the top 10 septic to sanitary sewer projects range from approximately $340,000 to $49,000,000. The estimated cost to complete all 10 projects is approximately $96,000,000. The estimated nutrient removal benefit if all 10 projects are completed is approximately 60,000 lb TN at an average cost of $1,600/lb TN.

The 2005 Water and Sewer Interlocal Agreement (WSA) identifies target areas to be investigated by the City for septic to sanitary conversion and is the guiding document for septic to sanitary conversion within Leon County. The target areas identified as part of this study are supplemental to the WSA. Parts of Study Area 5 and Area 6 have been identified as target areas in subsequent Interlocal Agreements, NE Lake Munson (2021) and Woodville Rural (2020) respectively. It is noted that some of the areas identified are outside of the City limits, however they do still impact waterbodies that are within the City's jurisdiction.

7.5 Structural Practices

Structural BMPs include any physical structures used to mitigate the changes in stormwater caused by urban development. They are water structures or facilities that are intended to provide a flood control and/or a water quality benefit. Structural BMPs can be further organized into retention, detention, and filtration based practices depending on their primary treatment mechanism. Examples of these practices can include stormwater ponds, filters, baseflow treatment systems, infiltration basins, etc. The intent of this section is to identify potential water quality improvement projects for the City to implement to improve and protect the water quality of downstream waterbodies.

The City has traditionally relied on wet detention systems to provide regional flood control and stormwater treatment. Since much of the stormwater conveyance within the City uses man-made ditches, the City has hard armored several segments of ditch to reduce erosion and associated pollution. The City also operates three alum treatment facilities that provide regional stormwater treatment. The largest alum treatment facility is the Upper Lake Lafayette Nutrient Reduction Facility (ULL-NRF), which is designed to treat up to 200 cfs of stormwater runoff prior to reaching Lake Lafayette. However, the City understands that additional stormwater treatment approaches will be likely required to meet statewide standards and community expectations in the future.

Potential site identification was based on the hot spot analysis presented in **Volumes 3**, **4**, and **5**. Individual project sites were identified by locating empty or underutilized parcels within CDAs that had elevated nutrient load contributions and were located conveniently relative to stormwater conveyances. Appropriate stormwater treatment mechanisms and structural practice approaches were then identified for each site based on individual characteristics. A total of 26 structural BMP projects were identified, see **Exhibit 7-3**.

7.5.1 Structural Practice Approaches

A total of seven different types of structural BMPs were identified as appropriate for implementation within the City to help improve water quality of stormwater discharging into surface waterbodies. The types of structural BMPs identified include enhancing existing stormwater ponds with baffles and biosorption activated media (BAM) filtration, dredging stormwater ponds/surface waterbodies, reversion to wetland, channel hard armoring, NSBBs, regional passive baseflow treatment systems, and regional baseflow treatment systems, which are discussed further below.

7.5.1.1 Enhancement of Existing Stormwater Ponds with Baffles and BAM

Enhancement of existing stormwater facilities represents an opportunity to provide additional water quality benefit at a relatively low cost. Due to the fact that stormwater is already diverted and held at these facilities, and the City already owns the land, costs associated with land acquisition or diverting stormwater to the facility are not typically associated with these types of projects. Stormwater ponds can be enhanced in a number of ways to increase the water quality benefit, however for the purposes of this document it refers to adding baffles within the pond and implementation of filtration on the pond discharge.

Baffles, in the form of sheet pilings, earthen berms, or gabion baskets can be incorporated into an existing pond to control or divert water flow, improve flow conditions, eliminate short-circuiting, and increase residence time. By increasing the flow path length, the settling of particles is increased, and thus nutrient removal is increased. Additionally, the amount of time available for biological processes to occur is increased, resulting in further nutrient reductions. The nutrient removal potential of these systems is directly related to residence time for these kinds of treatment practices (Harper and Baker, 2007). It is noted that, for the purposes of estimating the water quality benefit of retrofitting a wet detention pond with baffles, the pond residence time was assumed to increase from 21 days to 35 days, which is based on the assumption that all City wet detention ponds are currently functioning with a 21-day residence time.

Filtration, using BAM, can be incorporated into an existing wet detention pond to provide additional pollutant removal. BAM refers to a class of filter media that promotes biofilm growth and leverages physical, chemical, and biological processes to remove nitrogen and phosphorus species (Geosyntec, 2023d). The type of BAM can be customized to fit the needs of the location ranging from a coarse material mix for higher flow capacity to a finer material mix for systems with more attenuation and longer duration lower flow conditions. The media type and filter size should be based on the expected flow rates and required hydraulic loading rate of the media.

Based on previous studies (Geosyntec, 2022; Geosyntec, 2023b), the typical cost benefit of adding baffles and incorporating a BAM filtration component to an existing wet detention pond is estimated to be approximately $2,000/lb TN and $19,000/lb TN. Of the 26 projects identified, 10 were pond enhancement projects. These include projects A, B, D, H, I, L, R, X, Y, and Z (**Exhibit 7-3**).

7.5.1.2 Stormwater Pond/Surface Waterbody Dredging

Over time, waterbodies can accumulate a layer of organic matter and sediment, commonly referred to as muck. Muck accumulation can lead to a range of water quality issues, including reduced oxygen levels, increased nutrient concentrations, and decreased water clarity. Sediments can enter waterbodies via upstream erosion, frequently caring nutrients and other pollutants. Dredging is an approach to remove these accumulated nutrient rich sediments that will restore the pond's depth and overall capacity. The removal of these nutrient rich sediments disrupt/retard the cycle of nutrient release to the water column, thereby improving the long-term sustainability and aesthetic appeal of the waterbody.

Dredging primarily addresses internal nutrient cycling and sediment buildup within the pond by removing accumulated muck. Dredging projects have historically resulted in sediment P flux reductions of about 60 percent and N flux reductions of about 10 percent (Riza et al., 2023). However, each waterbody is unique and historic reductions reported in other studies may not necessarily reflect the benefit for the ponds identified in this study. While some nutrient flux from sediments is normal, ponds and waterbodies with excess muck accumulation can have significantly increased nutrient fluxes from sediments. Accordingly, potential flux reductions achieved from dredging were estimated based on a recently completed study done for Shakey Pond in Tallahassee (Geosyntec, 2024). Based on this, the water quality benefit due to sediment dredging is estimated to result in an 87 percent reduction in N flux and a 50 percent reduction in P flux.

Based on the previous Shakey Pond study (Geosyntec, 2024), the typical cost benefit for a small waterbody is expected to be approximately $500/lb TN and $29,000/lb TP removed. It is noted that the presence of toxic contaminants in dredged material may significantly increase the cost of dredging and disposal. Additionally, for larger waterbodies it may be necessary to identify a Dredge Materials Management Area (DMMA) to decant the muck, which typically requires treatment of decanted water prior to discharge back to the waterbody, potentially resulting in significant additional costs. Of the 26 projects identified, a total of 1 was a dredging project, project E (**Exhibit 7-3**).

7.5.1.3 Wetland Reversion

A planted wetland (often referred to as a constructed or engineered wetland) can significantly improve water quality through the introduction of native vegetation which acts as a natural filter to remove contaminants, excess nutrients, and sediments from water. This eco-friendly solution not only enhances water clarity and quality, but also promotes biodiversity. Planted wetlands are typically designed to be shallow, with water depths ranging from a few inches to a few feet. Planted wetlands provide dual treatment of external and internal nutrient loads. For external loads, like stormwater runoff, planted wetlands slow the flow of incoming water, they act as a natural filter, and provide a long residence time compared to a traditional stormwater pond. For internal loads, planted wetlands utilize healthy microbial communities which break down organic matter and nutrients. They also create aerobic conditions in the sediment through the release of oxygen via photosynthesis. Finally, wetland vegetation can also absorb and assimilate nutrients from the sediments, as well as increase overall habitat quality and biodiversity.

Based on the previous Shakey Pond study (Geosyntec, 2024), the typical cost benefit is expected to be approximately $20/lb TN and $150/lb TP. Of the 26 projects identified, a total of 2 were repairing/reverting to a treatment wetland, projects C and U (**Exhibit 7-3**).

7.5.1.4 Channel Hard Armoring

Streambank erosion can occur due to increased development and impervious areas upstream causing larger volumes and increased velocities of runoff entering streams and thus eroding the soil and destabilizing the banks. Extreme weather can also destabilize stream banks by producing higher than usual velocities and volumes of runoff. The erosion that occurs in streams can contribute to sedimentation and degradation of water quality in downstream receiving waterbodies. Channel hard armoring helps stabilize stream banks and reduce future erosion by protecting the soil and minimizing soil and water interaction. Hard armoring reduces slope instability and prevents scouring from occurring, which may lead to damage of the surrounding structures and downstream water quality impacts.

The cost of hard armoring a channel with gabion baskets, per the City of Tallahassee, is $2,000 per linear foot. The estimated benefit is 0.075 lb TN/ft and 0.057 lb TP/ft, per Margenot et al.

(2023) and Wood (2018). Based on these assumptions, the estimated cost benefit for these types of projects is approximately $1,300/lb TN and $1,750/lb TP. While these cost benefits are not as favorable as other projects, it is worth noting that the benefit of reducing the sediment that is transported downstream to stormwater treatment facilities and surface waterbodies is significant due to high cost of sediment removal. Of the 26 projects identified, a total of 7 were channel hard armoring projects, projects F, G, O, P, S, T, and W (**Exhibit 7-3**).

7.5.1.5 Nutrient Separating Baffle Box

NSBBs consist of prefabricated concrete vaults with multiple chambers using flow deflectors to facilitate the settling of particulates with a metal mesh basket to remove large organic and inorganic debris. These practices are typically installed in line with traditional drainage systems as far downstream as possible to provide treatment to as much of the watershed as possible. NSBBs are typically serviced by vacuum trucks and can capture thousands of pounds of debris, sediment, and nutrients.

The cost benefit of installing and maintaining a NSBB is estimated to be $3,000/lb TN and $7,500/lb TP. This is based on a Port St. John study (Geosyntec (Draft), 2023c). Of the 26 projects identified, a total of 2 were NSBB projects, projects J and K (**Exhibit 7-3**).

7.5.1.6 Regional Passive Baseflow Treatment Systems

Regional passive baseflow treatment systems are different from traditional stormwater treatment systems in that the goal is to provide treatment to baseflow more so than directly treating stormwater. Baseflow, for the purposes of this master plan, is defined as channel flow which consists of shallow groundwater inflows and stormwater. These systems are located along flowing channels and divert water from the channel to a treatment system using a weir or some other diversion structure.

Based on previous studies (Geosyntec, 2022; Geosyntec, 2023e), the typical cost benefit of implementing a passive baseflow treatment system is estimated to be approximately $20/lb TN and $60/lb TP. Of the 26 projects identified, a total of 3 were regional passive baseflow treatment systems, projects M, N, and V (**Exhibit 7-3**).

7.5.1.7 Regional Baseflow Treatment Systems

Regional baseflow treatment systems are different from stormwater treatment systems in that they target baseflow for treatment, which are not dependent on rainfall for treatment to occur. Baseflow is essentially always available for treatment as long as flow is present in a channel. The water quality benefit is achieved by adding a small pump station to direct water from a flowing canal to the proposed treatment system, such as a pond with a wetland shelf filter. The pond provides nutrient removal as described above while the BAM shelf filter can provide additional removals via adsorption and biological processes. The amount of treatment depends on the flow conditions within the channel, i.e., the more flow the more treatment provided. These systems provide treatment to baseflow and some stormwater before it discharges back into the canal.

Based on previous studies (Geosyntec, 2022; Geosyntec 2023e), the typical cost benefit of implementing a regional baseflow treatment system is estimated to be approximately $10/lb TN and $40/lb TP. Of the 26 projects identified, a total of 1 was a regional baseflow treatment system, project Q (**Exhibit 7-3**).

7.5.2 Summary of Structural Practices

An outcome of this surface water quality master plan is to identify water quality improvement projects for the City to implement to help protect the water quality of their surface waterbodies. To this end, 26 potential projects were identified for the City to consider based on the hot spot analysis presented in **Volumes 3**, **4**, and **5**. These were made up on 10 pond enhancement projects, 1 dredging project, 2 treatment wetland projects, 7 channel hard armoring projects, 2 NSBB projects, 3 regional passive baseflow treatment systems, and 1 regional baseflow treatment system.

Of these, a total of 10 projects were identified for immediate consideration based on various decision variables discussed (**Table 7-2**). Four of these projects the City has already identified and performed an initial evaluation, namely a wetland reversion project, 2 channel hard armoring projects, and 1 pond enhancement. For these projects, a brief description is provided that describes the proposed project and the expected benefit. The remaining 6 are newly identified projects for the City to consider, which includes 3 pond enhancement projects, 2 regional passive baseflow treatment systems, and 1 regional baseflow treatment system. These are more fully described to include a detailed description of the proposed project, an estimation of the pollutant removal, permitting considerations, maintenance considerations, and a cost benefit analysis.

An additional 8 projects were identified for future priority consideration and include 2 pond enhancement projects, 1 dredging project, and 5 channel hard armoring projects.

The top structural water quality improvement projects were identified by Geosyntec and discussed with the City, see **Exhibit 7-3**. A total of 26 projects were identified with 7 in the Lake Jackson basin, 13 in the Lake Munson basin, and 6 in the Lake Lafayette basin. To determine which of the 26 projects should be prioritized as a top 10 project, they were assigned scores based on the following decision variables:

- A total of 4 points are assigned to the project if it is located within the City's jurisdiction and 4 points are subtracted if it is not.
- A total of 2 points are assigned to the project if the parcel of land that the project is on is owned by the City.
- A total of 2 points are assigned to the project if the project area is within 0.5 miles of Lake Lafayette, Lake Munson, or Lake Jackson.
- A total of 2 points are assigned to the project if the project would treat more than 75 percent of the CDA, and 1 point is assigned to the project if it treats 50-75 percent of the CDA.
- A total of 2 points are assigned to the project if it is within the top 25 percent in terms of TN loading to the project area, and 1 point is assigned to the project if it is within the top 50 percent in terms of TN loading to the project area.

- A total of 2 points are assigned to the project if it is within the top 25 percent in terms of TP loading to the project area, and 1 point is assigned to the project if it is within the top 50 percent in terms of TP loading to the project area.
- A total of 1 point is assigned to the project if the next downstream waterbody is impaired.
- A total of 1 point is subtracted from the project if the project is immediately upstream of a regional treatment facility.
- A total of 1 point is subtracted from the project if the project requires mechanical systems operation.
- A total of 3 points is subtracted from the project if the project offers only trash removal and total of 1 point is subtracted from the project if the project offers only erosion control.
- A total of 2 points is assigned to the project if preliminary project planning is already complete.

Table 7-2: Decision Matrix for Determining the Top 10 Priority Projects

Decision Variable	Projects (A-Z)																									
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Within COT Jurisdiction	4	-4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	-4	-4	4	-4	4	-4
Land Ownership	2	0	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	0	0	2	0	2	0
Proximity to Study Waterbody	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0
Percent of CDA Area Treated	0	2	2	0	0	0	0	0	0	0	0	0	1	2	0	0	2	0	0	0	2	2	2	0	0	0
TN Loading to Waterbody	0	2	1	0	0	0	0	2	2	1	1	0	2	2	0	0	2	1	0	0	1	1	0	0	0	1
TP Loading to Waterbody	0	2	1	0	0	0	0	2	1	0	0	0	2	2	0	1	2	1	1	0	1	2	0	0	0	0
Next Downstream Waterbody is Impaired	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Immediately Upstream of Regional Treatment Facility	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1	0	0	0
Requires Mechanical System Operation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-4	0	0	0	0	0	0	0	0	0
Limited Nutrient Removal	0	0	0	0	0	-1	-1	0	0	-3	-3	0	0	0	-1	-1	0	0	-1	-1	0	0	-1	0	0	0
Preliminary Project Planning Complete	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0

7.6 Top Project Concepts

The top 10 structural practices are subdivided into top projects currently being pursued by the City and top projects for the City to consider next. The projects that the City is currently pursuing are briefly described and the expected benefit is reported when available. The projects the City should consider for further evaluation are described more fully to include the proposed water quality improvement concept and location, pollutant reduction evaluation, maintenance considerations, permitting considerations, and a cost benefit analysis.

7.6.1 Projects Currently Underway

The following projects the City has already undertaken initial planning and evaluation efforts. A total of four projects were identified.

7.6.1.1 Project C, Wetland Reversion

This project is a wetland reversion project located in Shakey Pond, see **Exhibit 7-3**. It is a shallow, 14-acre pond located north of Interstate 10, bounded by Charleston Road, Gardenview Way, and AJ Henry Park Drive. Originally, Shakey Pond was a marsh-stream system that was dammed up and had a control structure added to it in the 1980s to turn it into a lake. Sometime in 2016 the control structure failed and drained most of the ponds permanent pool volume and leaving it about 2 feet deep. In 2022 FDEP added Shakey Pond to the verified impaired list for nutrients. A recently completed study of Shakey Pond performed by Geosyntec in 2024 evaluated different water quality improvement alternatives and identified a wetland reversion as the most cost-effective solution. Based on the analysis performed, this project had a very favorable cost benefit of $20/lb TN and $173/lb TP. Currently the City is moving forward with the next stages of this project.

7.6.1.2 Project Y, Pond Enhancement

Project Y is the Market District Multi-Purpose Stormwater Project, which is located northeast of the Interstate 10 and Thomasville Road intersection, east of Forest Lair, see **Exhibit 7-3**. This concept includes the existing pond to the west of the electric substation and the pond to east on the northeast corner of Maclay Boulevard South and Maclay Commerce Drive. Currently, the western pond is being considered for stormwater harvesting. The eastern pond is a target for future water quality improvements, potentially expansion of part of the existing pond and addition of a constructed wetland, and/or incorporation of BAM. The east pond concept has yet to be designed and will be coordinated with the Blueprint Market District placemaking project, which has undergone preliminary project planning. Based on the current stage of this project, no cost estimate is available so no cost benefit can be presented.

7.6.1.3 Project F, Erosion Control Project

Project F is Blueprint’s Orange-Meridian Placemaking Project. This project is an erosion control project, specifically ditch lining, located in a stream north of Orange Avenue, between Wahnish Way and Brighton Road, see **Exhibit 7-3**. This section of the stream is approximately 5,000 ft long. To stabilize the banks of the stream, it is proposed to hard armor the stream with gabion baskets. Improvements to a portion of this segment are part of the Blueprint Orange-Meridian placemaking project, which has undergone preliminary project planning. The current project represents a partial stream improvement based on the recommendations in this master plan and it is recommended that the area be reassessed after the project is complete to determine if the full, longer section should be hard armored. Based on the current stage of this project, no cost estimate is available so no cost benefit can be presented.

7.6.1.4 Project S, Erosion Control Project

Project S is an erosion control project located in a stream located northwest of Springhill Road and Autumn Lane. The section begins at Munson Slough north of Autumn Road and continues northeast towards West Orange Avenue, see **Exhibit 7-3**. This section of the stream is approximately 2,900 ft long. To stabilize the banks of the stream, it is proposed to hard armor the stream with gabion baskets. Similar improvements are part of Blueprint's Capital Cascade Trail Segment 4 project. Based on the current stage of this project, no cost estimate is available so no cost benefit can be presented.

7.6.2 Projects for Immediate Consideration

The following six projects were identified to be for immediate consideration and the City should consider proceeding to further evaluation and design stages. Typically, cost benefit calculations are based on construction costs and maintenance that occurs over a 20-year period. Therefore, the pollutant removal was calculated over a 20-year period for each project.

7.6.2.1 Project N, Regional Passive Baseflow Treatment System

Project N is a regional passive baseflow treatment system. The project is intended to be located between Wahnish Way and South Adams Street, either north or south of West Orange Avenue. It is noted that both potential locations are located on Florida A&M University campus and would require coordination with the University, see **Figure 7-1**.

7.6.2.1.1 Water Quality Improvement Concept

The water quality improvement concept for Project N is a regional passive baseflow treatment system, as described in **Section 7.5.1.6** above. Since these systems are not dependent on rainfall for treatment to occur, providing more continuous treatment of smaller flows can represent a more significant water quality benefit than targeting stormwater directly. The specific concept is to install a weir to reroute water from the canal to a wet detention pond that has a BAM enhanced wetland shelf filter. The wet detention pond provides nutrient removal relative to the provided residence time. The BAM wetland shelf filter removes nutrients through filtration, adsorption, biological uptake, nitrification, and denitrification. This would provide treatment to baseflow and some stormwater before it discharges back into the canal. To further improve the water quality in this system, a small pump could be installed instead of the weir so that the water could be treated more continuously which would result in removal of more nutrients and significantly improving the cost benefit.

7.6.2.1.2 Pollutant Reduction Evaluation

The estimated loading that enters the proposed project area annually is approximately 20,000 lb TN and 1,500 lb TP. Regional passive baseflow treatment systems like that described above are expected to remove up to 42 percent of TN and 74 percent of TP (Geosyntec, 2022; Geosyntec, 2023d), resulting in up to 90,000 lb TN and 15,000 lb TP removed over 20 years. See **Table 7-3** for a breakdown of the removals and costs.

7.6.2.1.3 Maintenance Considerations

Maintenance for regional passive baseflow treatment systems is similar to that required for a traditional wet detention pond, including to mow the pond berm, to remove debris, litter, or sediment accumulation occurring at or near the diversion weir and/or pond control structure. Additional maintenance needs include checking that water is still flowing through the BAM wetland shelf filter, removal of any invasive or exotic vegetation, and replacement of damaged, dead, or dying vegetation. The vegetation management aspect of the maintenance activities is expected to be more involved for newly planted systems than those that are more mature and established. It is noted that accumulation of debris is often associated with larger storm events, as large storm events tend to wash more debris from the watershed and with higher flows have the potential to carry debris further downstream.

7.6.2.1.4 Permitting Considerations

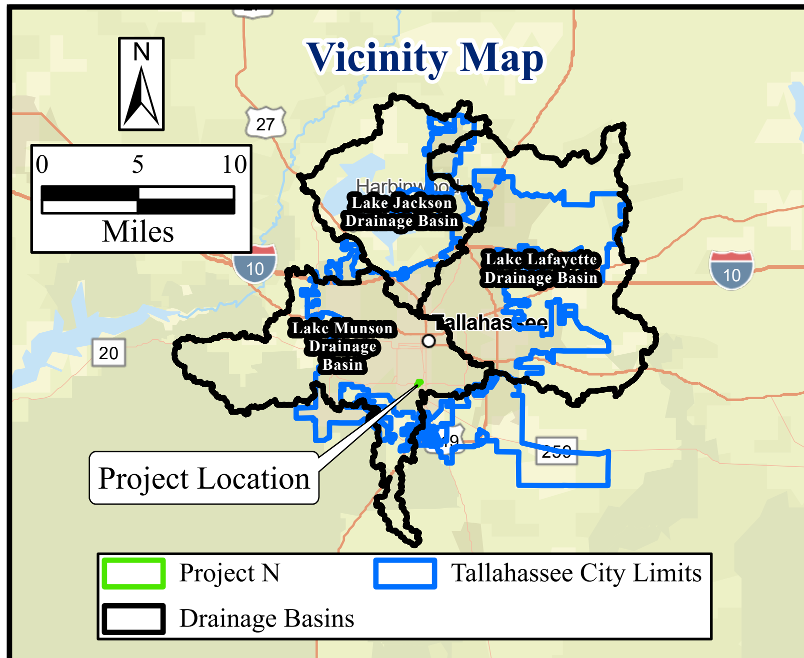
It is expected that an Environmental Resource Permit (ERP) from NWFWMD will be required. For a project to quality for an ERP, it must demonstrate that the proposed project will not result in upstream flooding or increases in peak stage, will not result in increases in peak discharge rates from the site, and will meet water quality treatment requirements.

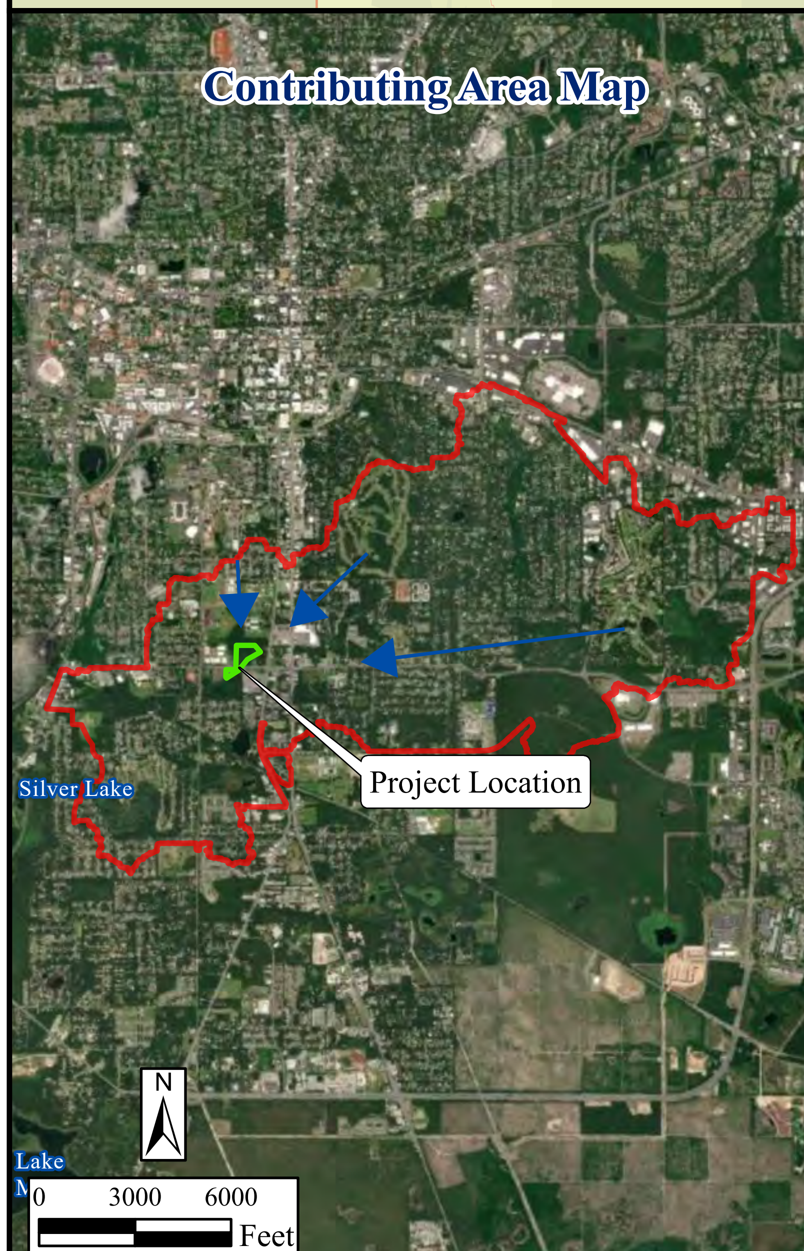
7.6.2.1.5 Cost Benefit Analysis

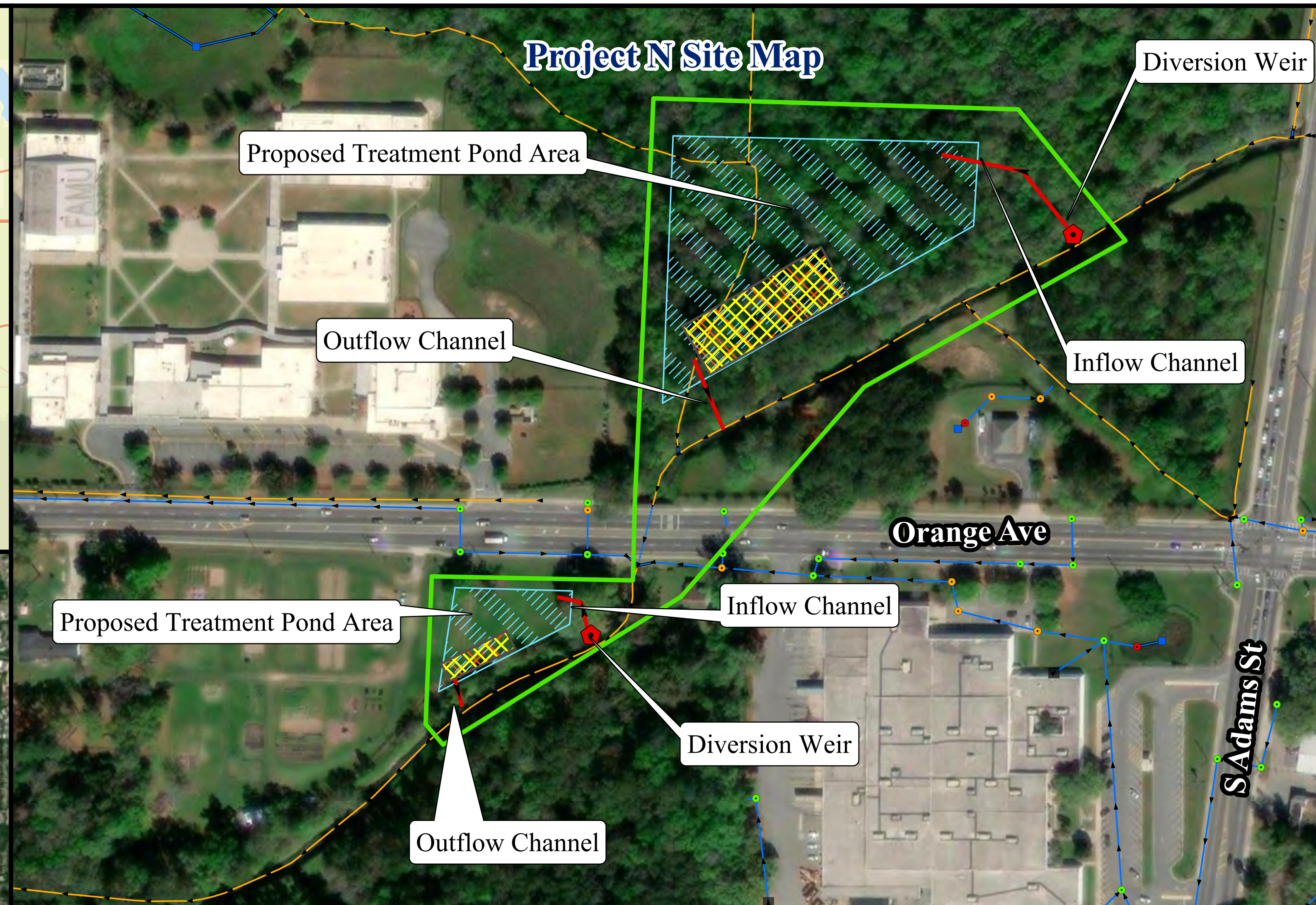
A typical cost of implementing a regional passive baseflow treatment system is approximately $3,000,000. Based on the anticipated water quality benefit over an assumed 20-year project life, the cost benefit for TN and TP is approximately $30/lb removed and $200/lb removed, respectively (**Table 7-3**).

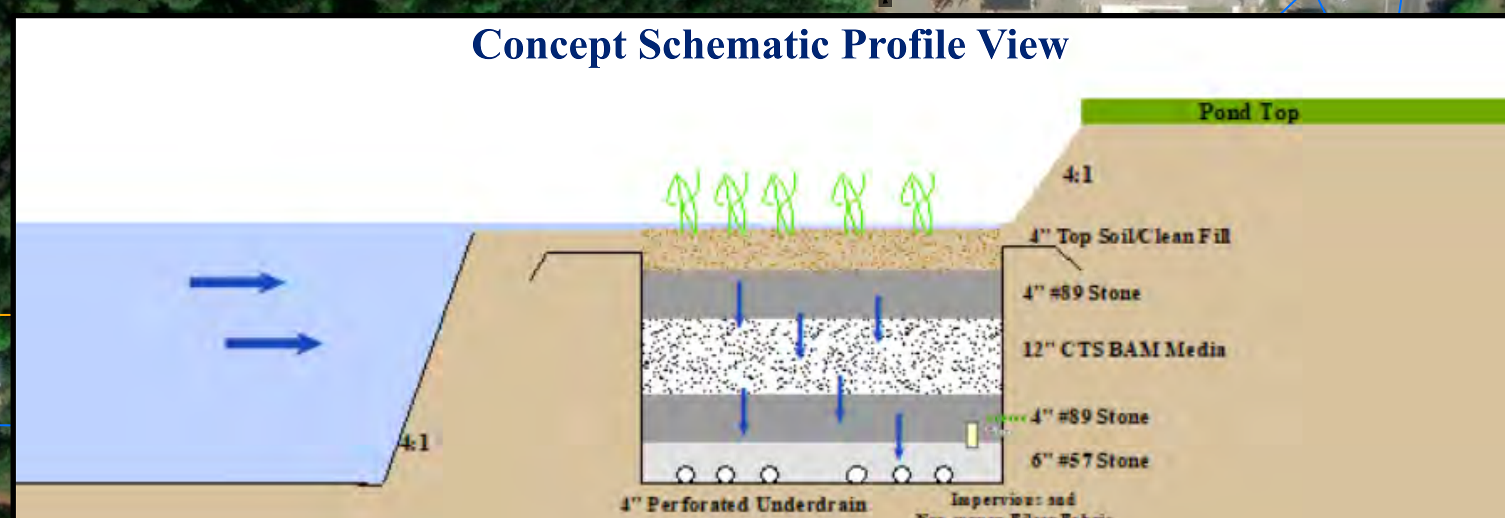
Table 7-3: Project N Regional Passive Baseflow Treatment System Cost Benefit

Parameter	Pollutant Removed (lb/20 yr)	Estimated Project Cost ($)	Cost Benefit ($/lb)
TN	90,000	$3,000,000	$30
TP	15,000		$200









Project Letter	Improvement Type	Parameter	Existing Condition Loading (lb/20 yr)	Proposed Loading (lb/20 yr)	Pollutant Removed (lb/20 yr)	Cost Benefit ($/lb)
Project N	Baseflow Treatment System	TN	220,000	130,000	90,000	$30
		TP	20,000	5,000	15,000	$200

Note: Cost benefit was calculated based on previous studies (Geosyntec, 2022; Geosyntec 2023b).

CITY OF TALLAHASSEE

N

0 250

Feet

Legend

- Project N
- CDA
- Upflow Filter
- Pipe
- Channel
- Inlet
- Junction
- General Flow Pattern

Sources
County Boundary: COT, 2022
Infrastructure: COT, 2022
Streets: COT, 2022

Figure 7-1:
Project N - Regional Passive Baseflow Treatment System

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

7.6.2.2 Project M, Regional Passive Baseflow Treatment System

Project M is a regional passive baseflow treatment system. The project is intended to be located just east of Mabry Street, south of Roberts Avenue. Munson Slough is the stream that would be directly connected to this regional passive baseflow treatment system, see **Figure 7-2.**

7.6.2.2.1 Water Quality Improvement Concept

The water quality improvement concept for Project M is a regional passive baseflow treatment system, as described in **Section 7.5.1.6** above. Since these systems are not dependent on rainfall for treatment to occur, providing more continuous treatment of smaller flows can represent a more significant water quality benefit than targeting stormwater directly. The specific concept is to install a weir to reroute water from the canal to a wet detention pond that has a BAM enhanced wetland shelf filter. The wet detention pond provides nutrient removal relative to the provided residence time. The BAM wetland shelf filter removes nutrients through filtration, adsorption, biological uptake, nitrification, and denitrification. This would provide treatment to baseflow and some stormwater before it discharges back into the canal. To further improve the water quality in this system, a small pump could be installed instead of the weir so that the water could be treated more continuously which would result in removal of more nutrients and significantly improving the cost benefit.

7.6.2.2.2 Pollutant Reduction Evaluation

The estimated loading that enters the proposed project area annually is approximately 15,000 lb TN and 1,000 lb TP. Regional passive baseflow treatment systems like that described above are expected to remove up to 42 percent of TN and 74 percent of TP (Geosyntec, 2022; Geosyntec, 2023d), resulting in up to 70,000 lb TN and 12,000 lb TP removed over 20 years. See **Table 7-4** for a breakdown of the removals and costs.

7.6.2.2.3 Maintenance Considerations

Maintenance for regional passive baseflow treatment systems is similar to that required for a traditional wet detention pond, including to mow the pond berm, to remove debris, litter, or sediment accumulation occurring at or near the diversion weir or pond control structure. Additional maintenance needs include checking that water is still flowing through the BAM wetland shelf filter, removal of any invasive or exotic vegetation, and replacement of damaged, dead, or dying vegetation. The vegetation management aspect of the maintenance activities is expected to be more involved for newly planted systems than those that are more mature and established. It is noted that accumulation of debris is often associated with larger storm events, as large storm events tend to wash more debris from the watershed and with higher flows have the potential to carry debris further downstream.

7.6.2.2.4 Permitting Considerations

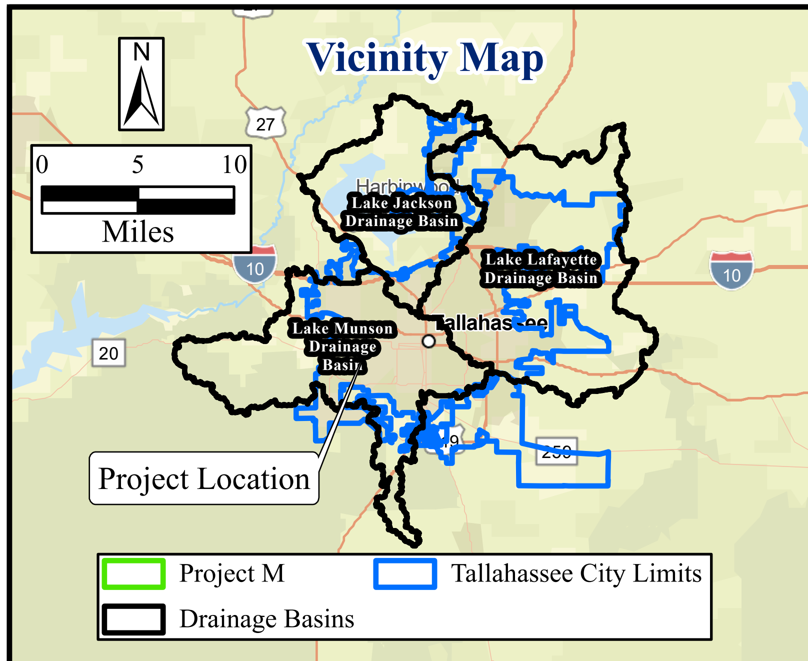
It is anticipated that an ERP from NWFWMD will be required. For a project to quality for an ERP, it must demonstrate that the proposed project will not result in upstream flooding or increases in peak stage, will not result in increases in peak discharge rates from the site, and will meet water quality treatment requirements.

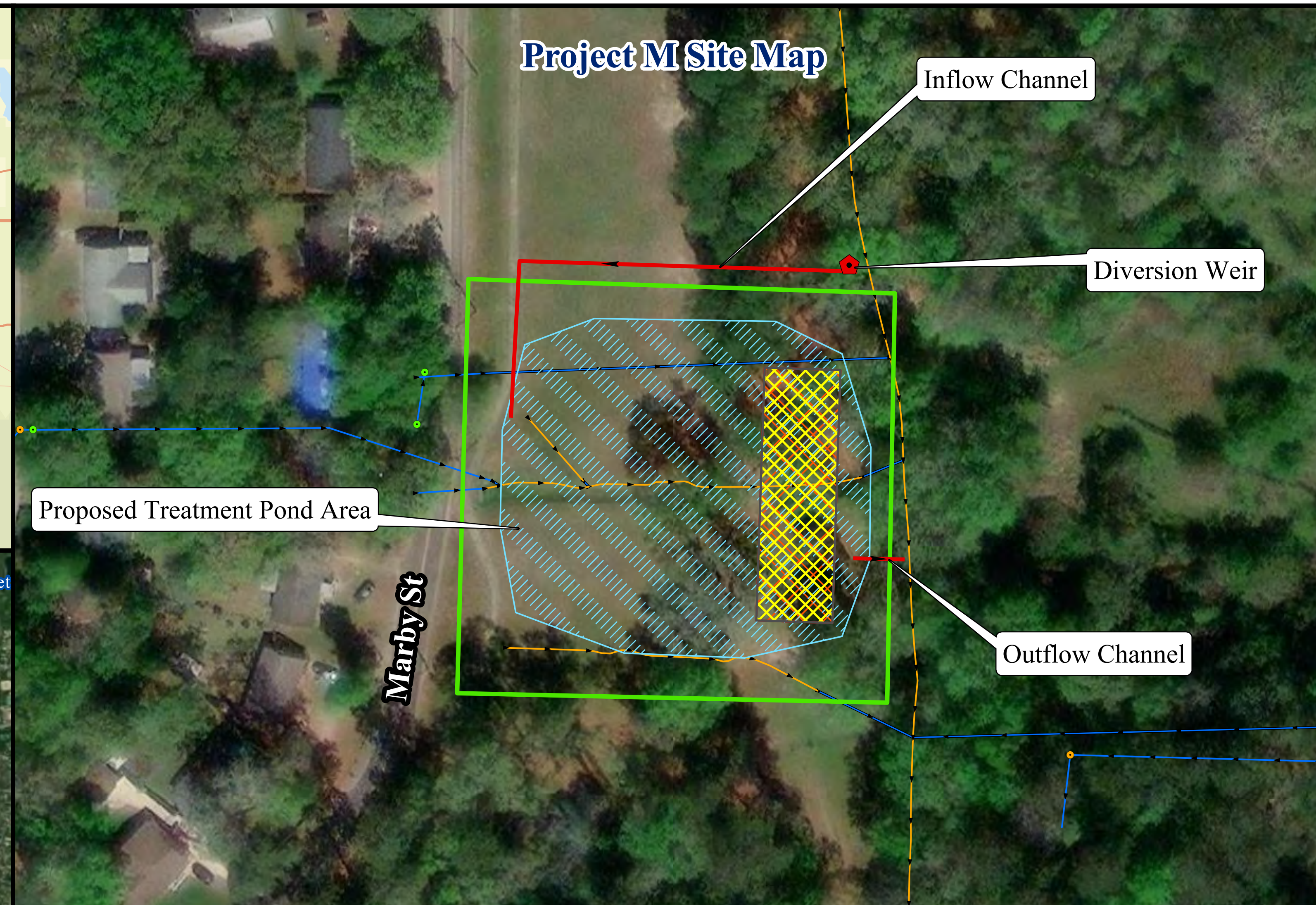
7.6.2.2.5 Cost Benefit Analysis

A typical cost of implementing a regional passive baseflow treatment system is approximately $3,000,000. Based on the anticipated water quality benefit over an assumed 20-year project life, the cost benefit for TN and TP is approximately $45/lb removed and $250/lb removed, respectively (**Table 7-4**).

Table 7-4: Project M Regional Passive Baseflow Treatment System Cost Benefit

Parameter	Pollutant Removed (lb/20 yr)	Estimated Project Cost ($)	Cost Benefit ($/lb)
TN	70,000	$3,000,000	$45
TP	12,000		$250





CITY OF TALLAHASSEE

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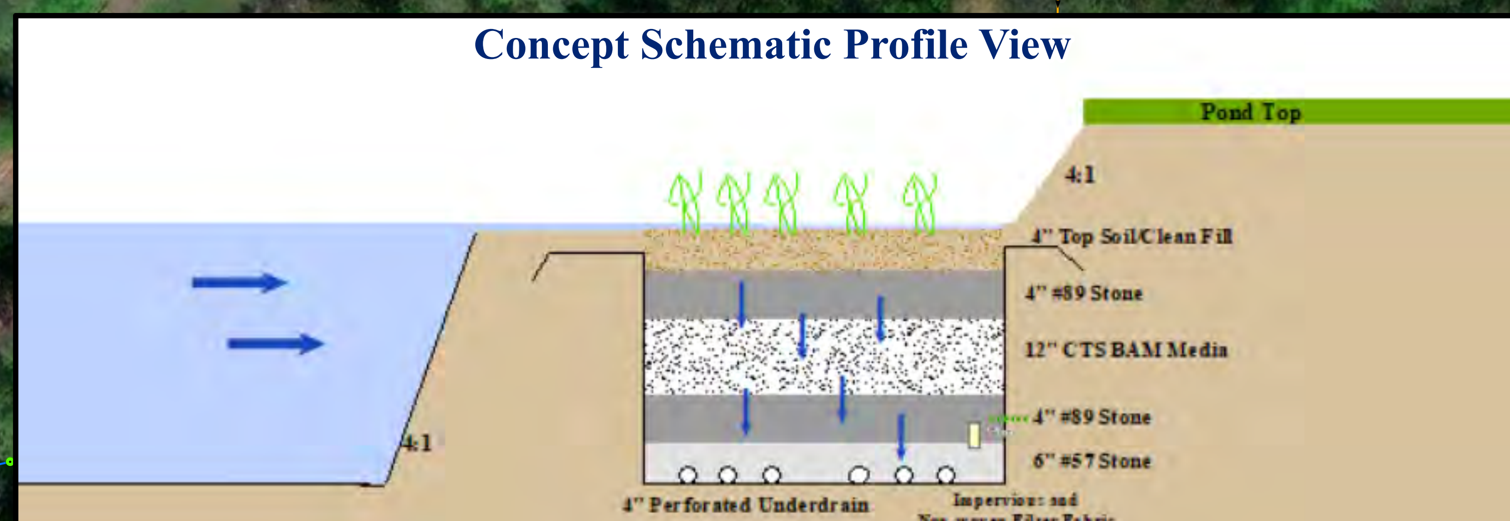
Feet

Legend

- Project M
- CDA
- Upflow Filter
- Pipe
- Channel
- Inlet
- Junction
- General Flow Pattern



Project Letter	Improvement Type	Parameter	Existing Condition Loading (lb/20 yr)	Proposed Loading (lb/20 yr)	Pollutant Removed (lb/20 yr)	Cost Benefit ($/lb)
Project M	Baseflow Treatment System	TN	170,000	100,000	70,000	$45
		TP	15,000	4,000	12,000	$250

Note: Cost benefit was calculated based on previous studies (Geosyntec, 2022; Geosyntec 2023b).

Sources
County Boundary: COT, 2022
Infrastructure: COT, 2022
Streets: COT, 2022

Figure 7-2:
Project M - Regional Passive Baseflow Treatment System

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

7.6.2.3 Project H, Pond Enhancement

Project H is a pond enhancement for a regional wet detention pond, namely Lake Elberta, which is located east of the intersection of Eppes Drive East and Lake Bradford Road, see **Figure 7-3**.

7.6.2.3.1 Water Quality Improvement Concept

Lake Elberta was constructed as a regional stormwater treatment facility in 1998 that was identified for a water quality enhancement in a manner similar to that described in **Section 7.5.1.1** to increase the water quality benefit of the BMP. Specifically, the recommended enhancements are to retrofit the pond by increasing pond capacity by dredging accumulated sediments, adding baffles to increase the flow path length of water, and adding filtration on the discharge side of the pond to increase removal of dissolved nutrients. By increasing pond capacity, the residence time is assumed to increase from 21 days to 35 days. It is assumed that this pond was designed to have a 21-day residence time. Baffles, in the form of sheet pilings, earthen berms, or gabion baskets, can be incorporated to control or divert water flow, improve flow conditions, eliminate short-circuiting, and increase residence time. By increasing the flow path length, the particles settled and thus nutrients removed are increased. Additionally, the amount of time available for biological processes to occur is increased, resulting in further water quality benefit. The nutrient removal potential is directly related to residence time for these kinds of treatment practices.

Incorporation of BAM filtration is also recommended in the form of retrofitting a BAM filter at the downstream end of Lake Elberta. BAM refers to a class of filter media that promotes biofilm growth and leverages physical, chemical, and biological processes to remove nitrogen and phosphorus species.

7.6.2.3.2 Pollutant Reduction Evaluation

The estimated loading that enters the proposed project area annually is approximately 10,000 lb TN and 1,000 lb TP. Pond expansion and the incorporation of baffles is expected to remove an additional 3 percent of TN loading and 4 percent of TP loading based on the methods presented in Harper and Baker, 2007. The incorporation of BAM is expected to remove an additional 15 percent of TN loading and 15 percent of TP loading (BMPTrains, 2021). This results in up to 20,000 lb TN and 2,000 lb TP removed over 20 years. See **Table 7-5** for a breakdown of the removals and costs.

7.6.2.3.3 Maintenance Considerations

The expected maintenance of the proposed system is typical of wet detention ponds, including to mow the pond berm, to remove debris, litter, or sediment accumulation occurring at or near the significant pond inflow points or pond control structure. The side banks should be inspected for evidence of erosion or undercutting, and to ensure that vegetation is healthy and maintaining coverage. An additional maintenance need includes checking that water is still flowing through the BAM filter, which should be performed annually.

7.6.2.3.4 Permitting Considerations

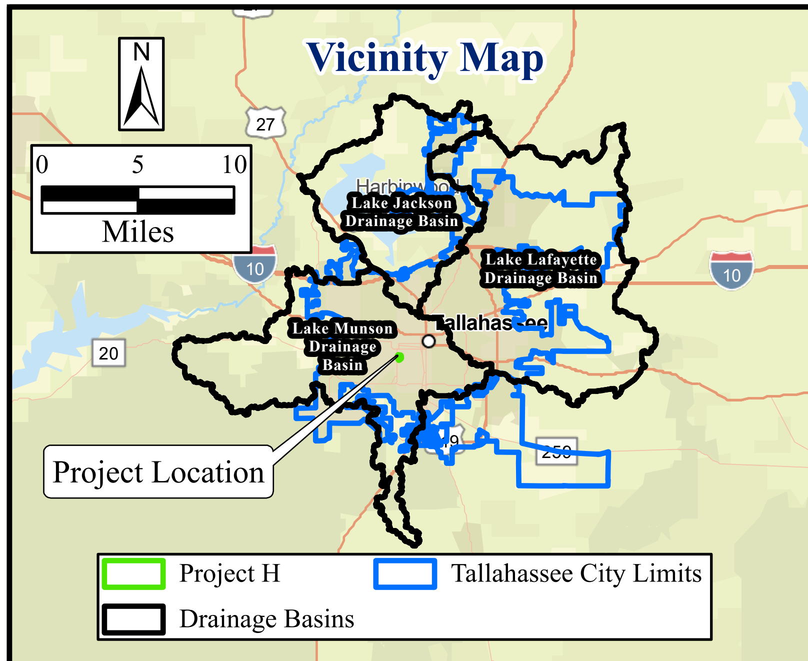
It is anticipated that an ERP modification from NWFWMD will be required. For a project to quality for an ERP modification, it must demonstrate that the proposed project will not result in upstream flooding or increases in peak stage, will not result in increases in peak discharge rates from the site, and will meet water quality treatment requirements.

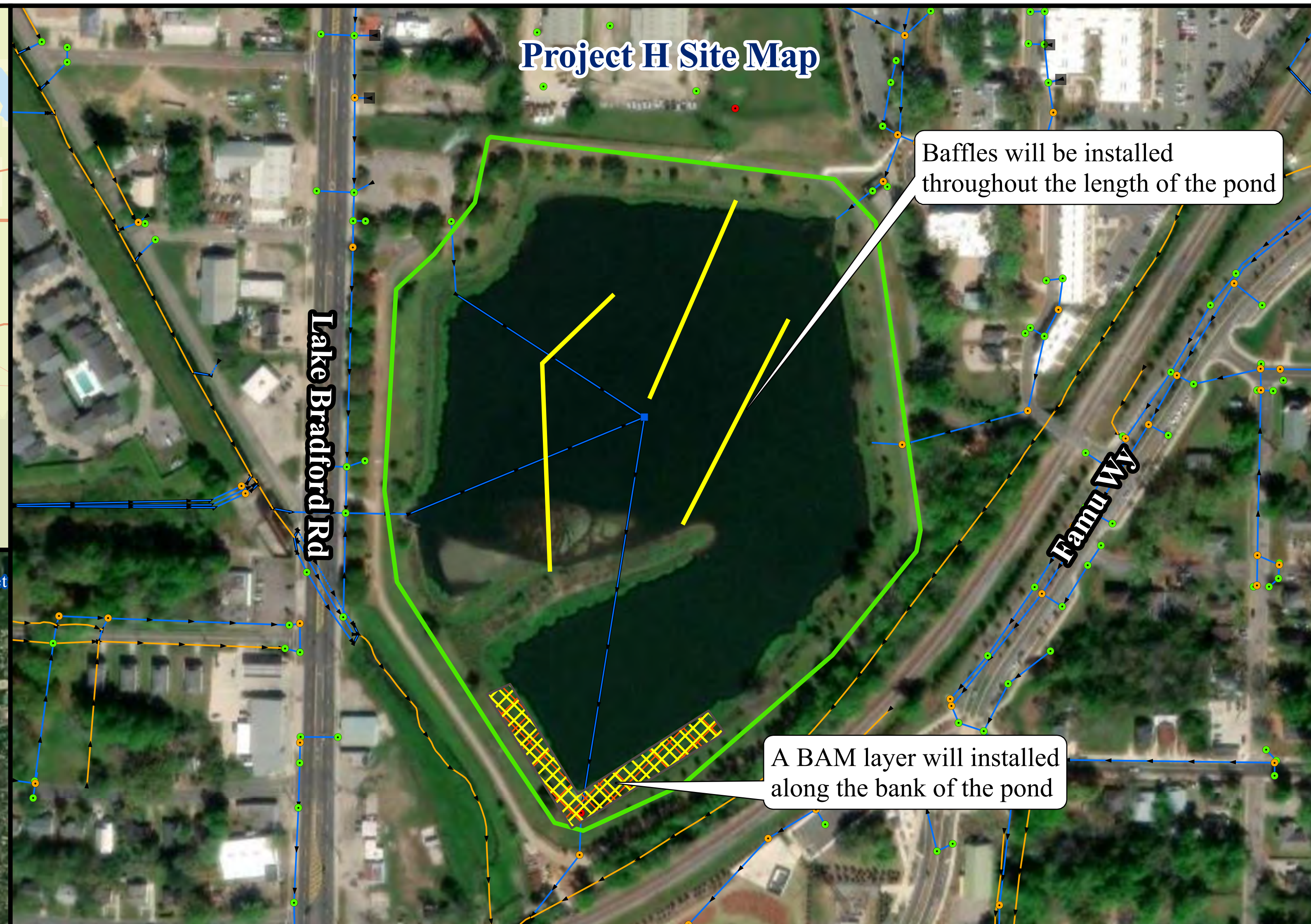
7.6.2.3.5 Cost Benefit Analysis

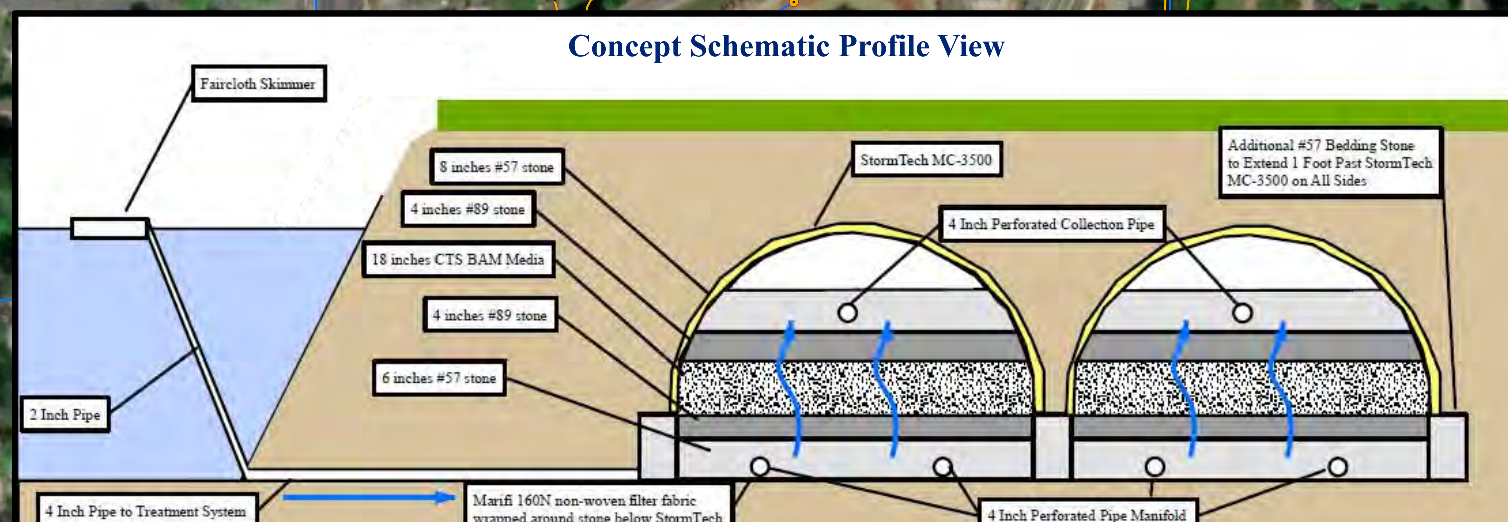
A typical cost of implementing pond enhancements as described is approximately $6,000,000. Based on the anticipated water quality benefit over an assumed 20-year project life, the cost benefit for TN and TP is approximately $300/lb removed and $3,000/lb removed, respectively (**Table 7-5**).

Table 7-5: Project H Pond Enhancement Cost Benefit

Parameter	Pollutant Removed (lb/20 yr)	Estimated Project Cost ($)	Cost Benefit ($/lb)
TN	20,000	$6,000,000	$300
TP	2,000		$3,000







Project Letter	Improvement Type	Parameter	Existing Condition Loading (lb/20 yr)	Proposed Loading (lb/20 yr)	Pollutant Removed (lb/20 yr)	Cost Benefit ($/lb)
Project H	Pond Enhancement	TN	120,000	10,000	20,000	$300
		TP	10,000	8,000	2,000	$3,000

Note: Cost benefit was calculated based on previous studies (Harper and Baker, 2007; BMPTrains, 2021).

CITY OF TALLAHASSEE

N

0 300

Feet

Legend

- CDA
- Project H
- Upflow Filter
- Pipe
- Channel
- Inlet
- Junction
- General Flow Pattern

Sources
County Boundary: COT, 2022
Infrastructure: COT, 2022
Streets: COT, 2022

Figure 7-3:
Project H - Pond Enhancement

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

7.6.2.4 Project I, Pond Enhancement

Project I is a pond enhancement for an existing wet detention pond located between Mayhew Street, Eppes Drive, and Pepper Drive, see **Figure 7-4**.

7.6.2.4.1 Water Quality Improvement Concept

An existing wet detention pond was identified to enhance the water quality treatment provided. The proposed enhancements include potential expansion of the pond into the empty parcels to the south, adding baffles to increase the flow path length and adding filtration on the discharge end of the pond, as described in **Section 7.5.1.1**. Baffles, in the form of gabion baskets are recommended since they are cheaper than other options and additional pond volume is proposed which would more than offset the volume occupied by the baffles. Pond baffles control or divert water flow, improve flow conditions, and increase residence time. By increasing the flow path length, the amount of particles settled, and thus nutrients removed, are increased. Additionally, the amount of time available for biological processes to occur is increased resulting in further water quality benefit.

Additionally, the incorporation of BAM filter is proposed on the discharge end of the pond. BAM refers to a class of filter media that promotes biofilm growth and leverages physical, chemical, and biological processes to remove nitrogen and phosphorus species.

7.6.2.4.2 Pollutant Reduction Evaluation

The estimated loading that enters the proposed project area annually is approximately 2,000 lb TN and 200 lb TP. Pond expansion and the incorporation of baffles is expected to remove an additional 3 percent of TN loading and 4 percent of TP loading based on the methods presented in Harper and Baker, 2007. The incorporation of BAM is expected to remove an additional 15 percent of TN loading and 15 percent of TP loading (BMPTrains, 2021). This results in up to 5,000 lb TN and 500 lb TP removed over 20 years. See **Table 7-6** for a breakdown of the removals and costs.

7.6.2.4.3 Maintenance Considerations

The expected maintenance of the proposed system is typical of wet detention ponds, including to mow the pond berm, to remove debris, litter, or sediment accumulation occurring at or near the significant pond inflow points or pond control structure. The side banks should be inspected for evidence of erosion or undercutting, and to ensure that vegetation is healthy and maintaining coverage. An additional maintenance need includes checking that water is still flowing through the BAM filter, which should be performed annually.

7.6.2.4.4 Permitting Considerations

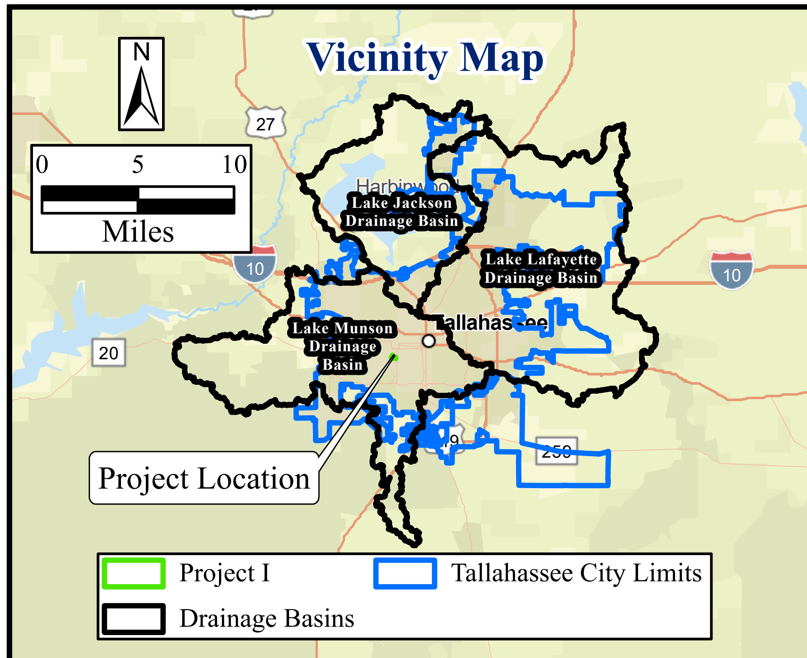
It is anticipated that an ERP modification from NWFWMD will be required. For a project to quality for an ERP modification, it must demonstrate that the proposed project will not result in upstream flooding or increases in peak stage, will not result in increases in peak discharge rates from the site, and will meet water quality treatment requirements.

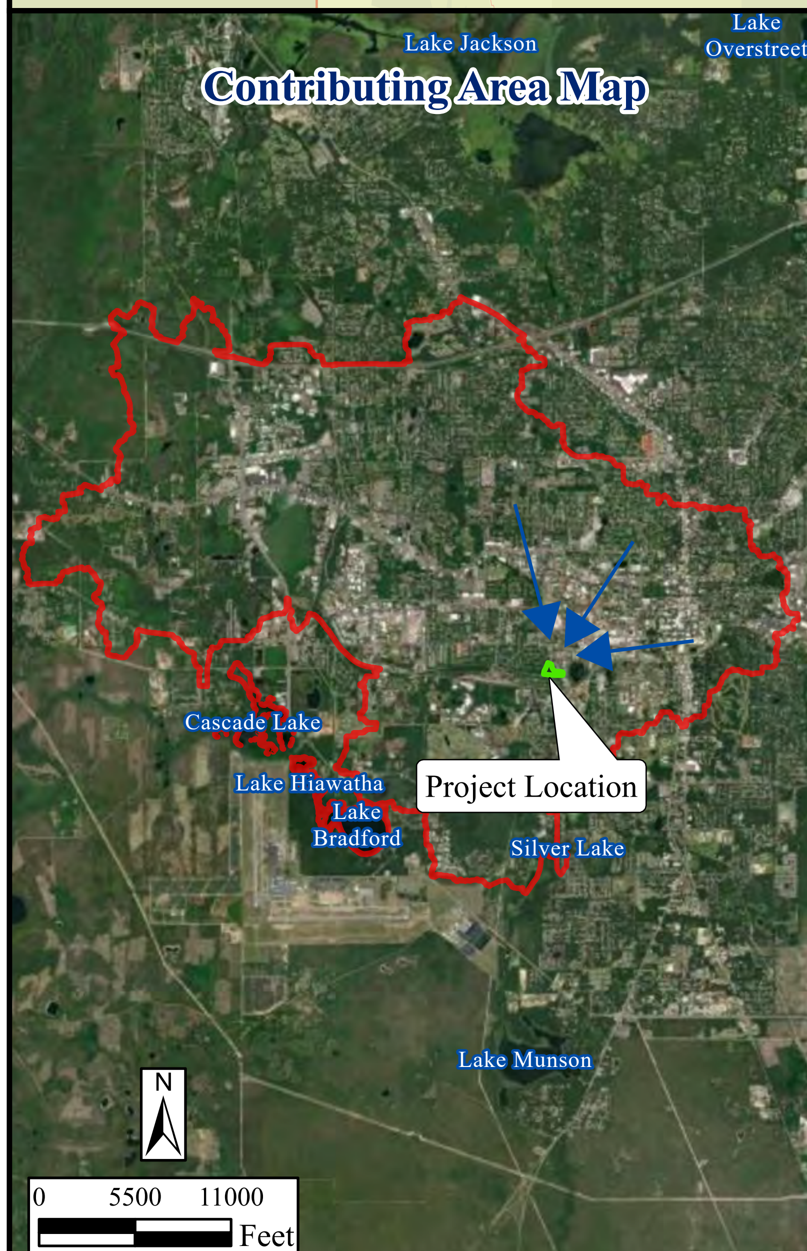
7.6.2.4.5 Cost Benefit Analysis

The cost of implementing a enhancing a pond by expansion, baffles, and BAM incorporation is $3,000,000. Based on the anticipated water quality benefit over an assumed 20-year project life, the cost benefit for TN and TP is approximately $600/lb removed and $6,000/lb removed, respectively (**Table 7-6**).

Table 7-6: Project I Pond Enhancement Cost Benefit

Parameter	Pollutant Removed (lb/20 yr)	Estimated Project Cost ($)	Cost Benefit ($/lb)
TN	5,000	$3,000,000	$600
TP	500		$6,000





CITY OF TALLAHASSEE

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- Project I
- CDA
- Upflow Filter
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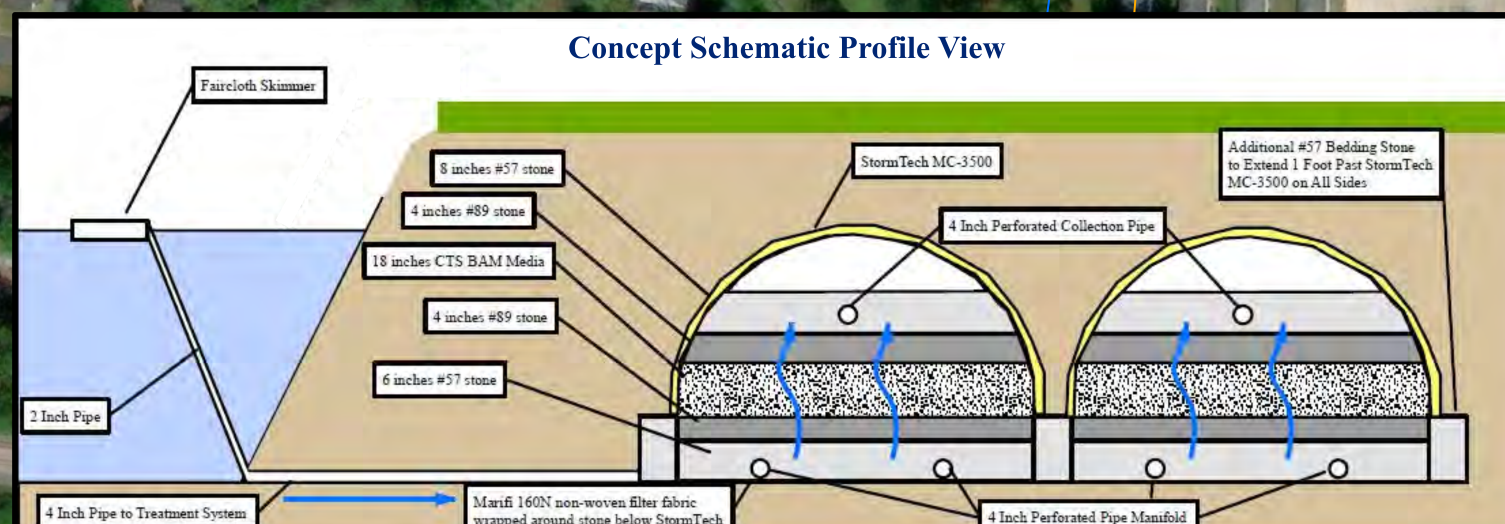
- Channel
- Inlet
- Junction
- General Flow Pattern



Project Letter	Improvement Type	Parameter	Existing Condition Loading (lb/20 yr)	Proposed Loading (lb/20 yr)	Pollutant Removed (lb/20 yr)	Cost Benefit ($/lb)
Project I	Pond Enhancement	TN	30,000	25,000	5,000	$600
		TP	3,000	2,000	500	$6,000

Note: Cost benefit was calculated based on previous studies (Geosyntec, 2022; Geosyntec 2023b).

Sources
County Boundary: COT, 2022
Infrastructure: COT, 2022
Streets: COT, 2022

Figure 7-4:
Project I - Pond Enhancement

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

7.6.2.5 Project Q, Regional Baseflow Treatment System

Project Q is a regional baseflow treatment system proposed to be located south of Bragg Drive and east of the Jake Gaither Municipal Golf Course, see **Figure 7-5**.

7.6.2.5.1 Water Quality Improvement Concept

The water quality improvement concept for Project Q is a regional baseflow treatment system, as described in **Section 7.5.1.7** above. Since these systems are not dependent on rainfall for treatment to occur, providing more continuous treatment of smaller flows using a pump can represent a more significant water quality benefit than targeting stormwater directly. The specific concept is to install a small pump station to continuously pump water from the canal to a wet detention pond that has a BAM enhanced wetland shelf filter. The wet detention pond provides nutrient removal relative to the provided residence time. The BAM wetland shelf filter removes nutrients through filtration, adsorption, biological uptake, nitrification, and denitrification. This would provide treatment to baseflow and some stormwater before it discharges back into the canal.

7.6.2.5.2 Pollutant Reduction Evaluation

The estimated loading that enters the proposed project area annually is approximately 19,000 lb TN and 2,000 lb TP. Regional passive baseflow treatment systems like that described above are expected to remove up to 42 percent of TN and 74 percent of TP (Geosyntec, 2022; Geosyntec, 2023d), resulting in up to 100,000 lb TN and 16,000 lb TP removed over 20 years. See **Table 7-7** for a breakdown of the removals and costs.

7.6.2.5.3 Maintenance Considerations

Maintenance for regional baseflow treatment systems is similar to that required for a traditional wet detention pond, including to mow the pond berm, to remove debris, litter, or sediment accumulation occurring at or near the diversion weir or pond control structure. Additional maintenance needs include checking that water is still flowing through the BAM wetland shelf filter, removal of any invasive or exotic vegetation, and replacement of damaged, dead, or dying vegetation. The vegetation management aspect of the maintenance activities is expected to be more involved for newly planted systems than those that are more mature and established. It is noted that accumulation of debris is often associated with large storm events, as large storm events tend to wash more debris from the watershed and with higher flows have the potential to carry debris further downstream. The pump should be inspected semi-annually to ensure that it is functioning at the intended rate. In the case of pump failure, it should be replaced with a pump that operates at the same rate so that the original nutrient removal rates would be restored.

7.6.2.5.4 Permitting Considerations

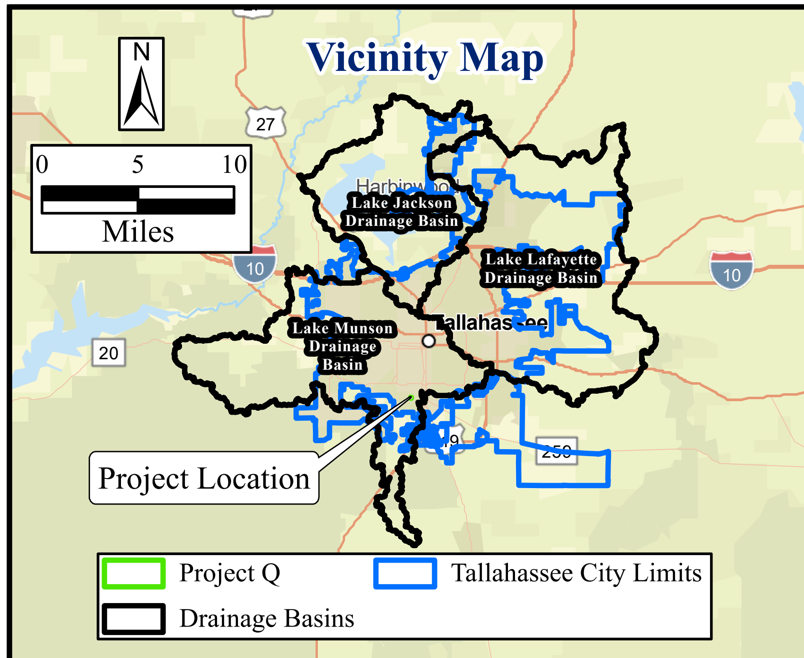
It is anticipated that an ERP from NWFWMD will be required. For a project to qualify for an ERP, it must demonstrate that the proposed project will not result in upstream flooding or increases in peak stage, will not result in increases in peak discharge rates from the site, and will meet water quality treatment requirements.

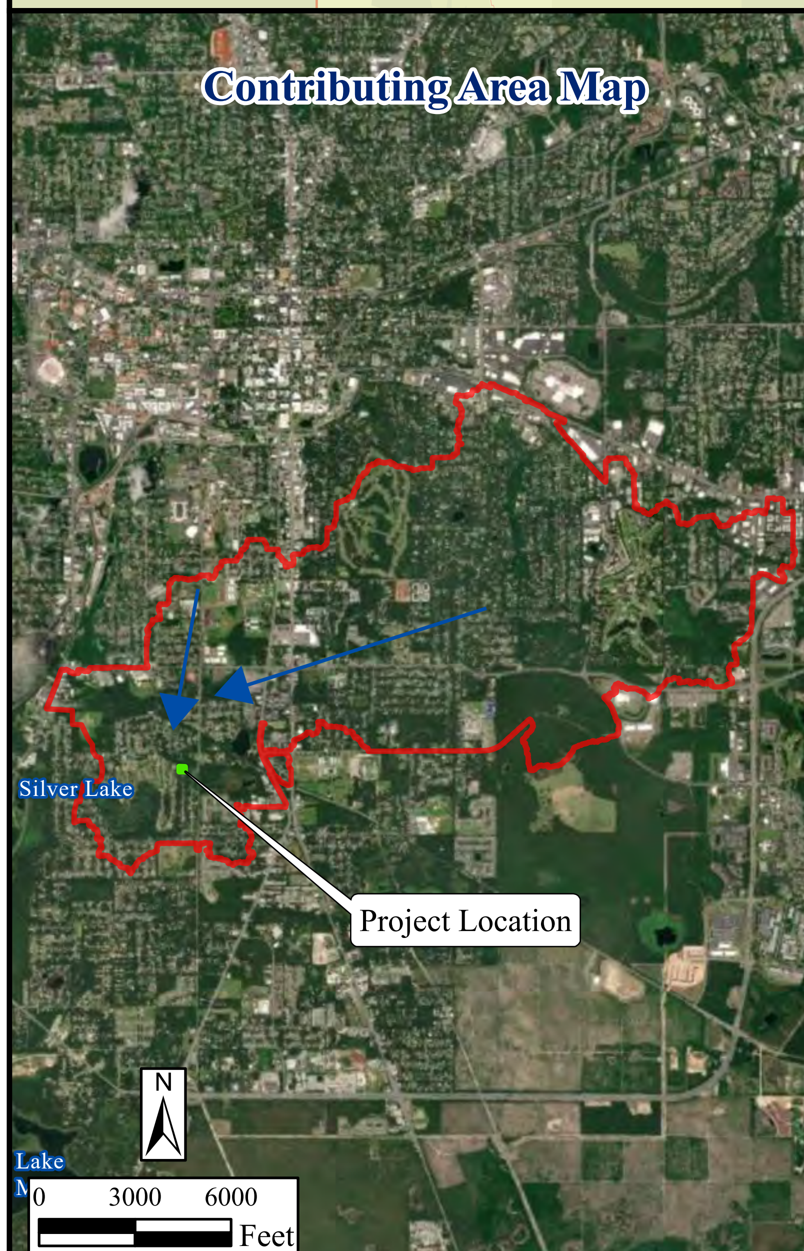
7.6.2.5.5 Cost Benefit Analysis

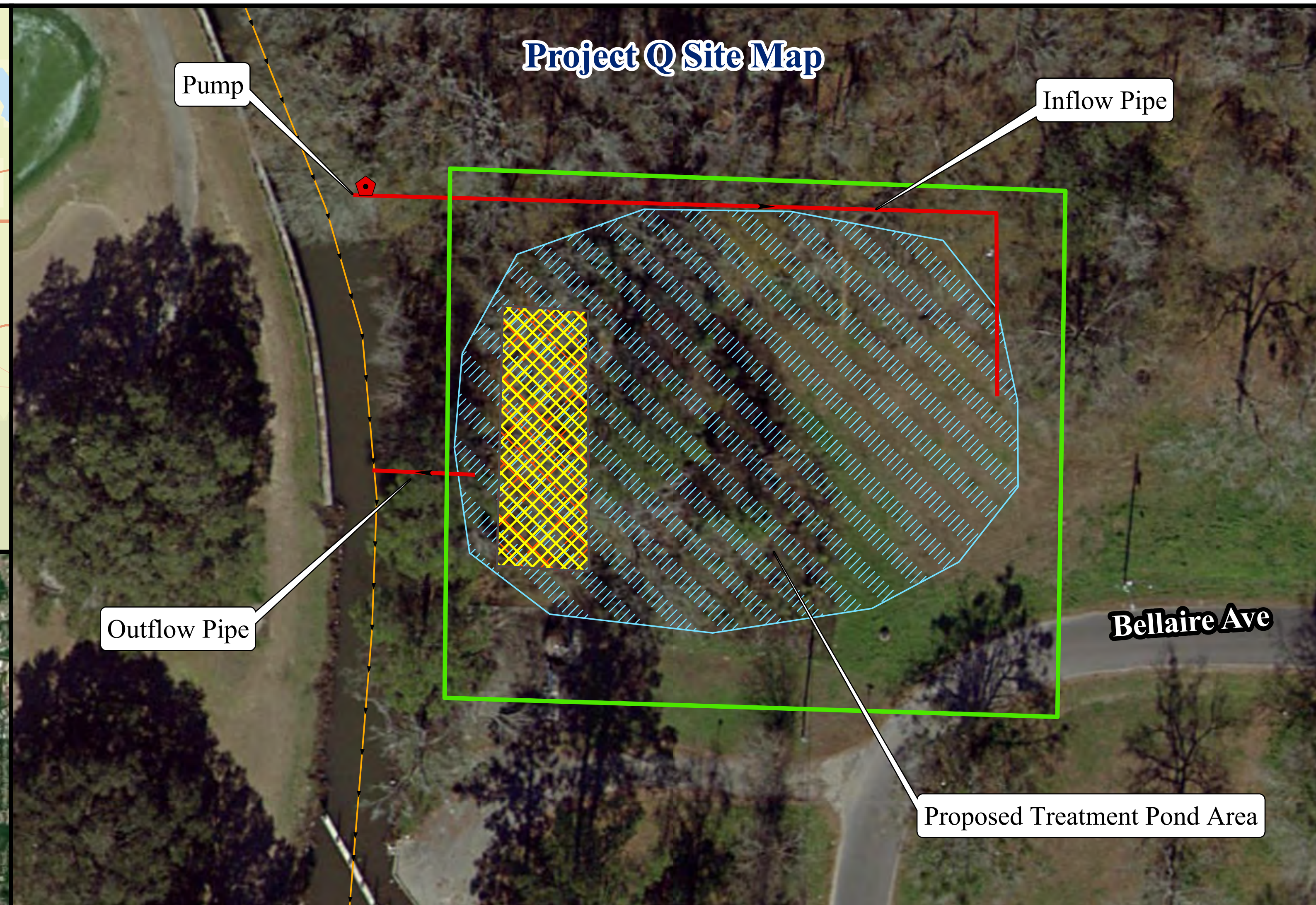
A typical cost of implementing a regional baseflow treatment system is approximately $2,500,000. Based on the anticipated water quality over an assumed 20-year project life, the cost benefit for TN and TP is approximately $25/lb removed and $155/lb removed, respectively (**Table 7-7**).

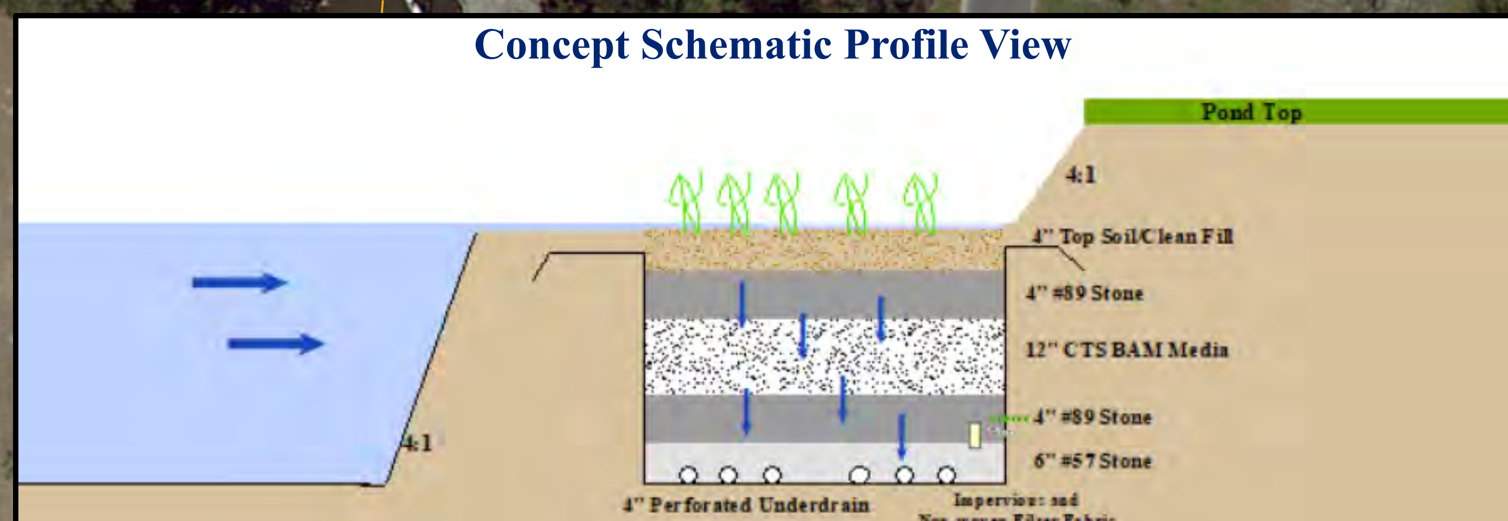
Table 7-7: Project Q Regional Baseflow Treatment System Cost Benefit

Parameter	Pollutant Removed (lb/20 yr)	Estimated Project Cost ($)	Cost Benefit ($/lb)
TN	100,000	$2,500,000	$25
TP	16,000		$155









Project Letter	Improvement Type	Parameter	Existing Condition Loading (lb/20 yr)	Proposed Loading (lb/20 yr)	Pollutant Removed (lb/20 yr)	Cost Benefit ($/lb)
Project Q	Baseflow Treatment System	TN	230,000	130,000	100,000	$25
		TP	22,000	6,000	16,000	$155

Note: Cost benefit was calculated based on previous studies (Geosyntec, 2022; Geosyntec 2023b).

CITY OF TALLAHASSEE

N

0 50

Feet

Legend

- Project Q
- CDA
- Upflow Filter
- Channel
- General Flow Pattern

Sources
County Boundary: COT, 2022
Infrastructure: COT, 2022
Streets: COT, 2022

Figure 7-5:
Project Q - Regional Baseflow Treatment System

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

7.6.2.6 Project R, Pond Enhancement

Project R is a pond enhancement for an existing dry detention pond that has a channel flowing through the middle of it located north of Daniels Street and west of James Street, see **Figure 7-6**.

7.6.2.6.1 Water Quality Improvement Concept

An existing dry detention pond that has a channel flowing through the middle of it was identified to enhance the water quality treatment provided. The proposed enhancements include potential expansion of the pond by excavating the existing pond to create a wet detention pond, add baffles to increase the flow path length, and add filtration on the discharge end of the pond in a manner similar to that described in **Section 7.5.1.1**. Baffles, in the form of gabion baskets are recommended since they are cheaper than other options and additional pond volume is proposed which would more than offset the volume occupied by the baffles. Pond baffles control or divert water flow, improve flow conditions, and increase residence time. By increasing the flow path length, the amount of particles settled, and thus nutrients removed, are increased. Additionally, the amount of time available for biological processes to occur is increased resulting in further water quality benefit.

Additionally, the incorporation of BAM filter is proposed on the discharge end of the pond. BAM refers to a class of filter media that promotes biofilm growth and leverages physical, chemical, and biological processes to remove nitrogen and phosphorus species.

7.6.2.6.2 Pollutant Reduction Evaluation

The estimated loading that enters the proposed project area annually is approximately 8,000 lb TN and 700 lb TP. Pond expansion and the incorporation of baffles is expected to remove an additional 3 percent of TN loading and 4 percent of TP loading based on the methods presented in Harper and Baker, 2007. The incorporation of BAM is expected to remove an additional 15 percent of TN loading and 15 percent of TP loading (BMPTrains, 2021). This results in up to 20,000 lb TN and 2,000 lb TP removed over 20 years. See **Table 7-8** for a breakdown of the removals and costs.

7.6.2.6.3 Maintenance Considerations

The expected maintenance of the proposed system is typical of wet detention ponds, including to mow the pond berm, to remove debris, litter, or sediment accumulation occurring at or near the significant pond inflow points or pond control structure. The side banks should be inspected for evidence of erosion or undercutting, and to ensure that vegetation is healthy and maintaining coverage. An additional maintenance need includes checking that water is still flowing through the BAM filter, which should be performed annually.

7.6.2.6.4 Permitting Considerations

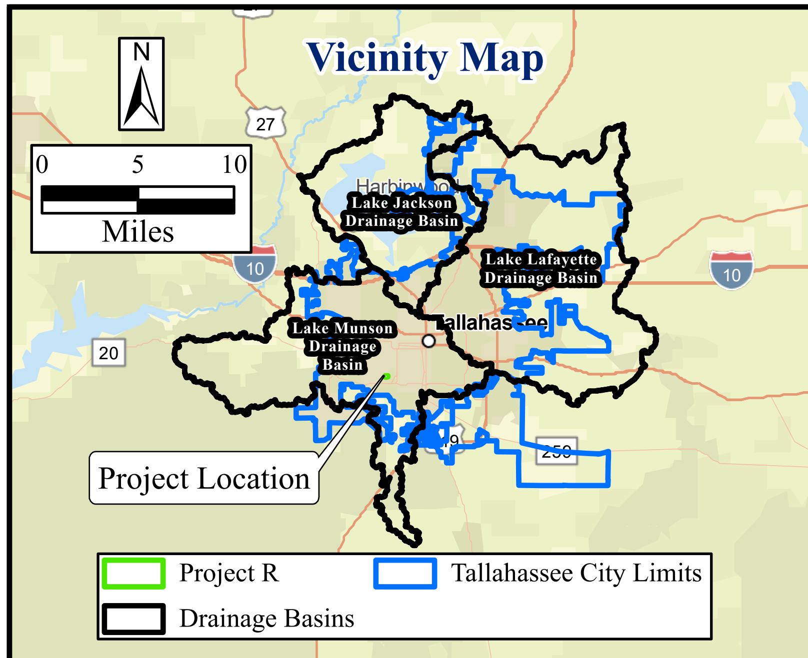
It is anticipated that an ERP modification from NWFWMD will be required. For a project to quality for an ERP modification, it must demonstrate that the proposed project will not result in upstream flooding or increases in peak stage, will not result in increases in peak discharge rates from the site, and will meet water quality treatment requirements.

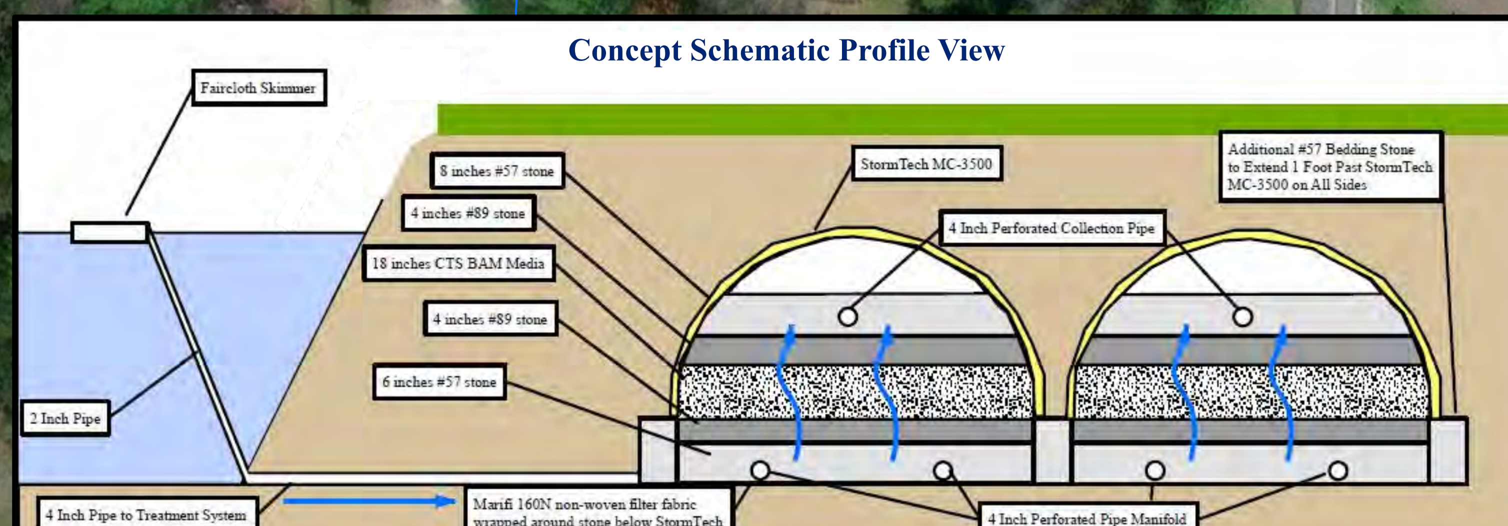
7.6.2.6.5 Cost Benefit Analysis

A typical cost of implementing pond enhancements as described is approximately $4,000,000. Based on the anticipated water quality benefit over an assumed 20-year project life, the cost benefit for TN and TP is approximately $200/lb removed and $2,000/lb removed, respectively (**Table 7-8**).

Table 7-8: Project R Pond Enhancement Cost Benefit

Parameter	Pollutant Removed (lb/20 yr)	Estimated Project Cost ($)	Cost Benefit ($/lb)
TN	20,000	$4,000,000	$200
TP	2,000		$2,000





Project Letter	Improvement Type	Parameter	Existing Condition Loading (lb/20 yr)	Proposed Loading (lb/20 yr)	Pollutant Removed (lb/20 yr)	Cost Benefit ($/lb)
Project R	Pond Enhancement	TN	90,000	70,000	20,000	$200
		TP	8,000	6,000	2,000	$2,000

Note: Cost benefit was calculated based on previous studies (Geosyntec, 2022; Geosyntec 2023b).

CITY OF TALLAHASSEE

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Feet

Legend

- Project R
- CDA
- Upflow Filter
- Pipe
- Channel
- Inlet
- Junction
- General Flow Pattern

Sources
County Boundary: COT, 2022
Infrastructure: COT, 2022
Streets: COT, 2022

Figure 7-6:
Project R - Pond Enhancement

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

7.6.3 Future Priority Projects

The projects presented in this section scored well using the decision variables mentioned in **Section 7.5.2**. The projects include a variety of pond enhancement, dredging, and erosion control projects and should be considered for future water quality improvement project consideration. A brief description of each future priority project is provided below.

7.6.3.1 Project A, Pond Enhancement

Project A is a pond enhancement located within the Lake Lafayette basin at Phillips Road Pond, between Phillips Road, Blair Stone Road, and Mahan Drive, see **Exhibit 7-3**. The pond enhancement would comprise of increasing the size of the pond, since currently it is narrow, has bends throughout, and is shaped like a winding river. Baffle installation and BAM incorporation is also recommended in a manner similar to that described in **Section 7.5.1.1**. The estimated loading that enters the project area annually is approximately 485 lb TN and 37 lb TP. The anticipated nutrient removals for expanding the pond and adding baffles are 3 percent and 4 percent for TN and TP, respectively. The anticipated nutrient removals for BAM incorporation are approximately 15 percent and 15 percent for TN and TP, respectively. Expected costs for this enhancement are approximately $4,250,000.

7.6.3.2 Project D, Pond Enhancement

Project D is a pond enhancement located within the Lake Lafayette basin at the north corner of the Capital Circle Northeast and Miccosukee Road intersection, see **Exhibit 7-3**. The pond enhancement would comprise of increasing the size of the pond, incorporating BAM in the banks of the pond, and installing baffles throughout the length of the pond to increase flow path, see **Section 7.5.1.1**. The estimated loading that enters the project area annually are approximately 194 lb TN and 15 lb TP. The anticipated nutrient removals for expanding the pond and adding baffles are approximately 3 percent and 4 percent for TN and TP, respectively. The anticipated nutrient removals for BAM incorporation are approximately 15 percent and 15 percent for TN and TP, respectively. Expected costs for this enhancement are approximately $2,000,000.

7.6.3.3 Project E, Dredging

Project E is a dredging effort within the Lake Lafayette basin at the McCord Pond located in Guyte P McCord Park. This is located south of the Thomasville Road and Armistead Road intersection, see **Exhibit 7-3**. Dredging would improve the pond by removing the excess sediment that has been transported via the stream south of the pond. The removal of the sediment would restore the storage volume to the permitted condition. More detail on dredging projects can be found in **Section 7.5.1.2**. The estimated annual flux rate was estimated to be 70 pounds per acre (lb/ac) for TN and 2 lb/ac for TP based on a recent study performed on a nearby lake, Shakey Pond (Geosyntec, 2024). The anticipated nutrient removals for dredging the pond is 87 percent and 50 percent for TN and TP, respectively. With dredging projects, it is noted that there is a potential need for additional costs to dispose of dredged materials and for identification of a DMMA. This is to be addressed as part of a feasibility study. Expected costs for this dredging project are approximately $6,000,000.

7.6.3.4 Project P, Channel Hard Armoring

Project P is a channel hard armoring project within the Lake Munson basin in the stream that flows east-west between Beechnut Lane and Peachtree Drive, see **Exhibit 7-3**. The area of interest has a length of about 1,300 feet. Channel hard armoring would be administered in the form of gabion baskets along the sidebank of the area of interest. This would significantly reduce erosion and/or scouring currently occurring, which would reduce associated sediment accumulation and nutrient discharges to downstream waterbodies. Hard armoring is described in more detail in **Section 7.5.1.4**. Based on the nature of this project, the water quality benefit is estimated based on the reduction in erosion, which was previously presented in **Section 7.5.1.4** to be 0.075 lb TN/ft-year and 0.057 lb TP/ft-year. Therefore, the estimated water quality benefit was 97.5 lb TN/year and 74.1 lb TP/year. Expected costs for this channel hard armoring project are approximately $2,600,000.

7.6.3.5 Project W, Channel Hard Armoring

Project W is a channel hard armoring project within the Lake Jackson basin in the stream that flows east-west and is located Trebark Drive and Sharer Road, see **Exhibit 7-3**. The area of interest has a length of about 1,500 feet. Channel hard armoring would be administered in the form of gabion baskets along the sidebank of the area of interest. This would significantly reduce erosion and/or scouring currently occurring, which would reduce associated sediment accumulation and nutrient discharges to downstream waterbodies, which in this case is the Megginnis Arm Regional Stormwater (MARS) facility. Hard armoring is described in more detail in **Section 7.5.1.4**. Based on the nature of this project, the water quality benefit is estimated based on the reduction in erosion, which was previously presented in **Section 7.5.1.4** to be 0.075 lb TN/ft-year and 0.057 lb TP/ft-year. Therefore, the estimated water quality benefit was 112.5 lb TN/year and 85.5 lb TP/year. Expected costs for this channel hard armoring project are approximately $3,000,000.

7.6.3.6 Project G, Channel Hard Armoring

Project G is a channel hard armoring project within the Lake Lafayette basin in the stream that leads to McCord Pond, see **Exhibit 7-3**. The area of interest has a length of about 3,110 feet and flows north into the pond. Channel hard armoring would be administered in the form of gabion baskets along the sidebank of the area of interest. This would significantly reduce erosion and/or scouring currently occurring, which would reduce associated sediment accumulation and nutrient discharges to downstream waterbodies, which in this case is Lake Elberta. It is noted that this waterbody currently requires dredging due to the extensive sediment accumulation which has resulted in reduced storage volume and residence time. Hard armoring is described in more detail in **Section 7.5.1.4**. Based on the nature of this project, the water quality benefit is estimated based on the reduction in erosion, which was previously presented in **Section 7.5.1.4** to be 0.075 lb TN/ft-year and 0.057 lb TP/ft-year. Therefore, the estimated water quality benefit was 233.3 lb TN/year and 177.3 lb TP/year. Expected costs for this channel hard armoring project are approximately $6,200,000.

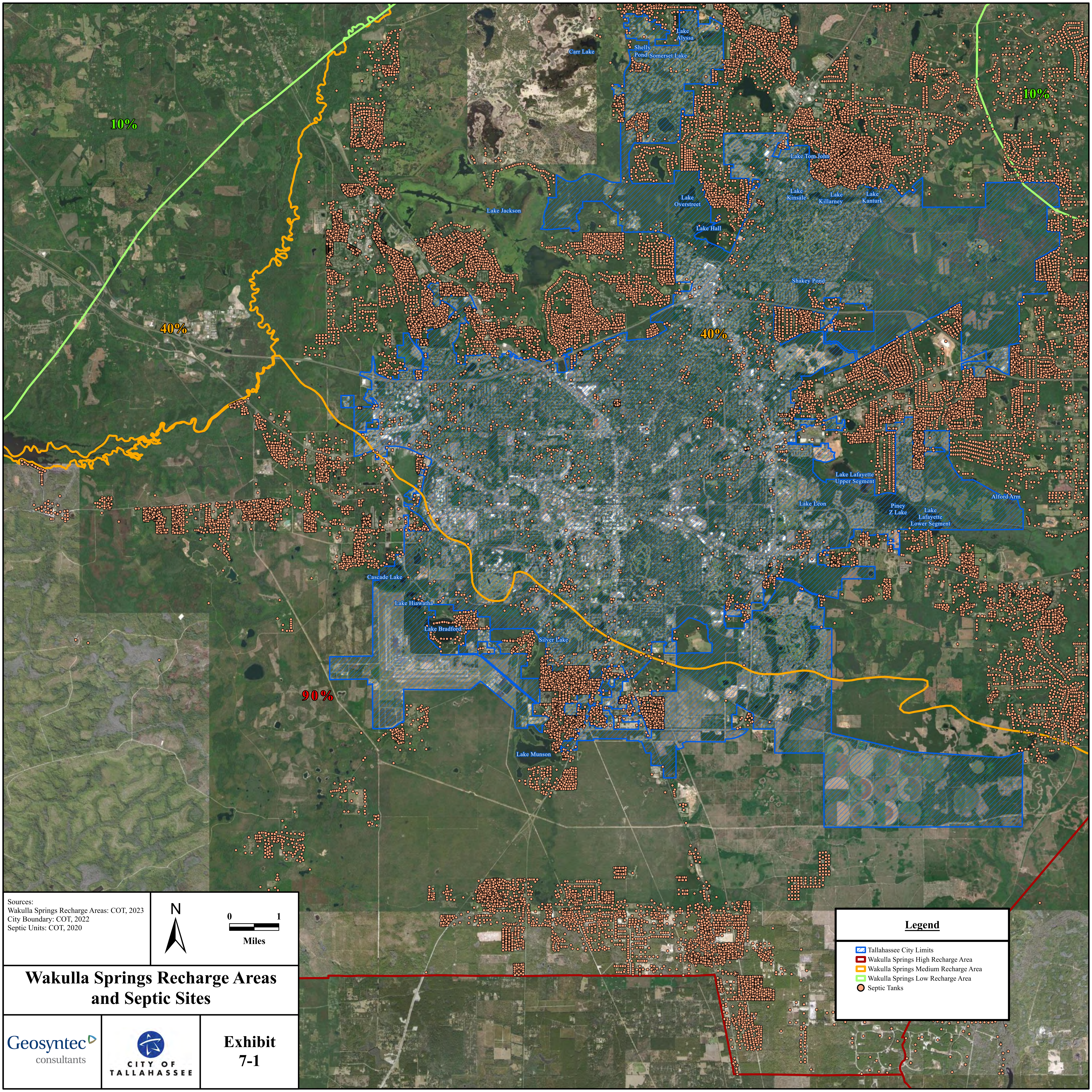
7.6.3.7 Project O, Channel Hard Armoring

Project O is a channel hard armoring project within the Lake Munson basin in the stream that eventually leads to Lake Elberta, see **Exhibit 7-3**. The area of interest has a length of about 2,500 feet and flows southeast from Jackson Bluff Road, parallel to Eppes Drive East, and eventually enters Lake Elberta. Channel hard armoring would be administered in the form of gabion baskets along the sidebank of the area of interest. This would significantly reduce erosion and/or scouring currently occurring, which would reduce associated sediment accumulation and nutrient discharges to Lake Elberta. Hard armoring is described in more detail in **Section 7.5.1.4**. Based on the nature of this project, the water quality benefit is estimated based on the reduction in erosion, which was previously presented in **Section 7.5.1.4** to be 0.075 lb TN/ft-year and 0.057 lb TP/ft-year. Therefore, the estimated water quality benefit was 187.5 lb TN/year and 142.5 lb TP/year. Expected costs for this channel hard armoring project are approximately $5,000,000.

7.6.3.8 Project T, Channel Hard Armoring

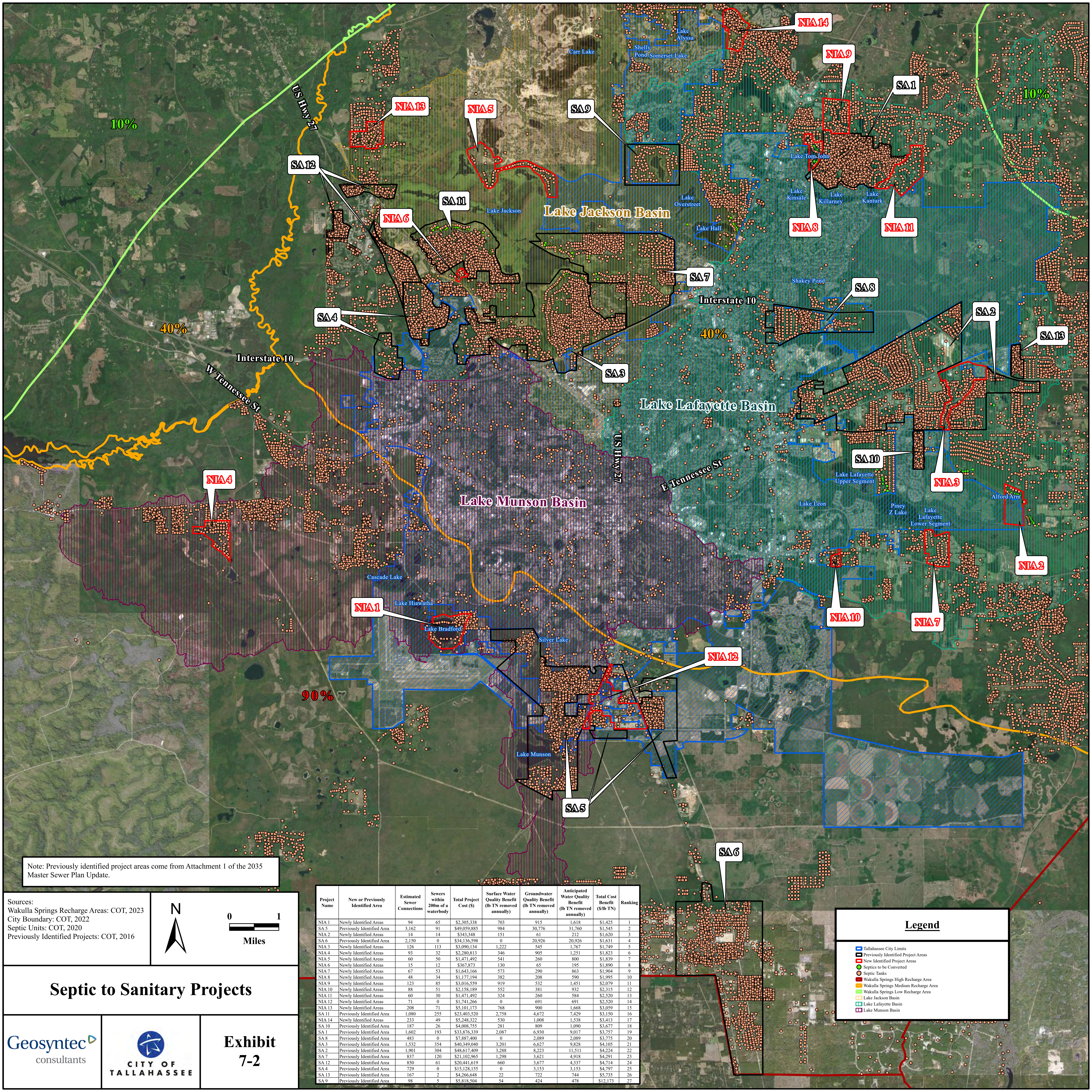
Project T is a channel hard armoring project within the Lake Jackson basin in the stream that flows north-south and is located east of North Meridian Road, see **Exhibit 7-3**. The area of interest has a length of about 2,200 feet. Erosion control would be administered in the form of gabion baskets along the sidebank of the area of interest. This would significantly reduce erosion and/or scouring currently occurring, which would reduce associated sediment accumulation and nutrient discharges to downstream waterbodies. Hard armoring is described in more detail in **Section 7.5.1.4**. Based on the nature of this project, the water quality benefit is estimated based on the reduction in erosion, which was previously presented in **Section 7.5.1.4** to be 0.075 lb TN/ft-year and 0.057 lb TP/ft-year. Therefore, the estimated water quality benefit was 165 lb TN/year and 125.4 lb TP/year. Expected costs for this channel hard armoring project are approximately $4,400,000.

EXHIBITS



Wakulla Springs Recharge Areas and Septic Sites

Exhibit 7-1



Note: Previously identified project areas come from Attachment 1 of the 2035 Master Sewer Plan Update.

Sources:
Wakulla Springs Recharge Areas: COT, 2023
City Boundary: COT, 2022
Septic Units: COT, 2020
Previously Identified Projects: COT, 2016

N

0 1
Miles

Project Name	New or Previously Identified Area	Estimated Sewer Connections	Sewers within 200m of a waterbody	Total Project Cost ($)	Surface Water Quality Benefit (lb TN removed annually)	Groundwater Quality Benefit (lb TN removed annually)	Anticipated Water Quality Benefit (lb TN removed annually)	Total Cost Benefit ($/lb TN)	Ranking
NIA 1	Newly Identified Areas	94	65	$2,305,338	703	915	1,618	$1,425	1
SA 5	Previously Identified Area	3,162	91	$49,059,885	984	30,776	31,760	$1,545	2
NIA 2	Newly Identified Areas	14	14	$343,348	151	61	212	$1,620	3
SA 6	Previously Identified Area	2,150	0	$34,136,598	0	20,926	20,926	$1,631	4
NIA 3	Newly Identified Areas	126	113	$3,090,134	1,222	545	1,767	$1,749	5
NIA 4	Newly Identified Areas	93	32	$2,280,813	346	905	1,251	$1,823	6
NIA 5	Newly Identified Areas	60	50	$1,471,492	541	260	800	$1,839	7
NIA 6	Newly Identified Areas	15	12	$367,873	130	65	195	$1,890	8
NIA 7	Newly Identified Areas	67	53	$1,643,166	573	290	863	$1,904	9
NIA 8	Newly Identified Areas	48	34	$1,177,194	382	208	590	$1,995	10
NIA 9	Newly Identified Areas	123	85	$3,016,559	919	532	1,451	$2,079	11
NIA 10	Newly Identified Areas	88	51	$2,158,189	552	381	932	$2,315	12
NIA 11	Newly Identified Areas	60	30	$1,471,492	324	260	584	$2,520	13
NIA 12	Newly Identified Areas	71	0	$1,741,266	0	691	691	$2,520	14
NIA 13	Newly Identified Areas	208	71	$5,101,173	768	900	1,668	$3,059	15
SA 11	Previously Identified Area	1,080	255	$23,403,520	2,758	4,672	7,429	$3,150	16
NIA 14	Newly Identified Areas	233	49	$5,248,322	530	1,008	1,538	$3,413	17
SA 10	Previously Identified Area	187	26	$4,008,755	281	809	1,090	$3,677	18
SA 1	Previously Identified Area	1,602	193	$33,876,339	2,087	6,930	9,017	$3,757	19
SA 8	Previously Identified Area	483	0	$7,887,400	0	2,089	2,089	$3,775	20
SA 3	Previously Identified Area	1,532	354	$40,349,040	3,201	6,627	9,828	$4,105	21
SA 2	Previously Identified Area	1,901	304	$48,617,409	3,288	8,223	11,511	$4,224	22
SA 7	Previously Identified Area	837	120	$21,102,965	1,298	3,621	4,918	$4,291	23
SA 12	Previously Identified Area	850	61	$20,441,619	660	3,677	4,337	$4,714	24
SA 4	Previously Identified Area	729	0	$15,128,155	0	3,153	3,153	$4,797	25
SA 13	Previously Identified Area	167	2	$4,266,648	22	722	744	$5,735	26
SA 9	Previously Identified Area	98	5	$5,818,504	54	424	478	$12,173	27

Legend

- Tallahassee City Limits
- Previously Identified Project Areas
- New Identified Project Areas
- Septics to be Converted
- Septic Tanks
- Wakulla Springs High Recharge Area
- Wakulla Springs Medium Recharge Area
- Wakulla Springs Low Recharge Area
- Lake Jackson Basin
- Lake Lafayette Basin
- Lake Munson Basin

Septic to Sanitary Projects

Geosyntec consultants

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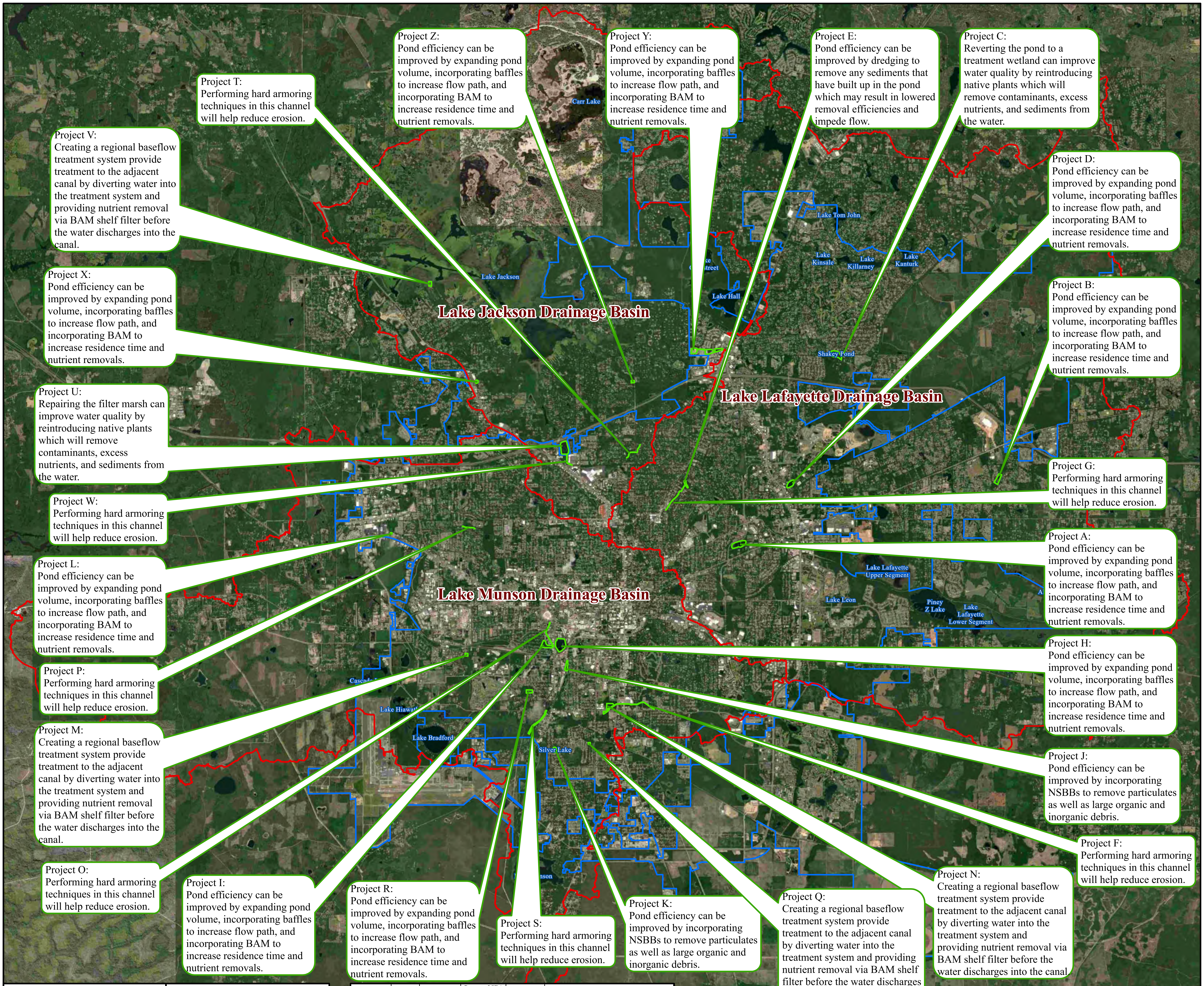
Exhibit 7-2



Sources:
City Boundary: COT, 2022
Drainage Basins: COT, 2022
Waterbodies: COT, 2022
Basemap: ESRI, 2021

Project Letter	Subbasin	CDA Basin	Percent of CDA Treated	Parcel Owner	Proposed BMP
A	Lafayette	LFBULLOF07	5%	COT	Pond enhancement: expand with baffles, BAM filter
B	Lafayette	LFBLLLOF14	80%	Other	Pond enhancement: expand with baffles, BAM filter
C	Lafayette	LFBSSOF02	100%	COT	Pond enhancement: wetland reversion
D	Lafayette	LFBULLOF07	2%	COT	Pond enhancement: expand with baffles, BAM filter
E	Lafayette	LFBULLOF07	20%	COT	Dredge
F	Munson	LMBLMOF05	10%	COT	Channel hard armoring
G	Lafayette	LFBULLOF07	12%	COT	Channel hard armoring
H	Munson	LMBLMOF05	20%	COT	Pond enhancement: expand with baffles, BAM filter
I	Munson	LMBLMOF05	15%	COT	Pond enhancement: expand with baffles, BAM filter
J	Munson	LMBLMOF05	1%	COT	NSBB
K	Munson	LMBLMOF05	1%	COT	NSBB
L	Munson	LMBLMOF05	0.1%	Other	Pond enhancement: expand with baffles, BAM filter
M	Munson	LMBLMOF05	60%	COT	Passive baseflow treatment systems
N	Munson	LMBLMOF05	75%	COT	Passive baseflow treatment systems
O	Munson	LMBLMOF05	20%	COT	Channel hard armoring
P	Munson	LMBLMOF05	15%	COT	Channel hard armoring
Q	Munson	LMBLMOF05	80%	COT	Baseflow treatment systems
R	Munson	LMBLMOF05	15%	COT	Pond enhancement: expand with baffles, BAM filter
S	Munson	LMBLMOF05	20%	COT	Channel hard armoring
T	Jackson	LJBLJOF01	15%	COT	Channel hard armoring
U	Jackson	LJBLJOF01	100%	Other	Pond enhancements: repair filter marsh
V	Jackson	n/a	100%	Other	Passive baseflow treatment systems
W	Jackson	LJBLJOF01	75%	COT	Channel hard armoring
X	Jackson	LJBLJOF18	15%	Other	Pond enhancement: expand with baffles, BAM filter
Y	Jackson	LJBLCOF01	40%	COT	Pond enhancement: expand with baffles, BAM filter
Z	Jackson	LJBLCOF05	35%	Other	Pond enhancement: expand with baffles, BAM filter

Structural BMP Projects

Geosyntec consultants

CITY OF TALLAHASSEE

Exhibit 7-3

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