DRAFT - Lake Alice Watershed Management Plan

Prepared for

University of Florida

April 2024

Prepared by

Wetland Solutions Inc

Table of Contents

Table of Exhibits

Figures

Tables

Section 1.0 Introduction

Lake Alice is the primary natural feature on the University of Florida (UF) Main Campus. The Campus Framework Plan notes the importance of this feature on campus and identifies Lake Alice as a:

> *"…campus organizer, unique natural resource, and compelling symbol of identity…"*

The Plan goes on to recommend that campus be centered around Lake Alice and states that the "Restoration and Expansion of these systems would, not only improve drainage conditions but, help organize and unite the 'blue' and 'green' campus corridors."

The importance of Lake Alice, and the creeks that feed it, are also identified and highlighted in the Campus Master Plan, Strategic Development Plan, Campus Trails Master Plan, the Landscape Master Plan, the Conservation Area Land Management Plan, as well as other System Plans and Master Plan elements. In fact, the importance of Lake Alice and the natural areas is a theme that links most of the campus planning documents.

In addition to the acknowledged value of these systems, Lake Alice and the creeks that feed it comprise the primary stormwater conveyance, treatment, and recharge system for more than half of the Main Campus. The purpose of this project is to develop a watershed management plan (WMP) for the Lake Alice Watershed that acknowledges the importance of this natural feature, presents a vision for the watershed, and makes recommendations for short-term and long-term management decisions for the lake and watershed.

Specific goals of this project included:

- Developing a comprehensive vision for the Lake Alice Watershed based on stakeholder input.
- Summarizing the historical and current development of campus, campus planning, stormwater and environmental permitting, and literature on the lake and watershed. The findings of this analysis are presented in Attachment A.
- Collecting available data and analyzing trends and relationships between parameters. Collected data and analyses are presented in Attachment B.
- Implementing a robust facilitation process to solicit, receive, and incorporate feedback from the Project Team, Steering Committee, and Stakeholders. A complete discussion of the facilitation efforts and collected feedback is provided in Attachment C.
- Updating and refining the stormwater model for the UF Main Campus developed in 2017 by Jones Edmunds. A summary of changes to the model is presented in Attachment D.
- Collecting vegetation data for the Conservation Areas in the Lake Alice Watershed to document current vegetative conditions and the cover of invasive-exotic species. Collected data are provided in Attachment E.
- Using the updated stormwater model to identify and prioritize, based on Steering Committee feedback, three erosion and three flooding locations for conceptual project development. This prioritization and the developed conceptual projects are described in Attachment F.

- Operation and maintenance recommendations for the stormwater system are described in Attachment G.
- Preparing comprehensive recommendations for watershed management including stormwater management, permitting, planning, design, operation and maintenance, and funding.

1.1 Location

The University of Florida Main Campus is located in North Central Florida in Alachua County in the City of Gainesville. Main Campus is divided between four watersheds: Lake Alice, Hogtown Creek, Tumblin Creek/Alachua Sink, and Internally-Drained Basins. Each of these watersheds is primarily a closed basin, meaning that rain that falls, and the runoff generated, flows to the lowest point in the basin and infiltrates or is otherwise directed to groundwater.

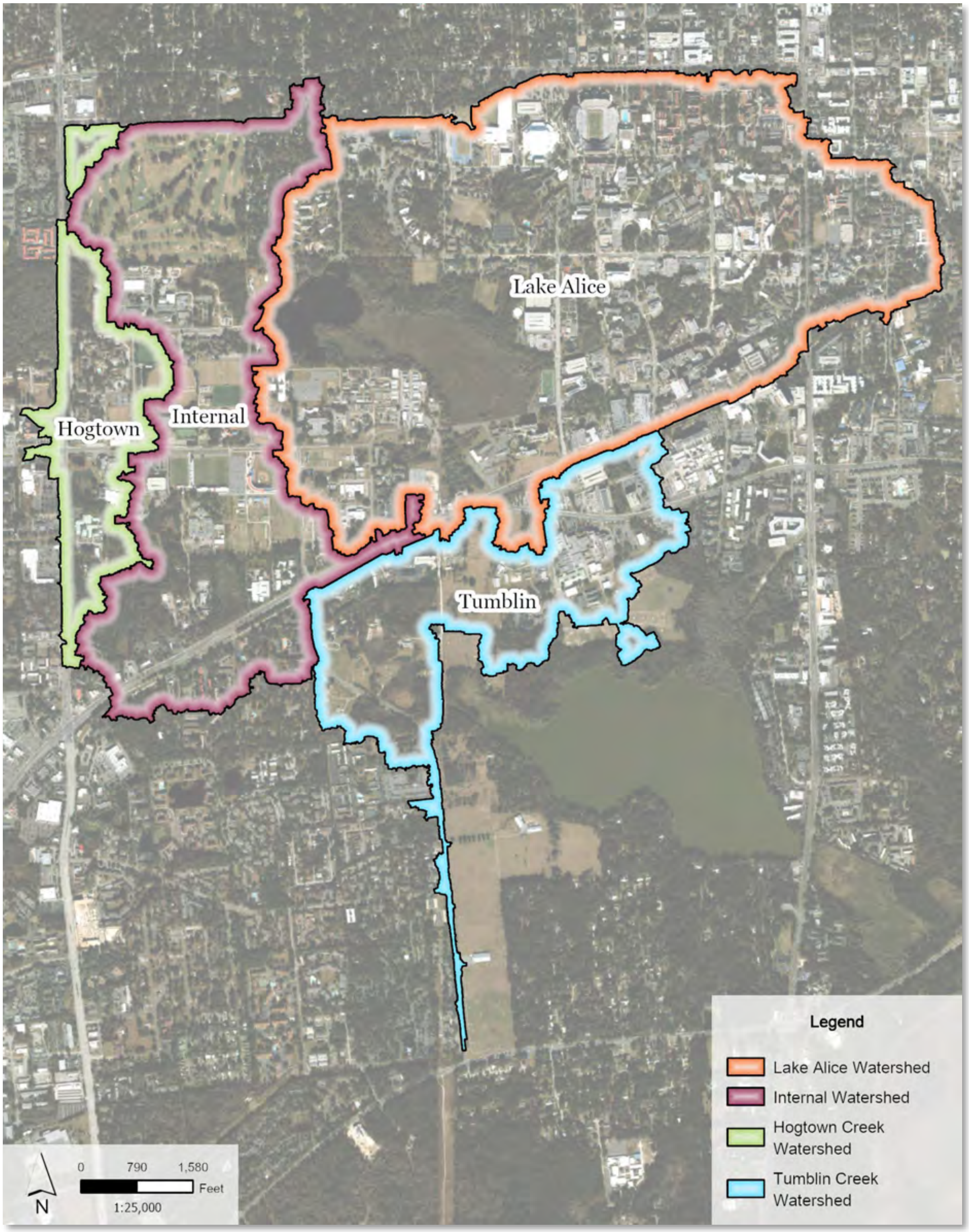
Lake Alice
Hogtown
Internal
Tumblin
Legend
Lake Alice Watershed
Internal Watershed
Hogtown Creek Watershed
Tumblin Creek Watershed
N
0
790
1,580
Feet
1:25,000

Figure 1. University of Florida Campus and Watersheds

Within the four watersheds that comprise Main Campus, the Lake Alice Watershed covers approximately 1,005 acres and most of the older portions of the Main Campus. The Lake Alice Watershed is primarily made up of University-owned property (868 acres). The University's control of most of the watershed means that there are unique opportunities for the University's actions to affect the overall watershed and for the University to implement best practices in watershed management that can serve as a model to other universities and municipalities in Florida and across the country.

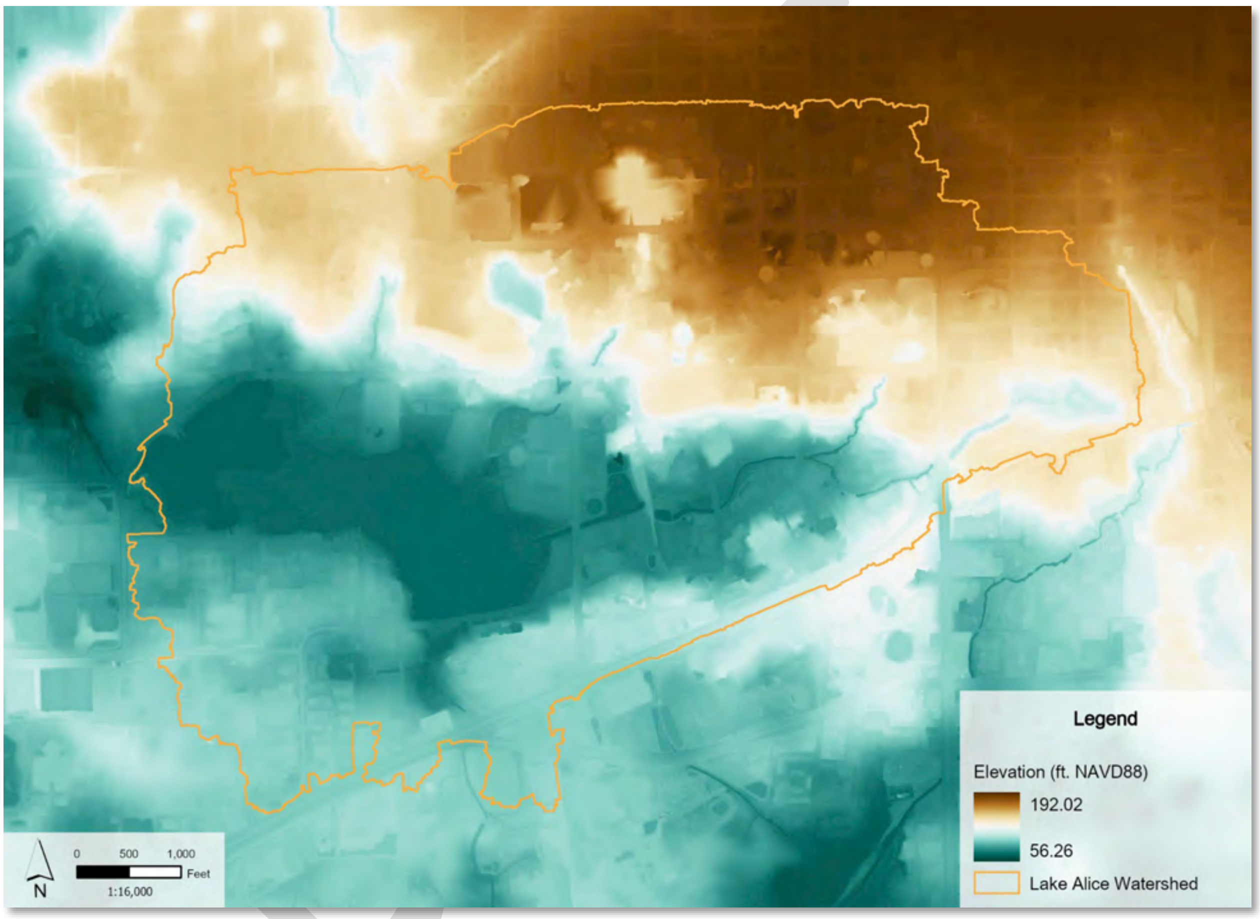

Figure 2. Lake Alice Watershed Elevations

1.2 Project Background

The University of Florida has been developing for more than 100 years. During this time the number, area, and types of buildings on campus have expanded and changed to make room for the many new colleges and students. This has included a significant increase in impervious surfaces on campus including roofs, roads, parking lots, sidewalks, and waterbodies. These surfaces, which now make up approximately 46%

of the Lake Alice Watershed (Chen-Moore & Associates, 2023), do not allow infiltration but instead convert most or all rainfall to runoff.

The University and much of Gainesville are situated within a relatively unique geological area characterized by “stream-to-sink” or closed watersheds. In North Central Florida, stream-to-sink watersheds are characterized by a clay layer perforated by sinkholes that connect the surface to the underlying, high-transmissivity, limestone Upper Floridan Aquifer (UFA). Runoff generated in the watershed flows downhill until it reaches one of these sinkholes where it can relatively rapidly infiltrate to the UFA. The UFA underlies most of Florida, as well as parts of Georgia and South Carolina and is the primary water supply across much of its extent (Figure 3).

Figure 3. Upper Floridan Aquifer and Confinement

The Lake Alice Watershed has multiple sinkholes dispersed across Main Campus and two drainage wells located on the edge of Lake Alice that provide infiltration to the UFA. The drainage wells were installed to control lake levels and reduce flooding after many of the natural sinkholes in the watershed were filled and/or disconnected from surface waterbodies.

With the continued addition of impervious area on campus, stormwater volumes and flows have substantially increased. Given the watershed’s unique geology, history, and ownership, Lake Alice has been permitted as the stormwater treatment basin for the entire Lake Alice Watershed with the natural and modified creeks used as conveyance for stormwater to the lake. These increases in stormwater volumes and flows have resulted in increased velocities in the creeks and pipes on campus which have in turn caused increased erosion and damage to stormwater infrastructure. As development has continued this damage has increased and been exacerbated by aging stormwater infrastructure.

The University observed these challenges in the stormwater system, including flooding, erosion, and sedimentation; and stormwater impacts on other utilities and buildings on campus and made the decision to develop a comprehensive management plan for the Lake Alice Watershed. This Lake Alice Watershed Management Plan wholistically considers the stormwater system, conservation areas, recreational features, creeks, and built areas of campus to make recommendations for how stormwater can be managed to protect and enhance both natural and built areas of campus.

1.3 Project and Facilitation Process Overview

This project relied on a robust facilitation effort to solicit, compile, and report on feedback. This process is summarized below. A more complete discussion of the facilitation schedule, strategies and tools used to solicit and organize feedback, as well as the feedback received from the facilitation process is presented in Attachment C.

1.3.1 Project Contributors

This project benefited from the contributions of knowledge, expertise, and time of numerous individuals. This included the Project Team, the Steering Committee, and other stakeholders. These contributions were used to guide the process and prioritize various objectives and outcomes for the WMP. To all of those who shared their time and expertise, thank you.

1.3.1.1 Project Team

The Project Team for the Lake Alice WMP included members of the University administration from Business Affairs including Planning, Design, and Construction; Facilities Services; Office of Sustainability and Business Affairs Technical Services. Table 1 shows the Project Team members, their role, and their affiliation.

Table 1. Project Team Membership

Name	Role	Representation
Linda Dixon	Project Manager	Planning, Design, and Construction
Rachel Mandell	Member	Planning, Design, and Construction
Mark Helms	Member	Facilities Services
Chuck Kammin	Member	Facilities Services
Matt Williams	Member	Office of Sustainability
Kaylee August	Member	Office of Sustainability
Angelique Hennon	Member	BATS - Space & GIS Management

1.3.1.2 Steering Committee

A Steering Committee was assembled for this project from University faculty, administrators, students, and other stakeholders. The role of the Steering Committee was to provide their technical and scientific input on problems in the watershed and feedback on management recommendations. The Steering Committee also helped identify and reach out to stakeholders.

Table 2. Steering Committee Membership

Name	Department
Eban Bean	UF Agricultural and Biological Engineering
Mark Brenner	UF Geological Sciences
Chuck Cichra*	UF Fisheries and Aquatic Sciences
Mark Clark	UF Soil, Water, and Ecosystem Sciences
Matt Cohen	UF Forest Resources and Conservation
Dave Conser	City of Gainesviille Urban Forestry
Lillian Crawford	UF Landscape Architecture - Student
Marty Dempsey	UF Recreational Sports
Stefan Gerber	UF Soil, Water, and Ecosystem Sciences
Stacie Greco	Alachua County Environmental Protection Department
John Guerra	UF Environmental Health and Safety
Mark Hostetler	UF Wildlife Ecology and Conservation
Jared Howard	UF Facilities Services - Wastewater
Mark Hoyer	Florida LAKEWATCH
Alan Ivory	UF Wildlife Ecology and Conservation - Student
Yi Luo	UF Landscape Architecture
Jeanna Mastrodicasa	UF IFAS
Nia Morales	UF Wildlfe Ecology and Conservation

Name	Department
Mark Newman	UF Engineering School of Sustainable Infrastructure & Environment
Steve Noll	UF History
AJ Reisinger	UF Soil, Water, and Ecosystem Sciences
John Sansalone	UF Engineering School of Sustainable Infrastructure & Environment
Tom Schlick	UF Facilities Services - Grounds
Bill Smith	UF University Athletic Association
Taylor Stein	UF Forest Resources and Conservation
Amanda Subalusky	UF Biology
Kim Tanzer	Former Professor UF Architecture & UVA Professor Emerita
Matt Whiles	UF Soil, Water, and Ecosystem Sciences
Missy Williams	UF Planning, Design & Construction

*Retired December 2023/Withdrew

1.3.1.3 Stakeholders

The University of Florida is a major landmark in Gainesville and is an important community connector. Campus is also the home, classroom, research facility, alma mater, and medical center for hundreds of thousands of students, Gainesville residents, visitors, and alumni. Because of the visibility of Lake Alice and the conservation areas, stakeholders for this project were considered to be any person on campus, in the community, or member of the broader “Gator Nation” that could be mobilized to participate. To maximize participation, both in-person and virtual engagements were used.

1.4 Lake Alice Regulations and Uses

Lake Alice, the creeks, and Conservation Areas on campus are not managed or operated by a single department. This means that the multitude of responsibilities associated with the watershed lie with different groups depending on the nature of the need. Departments that have a role in the management of stormwater or the Lake Alice Watershed on campus are shown in Table 3.

Table 3. Departments with Responsibilities for Lake Alice

Name	Role
Facilities Services – Grounds	Landscaping; Vegetative maintenance; Dredging
Facilities Services – Utilities	Stormwater infrastructure; Wastewater treatment facility; Reclaimed and irrigation, Stormwater permitting
Facilities Services – Finance	Solid waste management & recycling
Planning, Design, and Construction	New infrastructure in the watershed; New building construction and renovations
Environmental Health & Safety	Allowed uses around the lake and watershed; Bat houses; Hazardous waste and site management
Institute for Food and Agricultural Sciences (IFAS)	Greenhouses and research plots adjacent to lake
Student Life – Recreational Sports	Irrigation and fertilization of sports fields
University Athletic Association	Irrigation and fertilization of sports fields

University Police Department	Public safety

1.4.1 Conservation Areas Restrictions and Allowable Uses

Policies have been established for the Lake Alice Watershed and other waterbodies on the University's Main Campus to acknowledge the importance of these areas for wildlife, stormwater conveyance and management, and natural area conservation.

1.4.1.1 Conservation Area Restrictions

The following activities are prohibited in the Conservation Areas on Main Campus, including Lake Alice:

- Hunting, camping, and fishing,
- Swimming and wading,
- Feeding alligators,
- Boating,
- Harassing wildlife,
- Damaging or removing vegetation,
- Littering, and
- Access to closed areas.

Prohibitions on fishing are at least partially related to Florida Statute 790.25(h), which allows for carrying a firearm when engaged in fishing, camping, or hunting.

Exceptions to the above restrictions may be allowed for official performance of duties with an approved exemption from EHS.

1.4.1.2 Allowable Uses

Uses that are allowed in the Conservation Areas, including around Lake Alice and its tributary creeks include:

- Passive recreational uses from dawn to dusk,
- Pets if leashed and cleaned up after, and
- Research projects or studies with an approved exemption from EHS.

1.4.2 Teaching and Research

In addition to recreation in the Lake Alice Watershed the Conservation Areas on campus provide a valuable outdoor classroom for experiential and hands-on learning for a diversity of classes across departments. Classes that have used the watershed for some portion of their teaching are shown in Table 4, although this list is not exhaustive. These areas are also used for a wide variety of research activities.

Table 4. Courses that Use the Watershed for Teaching

Course Name	Course Number
Introductory Botany	BOT2010
Practical Plant Taxonomy	BOT2710
Local Flora	BOT3151C
Individual Studies	BOT4905
Ecosystems of Florida	BOT5695
Vascular Plant Taxonomy	BOT5725
Entering Research in Biology	BOT6905
Environmental Planning and Design	EES4932/EES5307
Invertebrate Field Biology	ENY3163/ENY5164
Spider Biology	ENY4905/ZOO4926
Introduction to Fishery Science	FAS4305C
Fish and Limnology	FAS6932
Dendrology	FNR3131C
Natural Resources Sampling	FNR3140C
Forest Conservation and People	FOR3004
Forest Ecology	FOR3153C
Foundations in Natural Resources and Conservation	FOR3200C
Tree Biology	FOR3342C
Urban Forestry	FOR4090C
Forest Health Management	FOR4624C
Sustainable Ecotourism	FOR4664
Take a Hike	FOR4934
Physiology of Forest Trees	FOR6340
Horticultural Plant Morphology and Identification	HOS5117C
Environmental Plant Identification and Use	ORH3513C
Advanced Plant Identification	ORH4932/HOS6932
Plant Ecology	PCB3601

Section 2.0 Lake Alice Watershed Vision

On the University of Florida (UF) campus, Lake Alice and the creeks, ponds, and wetlands that flow to it are unique environmental resources that serve as a campus and community touchstone, while providing critical ecosystem services. Gainesville's plentiful rainfall supports these iconic campus landscapes including the majestic moss-draped live oaks, the cascading creeks with their ponds and waterfalls, Lake Alice, and the wildlife that lives there. The same rainfall that nourishes these ecosystems, also flows across the natural and built environment, becoming stormwater that can convey pollutants, cause flooding, and damage property. Management of stormwater is critical to protect life, landscapes, ecosystems, and infrastructure. Proactive stormwater management mitigates risks, improves resilience, and enhances the natural and built environments that support healthy ecosystems and provide meaningful user experiences on campus.

Development and implementation of the Lake Alice watershed management plan (WMP) will allow UF to manage the lake and its drainage features, and to respect this multifaceted role, while enhancing these environmental resources. The WMP will guide the University as it seeks to integrate the natural resources of the lake and watershed with those of the built environment to create a healthy and balanced urban ecology. The plan will:

- Clarify watershed terms and definitions,
- Establish benchmarks, thresholds, and metrics,
- Recommend collaborative strategies to improve stormwater conveyance, enhance water quality, and increase habitat and recreational value,
- Define management roles, responsibilities, and approval processes, and
- Identify funding sources and mechanisms.

As the University and Lake Alice continue to evolve, the WMP will adapt to achieve long-term incremental progress towards a healthy and well-balanced lake and watershed.

The overall vision is expounded by four vision themes that describe aspirational goals and focus for the plan strategies.

2.1 Environmental Conditions and Stormwater Management

Lake Alice is the heart of campus and symbolizes the University's dedication to environmental stewardship. The lake and watershed are inextricably linked to successful stormwater conveyance and treatment on campus and provide vital ecosystem services. Incorporation of green stormwater infrastructure, low impact development, and best management practices will reduce flooding, erosion, and sedimentation that impact the University's assets and the natural environment. A visible, successful, and celebrated stormwater system will further the University's educational mission by telling the stormwater story while showcasing a commitment to innovation and excellence.

2.2 Recreation, Access and Accessibility, and Education

Lake Alice and the Conservation Areas provide a unique network of natural spaces integrated within the built environment of campus. This proximity offers consistent connection to nature and recreational opportunities that further the University's academic mission and enhance well-being. Increasing accessibility, passive recreation, and intentional programming in and around these areas raises awareness and appreciation for the watershed and University while promoting natural discovery.

2.3 Conservation and Biodiversity

The extensive natural areas on campus are an integral part of the University and community experience. The protection and enhancement of these areas is essential to foster biodiversity, protect wildlife habitats, and expand connectivity. These ecologically diverse communities provide a living laboratory for outdoor learning and best management practices for urban stream ecology and wildlife movements.

2.4 Organizational Accountability, Collaboration, and Responsiveness

The University of Florida strives to have well-maintained buildings and a vibrant landscape that is functional and well-used. Extending this standard to all natural areas and stormwater features requires clear coordination, communication, and a responsive organizational framework. Stormwater management is a critical component of preserving and enhancing the campus experience and image. Successful management depends on assigned responsibility and funding that ensures necessary projects and upgrades can be made. Endorsement of an adaptive watershed management plan with dedicated, recurring funding acknowledges the ongoing nature of watershed stewardship.

Section 3.0 Watershed Recommendations

The University of Florida is a paragon of educational excellence in the State of Florida and recognized nationally as a preeminent public university. This reputation is based not only on academic and research achievements but also the campus experience which encompasses the facilities and natural setting. The University's location, in the heart of Gainesville, is characterized by the unique geology of North Central Florida and stream-to-sink watersheds. This hydrology is exemplified on campus by Lake Alice and numerous other sinkhole features that capture and provide attenuation for stormwater before it infiltrates to the Upper Floridan Aquifer, the principal drinking water source for North Florida.

Development on campus has occurred over more than 100 years with the original two buildings in 1906 expanding to over 900 buildings today. This growth has mirrored and largely fueled the urbanization of Gainesville. However, with expansion has come impacts to the natural environment on campus including changes in land use and increased stormwater runoff. The same topography that makes for a scenic campus creates challenges for managing the runoff generated from impervious areas.

Lake Alice, the primary waterbody on campus, functions as the primary stormwater feature, receiving, attenuating, and providing a degree of water quality treatment for stormwater generated from more than 1,000 acres of campus and some adjacent areas of the City. The streams that flow across campus and feed Lake Alice serve as the primary stormwater conveyances receiving stormwater from overland flow and stormwater infrastructure. Stormwater inputs have resulted in impacts to these waterbodies in the form of erosion, sedimentation, and water quality impairments. Additionally, the lack of holistic stormwater and watershed management across the built areas of campus has resulted in new infrastructure (buildings, parking lots, sidewalks, athletic fields, etc.) having impacts on existing infrastructure (buildings, roads, stormwater pipes, etc.). These impacts have included flooding, erosion, and in some cases structural failure. While these impacts are clearly observable in developed areas, most stormwater infrastructure exists underground and many of the natural stormwater conveyances on campus are located in Conservation Areas and out of sight.

To ensure that stormwater does not impede growth and development as the University continues to evolve, it will be critical to manage stormwater in a holistic manner that maximizes the ecosystem services provided by the natural stormwater infrastructure on campus while reducing the impacts that reduce these same ecosystem services. This WMP makes a series of recommendations to improve stormwater management through implementable actions that can be taken across the departments responsible for planning, design, construction, operations, and maintenance. Consolidation and funding of watershed management is also presented. These recommendations are described in the following sections.

3.1 Lake Alice Paradox

When considering stormwater management and the role of Lake Alice on the University of Florida campus there is a paradox.

How can Lake Alice be both a stormwater treatment facility and a lake claimed as both a Water of the United States (WOTUS) and a Water of the State (WOTS) that is classified as impaired. These apparent contradictions and their implications create an untenable permitting quandary.

Lake Alice is the permitted stormwater facility for the portion of UF's campus that drains to the lake and has been since 1987, with issuance of the first Master Permit for stormwater on campus. As a stormwater treatment facility Lake Alice cannot be classified as impaired because it is a permitted waterbody that provides water quality and water quantity treatment for development on campus.

However, the Lake has previously been designated as both a WOTUS and a WOTS, meaning it is a natural waterbody that must be managed to support the uses designated for the lake. The designation for Lake Alice is as a Class III waterbody with uses for "Fish Consumption, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife". Unless more stringent standards have been set for the waterbody, Class III waterbodies must comply with the criteria contained within 62-302.530 and 62-302.531 FAC. Based on the water quality standards that apply for Lake Alice, the lake is listed on the 303d verified list of impaired waterbodies for total phosphorus.

Factors that further complicate this assessment relate to the configuration of Lake Alice and the surrounding depressional basins on campus. These basins are closed, meaning that stormwater runoff is contained and infiltrates to groundwater rather than flowing to a surface waterbody. The open water portion of Lake Alice (WBID 2719A) and the surrounding Lake Alice Watershed (WBID 2719 – named Lake Alice Outlet) both drain to the Upper Floridan Aquifer. However, both areas and other depressional basins on campus are described as being in the Orange Creek Basin, although the waterbodies on campus have no surface water connection to the basin. Additionally, the Lake Alice Watershed lies outside of any currently mapped springs priority focus areas (PFAs) or springsheds. The combination of these factors indicate that Lake Alice should likely not be included in the Orange Creek Basin but would be better classified as in one of the springs BMAP areas, either the Santa Fe, Rainbow Springs and Rainbow River, or Silver Springs. These designations highlight the challenge of identifying the appropriate basin and relevant water quality targets for waterbodies located in partially-confined areas of the state with both closed and open basins.

3.1.1 The Lake Alice Future

The inherent contradictions that exist for Lake Alice necessitate a decision be made for how the lake will be managed. Either the University must fully commit to managing stormwater on campus in a way that complies with stormwater regulations to improve the health of the Lake, or the University must repeat their challenge to the WOTUS/WOTS designation, gain approval from FDEP and EPA, and successfully reclassify all or a portion of Lake Alice as a stormwater management system.

Current rule-making under the Clean Waterways Act, passed this year, will modify the ERP Applicant's Handbook to require 80% removal of TN and TP in stormwater projects that discharge to a hydrologic unit code (HUC)-12 basin that includes an impaired waterbody. In this scenario, UF would be required to provide water quality improvement as part of projects within the Lake Alice Watershed, or to have an alternative watershed management plan approved and achieve post-development loads less than or equal to pre-development loads. These new requirements will be challenging to achieve in many areas of campus but striving to meet them will improve water quality and environmental conditions in a way that benefits the University in the future.

The recommendation of this project is that UF implement a comprehensive WMP that addresses stormwater and the environment as assets that enhance the campus experience and aesthetic. As a preeminent institution, the University can be a model for stormwater innovation and implement cutting-edge solutions that enhance water quality and natural spaces on campus in a way that highlights environmental stewardship and promotes research and learning. While this approach will involve numerous projects on campus and extensive capital expenditures, the long-term benefits of these actions will result in a sustainable stormwater solution on campus that reduces O&M and stormwater-related repair costs, while improving campus for students, faculty, alumni, and the community at large.

3.1.2 Effects of Climate Variability on Campus Stormwater

Modeling scenarios in process, results will be incorporated in final report.

3.1.2.1 Climate Effects without Stormwater Interventions

Modeling scenarios in process, results will be incorporated in final report.

3.1.2.2 Climate Effects with Stormwater Interventions

Modeling scenarios in process, results will be incorporated in final report.

3.2 Stormwater Project Recommendations

Proactive and effective stormwater management is imperative to allow the University to fulfill its educational and research missions. Without reliable and resilient stormwater management; there will be continued impacts to infrastructure, utilities, and personnel. These impacts result in capital costs to repair damage and correct deficiencies, increased operation and maintenance costs to keep marginal systems functional, and lost time for impacted staff and students.

Stormwater project recommendations were developed based on prioritization and ease of implementation. Projects were categorized as follows:

- Critical Projects: Required immediately to replace failing infrastructure.
- Near-Term Projects: Smaller or easier to implement projects with lower anticipated capital costs.
- Medium to Long-Term Projects: Larger projects that will be more expensive, are expected to take longer to implement and permit, or are likely to be phased.

3.2.1 Critical Projects

Projects identified as critical projects are needed to address failing infrastructure and life safety issues. All of the critical projects address extreme channel erosion. The University has successively completed similar repair projects in the past at Reitz Union Ravine, as shown in Figure 4, and at Diamond Creek. Critical projects were identified based on feedback from the Project Team and verified with site visits. This section discusses the problems at each location and the proposed approach to fix these areas including recommended next steps. Identified critical projects were:

- Jennings Creek Headwall Failure and Channel Erosion

- Graham Woods and Keys Complex Erosion and Channel Stability
- McKnight Brain Institute Channel Erosion

Figure 4. Reitz Ravine Repair and Stabilization Before and After

3.2.1.1 Jennings Creek Headwall Replacement and Step-Pool Stabilization

Jennings Creek is one of the primary creeks on campus that conveys stormwater to Lake Alice. The creek begins at Yulee Pit, located just west of SW 13th Street, and flows through a 48" pipe under Museum Road, northwest of Beaty Towers. At the downstream end of the pipe under Museum Road, the headwall that supports the pipe has collapsed and created a separation in the last joint of the pipe (Figure 5). This collapse is due to the volume and velocity of stormwater moving through this pipe which falls on an unprotected creek bed and has caused the erosion of material that previously supported the headwall. During a site inspection on July 5, 2023, the pipe was evaluated using a remotely-operated camera. At that time, it was determined that no additional pipe joints were separated. Upon inspection of the channel further downstream, a failed weir stretches across the creek. This feature appears to have historically backed water up creating a pool that would have absorbed the energy coming through the Jennings Creek pipe. This weir appears to have failed due to water eroding around the weir, which resulted in bank instability and the loss of trees along the channel edge. The loss of this pool subsequently resulted in the erosion of material supporting the headwall and the current condition of the headwall.

Figure 5. Jennings Creek Headwall Separation

The proposed project in this area consists of a series of step-pools with a new headwall installed on the Jennings Creek pipe. The conceptual design performs two necessary functions. The headwall replacement is necessary to allow flow through the pipe without additional upstream failure that might affect the integrity of the pipe and Museum Road. Pairing this replacement with the step-pool design will allow for energy dissipation on the downstream end of this pipe to protect the headwall and downstream channel. Rather than the rock and concrete weir that existed downstream on Jennings Creek previously, this project proposes to use sheetpile overflow structures installed perpendicular to the direction of flow and beyond the edge of channel to ensure that flows will not erode around or underneath the wall. The sheetpile will be topped with cemented stone to improve aesthetics in the installed system. The existing steep creek banks, depending on location, will be either laid back (slope decreased) or will have gabion baskets to retain the slope and to ensure bank stability. In both cases naturalized native planting will be used to increase habitat value, enhance slope stability, and improve aesthetics. The conceptual layout for this feature is shown in Figure 6. The figure includes the conceptual layout for the trails as shown in the Campus Trails Master Plan. The northern-most trail may need to be revised to ensure the trail supports do not increase scour at the toe of the west creek bank.

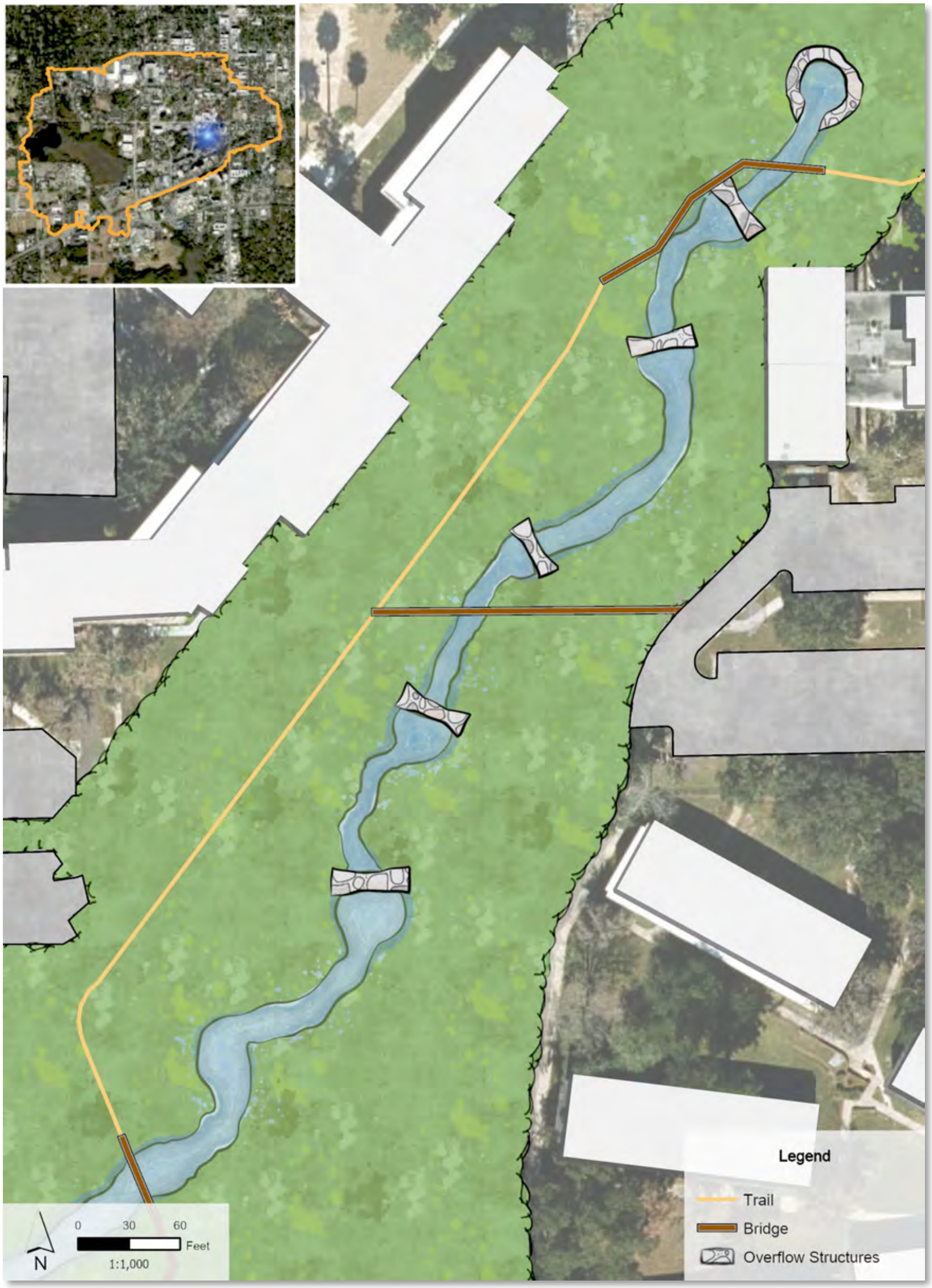
Legend
Trail
Bridge
Overflow Structures
N
0
30
60
Feet
1:1,000

Figure 6. Jennings Creek Headwall and Step-Pool Improvements

3.2.1.2 Graham Woods Stabilization

Graham Woods is located south of Stadium Road with Tolbert Hall to the east and the Keys Complex to the west. This is a relatively steep-sided depressional feature with a creek that flows through the bottom of the depression south toward Graham and Hume Ponds and ultimately to Lake Alice. The top of the north bank is at 136 feet NAVD 88, while the toe of slope is approximately 105 ft NAVD 88 at the north end and 97 ft NAVD 88 at the far south end. The bottom of Graham woods is gently sloped with a braided stream channel. Stormwater and excess irrigation water enters this feature from development along the border of Graham Woods and to the north of Stadium Road. At least 15 pipes enter Graham Woods from the north across Stadium Road and from developed areas along both sides of the Conservation Area. Stormwater leaves Graham Woods through a 48-inch reinforced concrete pipe (RCP) at the south end of Graham Woods. The 48-inch RCP runs under the foundation of Graham Hall. During large storm events, Graham Woods floods; the 100-year floodplain elevation is 101.3 ft NAVD 88.

Of the 15 pipes known pipes that enter Graham woods, all of them terminate upslope of the channel, and nearly all of them terminate outside of the jurisdictional wetland. This configuration has resulted in substantial erosion and bank instability on the perimeter of Graham Woods. At the northwest corner of Graham Woods, stormwater that bypasses inlets along Stadium Road is directed through a curb cut along the Keys Complex maintenance drive and into a vegetated area along Graham Woods. With the construction of the Heavener Football Complex and Student Health Care Center north of Stadium Road, additional stormwater was routed to this location which has resulted in an erosive channel forming along this surface drainage feature. Following initial channel formation, subsequent storms have contributed to additional erosion resulting in a vertical-walled channel approximately six feet deep that extended all the way back to the Keys Complex Drive (Figure 7). This feature exposed a communications conduit and was beginning to undermine the curb cut. Facilities Services used aggregate to form a temporary repair to reduce the potential for additional damage near the driveway.

Figure 7. Keys Complex Erosion

The resulting channel continues into Graham Woods and has resulted in the loss of soil supporting large trees within the Conservation Area and caused their collapse. The termination of this erosive feature is a deep stormwater feature with a sand-cement riprap wall and two additional pipe outlets (Figure 8). At this location the higher elevation pipe outlet is collapsing into the deep feature and there are apparent bank stability issues due to the near vertical sides of the stormwater feature. While temporary fencing has been installed to reduce access, the fence has been repeatedly damaged by people to allow access.

Figure 8. Graham Woods Erosion and Pipe Outlets

The proposed project in this area includes construction of one or more grade control structures in the bottom channel. Concrete structures, such as baffled end walls and riprap aprons will provide energy dissipation for stormwater inflows and will provide erosion protection for the various stormwater pipes that currently discharge into Graham Woods. To reduce erosion along the edges of Graham Woods, the side slopes will be recontoured and strategically hardened with gabion baskets, stormwater pipes will be extended with inverts lowered to enter the bottom of Graham Woods, and native vegetation will be installed to secure soils. Native plantings will also be used to restore habitat value and to improve aesthetics and recreational opportunities. To address upstream stormwater inflows, inlets along Stadium Road will be milled to capture flow more effectively, and a new stormwater inlet and pipe will be considered along the Keys Complex driveway to route flows into one of the existing stormwater inflow pipes rather than overland. Ideally the proposed project will also re-route the stormwater conveyance around, rather than under Graham Hall. The proposed concept for Graham Woods is shown in Figure 9.


Legend
Trail
Gabion Baskets
Overflow Structure
Creek
Pools
Sheetpile
0
50
100
Feet
1:1,600
N

Figure 9. Graham Woods Stabilization and Stormwater Basin

3.2.1.3 McKnight Brain Institute Erosion

The McKnight Brain Institute is located downstream of the confluence of Jennings and Diamond Creeks. In this location the sidewalk was constructed into the wetland that buffered the creek channel. The earthen embankment next to the sidewalk was constructed at a steep bank and included utilities between the sidewalk and the creek. The creek has eroded the toe of slope due to sheer stress, and changes in the flow characteristics of the system. This has resulted in flows being directed toward the edge of the sidewalk which has exposed utility conduits (Figure 10). This erosion risks undermining the existing sidewalk, and if it migrates further, a road and loading dock may be impacted.

Figure 10. Lake Alice Creek Along McKnight Brain Institute Sidewalk

Facilities Services proposed a repair for this location which would have included installation of earth-filled bags that would stabilize the failing slope, protect the conduits, and allow for establishment of vegetation over time. This concept, shown in Figure 11, was submitted to the SJRWMD along with a request for an exemption for shoreline stabilization. Unfortunately, the proposed project does not meet the requirements for the exemption.

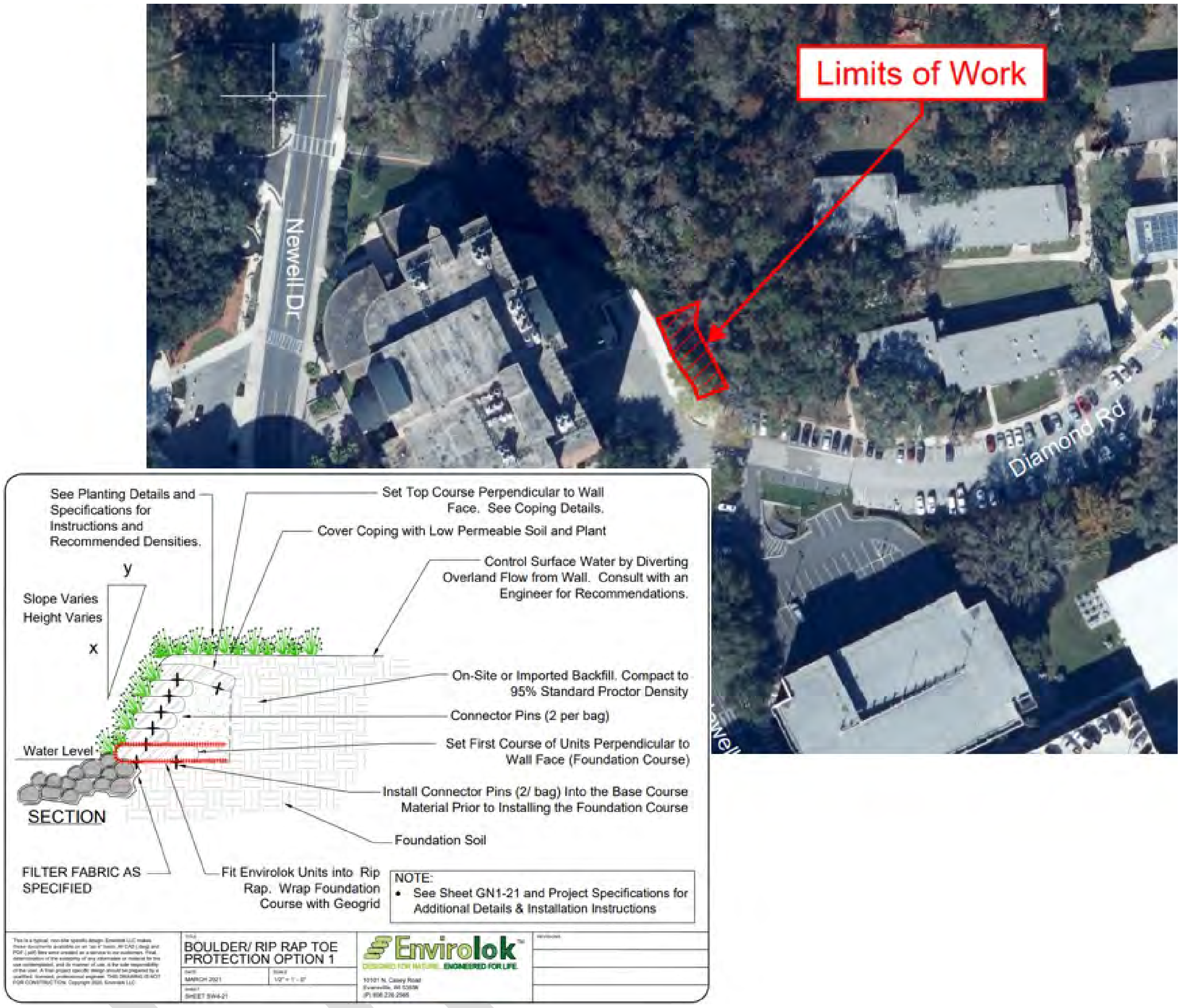

Figure 11. McKnight Brain Institute Proposed Creek Bank Stabilization (adapted from University of Florida, 2021)

It is recommended that this project have a design completed and that the University apply for a general permit (62-330.451 F.A.C.). In this location a repair that includes channel stabilization upstream may help re-direct flows away from the sidewalk. This may be accomplished with a sheetpile weir and limited excavation to remove accumulated sediments within the adjacent riparian area. This repair should be accompanied by slope stabilization, or hard armor, along the sidewalk to provide a long-term solution in this area.

3.2.2 Near-Term Projects

Projects identified as near-term projects are needed to address permitting/regulatory requirements, have been previously discussed and identified as opportunities, or are expected to be relatively low-cost. These recommendations include projects that are site-specific, but also stormwater management approaches that can be implemented more broadly throughout the watershed. The identified near-term projects include the following:

- Yulee Stormwater Park,
- Lake Alice South Stormwater Wetland,
- Site-Specific Stormwater Management,
- Dispersed Stormwater Management, and
- Sediment Traps at Lake Alice.

The near-term projects are described in detail below.

3.2.2.1 Yulee Stormwater Park

Yulee Pit is located north of Museum Road and west of SW 13th Street. This feature is a large depressional area that is the headwaters of the Jennings Creek which begins on the south side of Museum Road. This large depressional feature appears, based on historic aerials, to have been a seepage slope wetland that was dewatered by ditching through the wetland to Jennings Creek prior to the 1940s. Development has largely encircled this site which is in a high visibility area at one of the primary entrances to campus.

The recommended project at this location is a stormwater park that includes an open-water feature, fountain/aerator, littoral fringe, stabilized slopes, and human use features. Development of this feature will serve four primary purposes: increasing storage in the headwaters of Jennings Creek, dissipating energy associated with new multi-story development, improving water quality, and creating an inviting and accessible gateway to UF. This feature was conceptualized as a stormwater amphitheater with slopes stabilized and landscaped to provide a functional outdoor space for recreation, relaxation, and outdoor learning. Trails would be developed to connect adjacent buildings efficiently, but with overlooks of the park-like setting. The concept developed for this location is shown in Figure 12.

Figure 12. Yulee Stormwater Park

3.2.2.2 Lake Alice South Stormwater Wetland

The Lake Alice South Conservation Area is located between Archer Road to the south and Mowry Road and Lake Alice to the north. This area receives both seepage and stormwater flow from Archer Road that drain to Lake Alice. Because of the urban interface along Archer Road, this site receives a large amount of trash that enters the Conservation Area and flows toward Lake Alice. As with many channels on campus the higher elevation areas of this channel have been significantly eroded with sediment deposited in lower, flatter reaches of the stream. This has resulted in braiding and migration of the channel before it reaches a flat forested wetland and then Lake Alice.

The proposed project in this area is installation of a trash trap downstream of Archer Road and an expansion of the wetland to include upland and grassed areas downstream of a former culvert and road crossing that has eroded and failed (Figure 13). Installation of a trash trap will provide capture of much of the trash that currently migrates to Lake Alice and will facilitate efficient collection and disposal of the accumulated material. Given that this trash is generated from Archer Road, discussions should be initiated with FDOT to install and maintain this system. Repair of the existing creek crossing and expansion of the wetland will provide several benefits to the watershed and Lake Alice. These include improved water quality, increased stormwater storage, and creation of a passive use wetland park and recreational amenity in the southern portion of campus. The proposed layout in this location is shown in Figure 14.

Figure 13. Washed-Out Dirt Road in Lake Alice South Conservation Area


Enhanced
Wetland
Legend
Trail
Bridge
Culvert
Utility Road
Overlook
Sediment Basin
Trash Trap
Surveyed Wetlands
0
40
80
Feet
1:1,543
N

Figure 14. Lake Alice South Stormwater Wetland

3.2.2.3 Site-Specific Stormwater Management

The 2010 Master ERP is currently being renewed with a new Stormwater Master Plan Conceptual Permit expected to be issued in 2024. This new permit is expected to modify the way that individual projects for new construction or redevelopment are permitted on campus. As previously described, the current permitting process relies on Lake Alice being permitted as the wet detention pond for all development within the watershed, with the lake providing water quality treatment and storage. The new permit will continue to have Lake Alice permitted as the stormwater pond, but because of the documented impairments the lake will require water quality treatment on-site for each new project constructed in the watershed. Because of this requirement any new project or redevelopment will have to apply for either an individual permit, or if it qualifies, a general permit. Treatment will be required for the first 1 inch of runoff over the entire site area or for either 1.25 or 2.5 inches of runoff from the impervious area, depending on the treatment system, whichever is greater.

3.2.2.4 Dispersed Stormwater Management

The University of Florida is a highly developed campus that includes buildings and infrastructure constructed over more than 100 years. Because of the high intensity of development on campus, opportunities for implementing large stormwater projects are limited to either natural areas, un-built areas of campus, or within the footprint of structures that are to be demolished. Despite the lack of opportunities for developing large projects there are numerous opportunities to install smaller, low impact development (LID)/green stormwater infrastructure (GSI) projects on campus. These features offer the opportunity for dispersed stormwater management that can be implemented to provide treatment, reduce runoff volumes, and reduce peak flows. The University had a LID manual developed in 2010 (Causseaux, Hewett & Walpole, Inc., 2010). This manual offers recommendations on a wide variety of LID opportunities and recommendations on implementing these features on campus.

Figure 15. UF Southwest Recreation Center Rain Garden (The Nature Conservancy, n.d.)

Available forms of LID/GSI that would be optimal for developed areas of campus include bioretention, rain gardens, vegetated swales, curb cuts with recessed median storage, and permeable pavement. The Southwest Recreation Center has a rain garden, as shown in Figure 14. Many of these practices can be incorporated in the existing landscape through minor changes to grade, slopes, and small structural modifications. As an example, the surface parking lot at the O'Connell Center currently includes vegetated swales and curb cuts. However, the structures that convey this water into the stormwater network are at or near grade, meaning that minimal water is stored in these features before discharge. By modifying these structures to increase the grate elevation with incorporation of a lower elevation orifice these features could be designed to provide storage while still draining back to the bottom of the swale within 48-72 hours. Another opportunity available in many locations on campus are vegetated landscaped beds that are often bordered by brick edging or seat-walls. These areas could be re-designed to have grades lowered with curb cuts to allow for water to enter these areas during storms with water either infiltrating or being under-drained into the stormwater network in a more controlled fashion.

3.2.2.5 Sediment Sumps

To reduce sediment loads and associated nutrients from entering Lake Alice it is recommended that maintainable sediment sumps be constructed near the terminus of Lake Alice Creek and Fraternity Creek. Hume Pond effectively functions as a sediment trap for Hume Creek and the Graham Ponds provide this function for the creek through Graham Woods. These new sumps would be used to capture sediments and would provide an easily maintainable feature for removing sediment and the associated nutrient loads before it reaches Lake Alice. Potential implementation locations are shown in Figure 16.Figure 16 These features could also be added before Hume Pond and in the Graham Creek drainage to ease sediment maintenance without requiring frequent pond dredging.

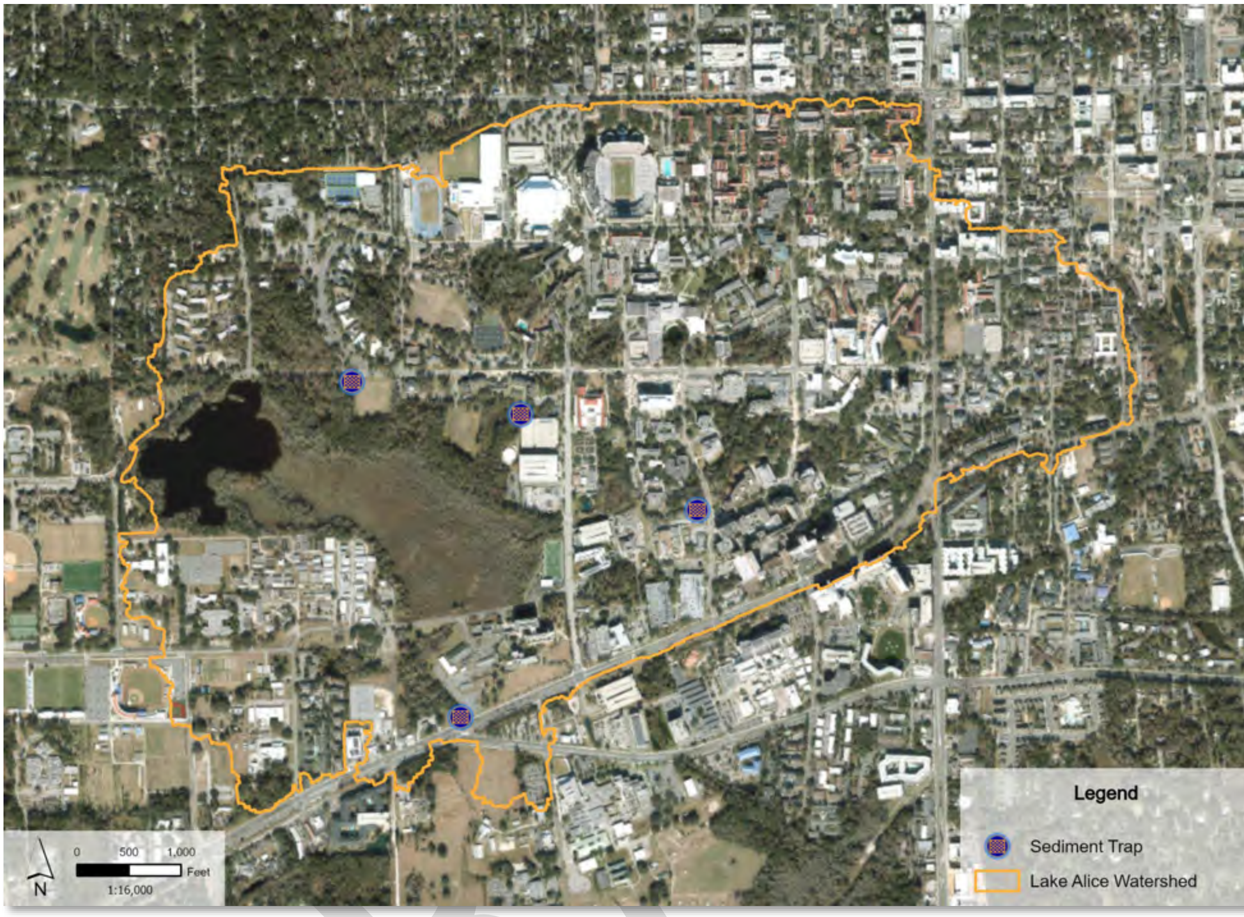

Figure 16. Potential Creek Sediment Sump Locations

3.2.3 Medium and Long-Term Projects

The level of development on campus means that there is a need for larger, comprehensive solutions that are expected to take committed capital funding over years. These projects are aimed at stabilizing channels and providing stormwater treatment on a scale that will protect infrastructure moving forward and improve water quality in downstream receiving waterbodies including Lake Alice and the Upper Floridan Aquifer. The scope and scale of these projects, like that of many buildings on campus, are grand and these projects will come to define the University's commitment to a vision of campus and its natural areas that preserves these places for the generations of students to come. The proposed medium and long-term projects include the following:

- Complete Creek Stabilization,
- Creek Daylighting,
- Lake Alice Dredging,
- Campus Mitigation Bank, and

- Regional Stormwater Treatment

The medium and long-term projects are described in detail below.

3.2.3.1 Complete Creek Stabilization

All the steep gradient creeks on campus have been impacted by increased stormwater flows that have caused erosion, sediment transport, and elevated phosphorus concentrations associated with scouring of the phosphorus-rich Hawthorn Formation. This recommendation extends the step-pool stabilization concept proposed for Jennings Creek, Diamond Creek and Graham Woods across campus to all impacted creek systems. These projects should be implemented with construction beginning at the upstream extent of each creek and progressing in a downstream direction. These projects should be designed with a consistent aesthetic in materials and stabilization methods.

These were considered as medium- to long-term projects based on the expectation that they would be phased based on available funding. Where possible, it is recommended that these projects be developed for complete segments of creeks in a single phase to reduce repetitive and overlapping impacts in Conservation Areas and to allow for installation of user access features in association with the stabilization projects. Creeks where this approach is recommended include Jennings Creek downstream to the junction with Diamond Creek, Diamond Creek downstream to the junction with Jennings Creek, Lake Alice Creek from the junction with Diamond and Jennings Creek to Center Drive, Hume Creek to Hume Pond, the creek in Graham Woods, and Fraternity Creek to Museum Road. These creek segments are shown in Figure 17.

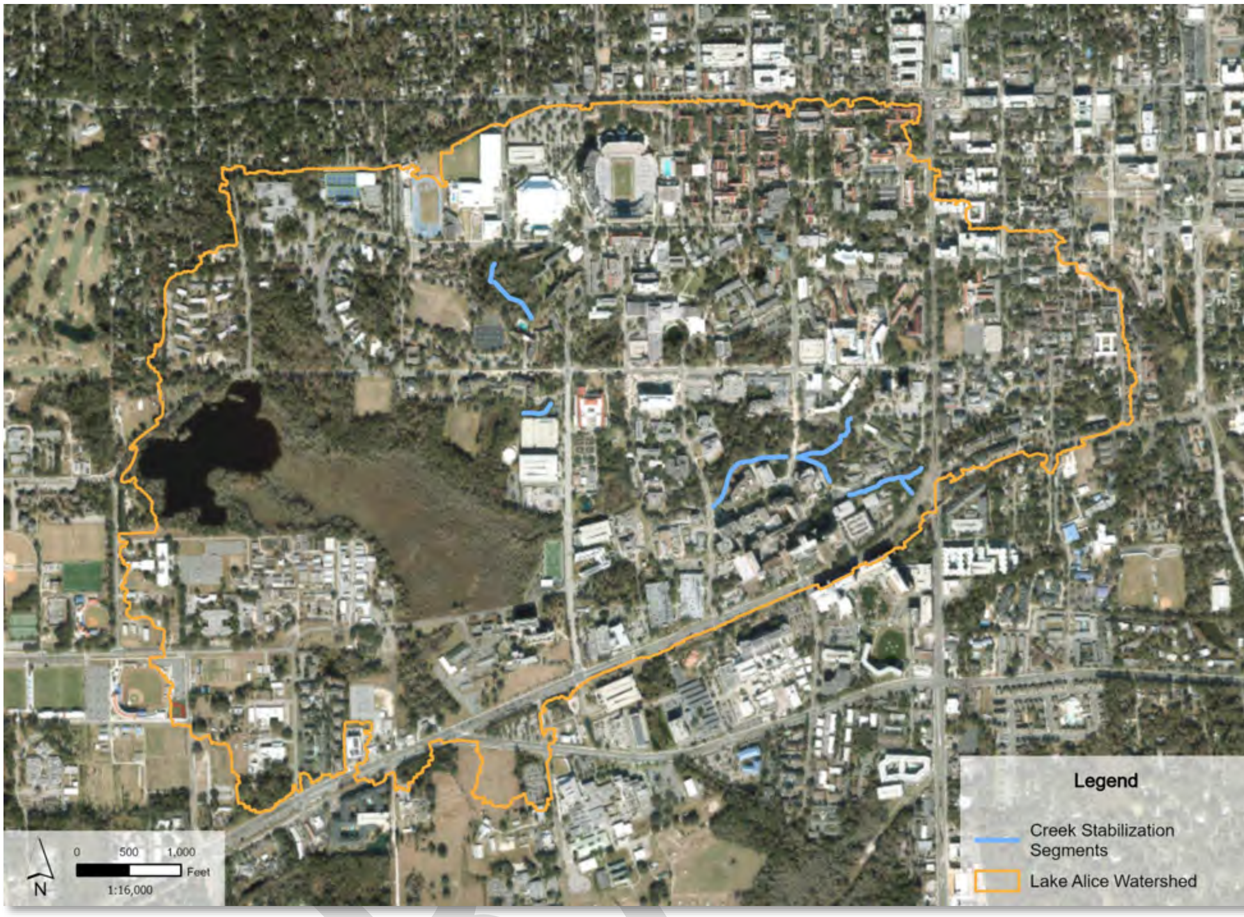

Figure 17. Creek Segments Recommended for Stabilization

3.2.3.2 Lake Alice Dredging

Increases in stormwater flows in channels and across steep slopes on campus have resulted in substantial erosion. This eroded material has been deposited in downstream waterways including low-gradient sections of creeks and in Lake Alice. When not removed, this sediment results in a loss of storage in creeks and the lakes and an increase in channel elevations that can cause channels to jump their banks and carve new channels resulting in additional erosion. For any material that is not removed upstream, the ultimate destination for this material is the lake.

The most recent bathymetric data available for Lake Alice is from a LakeWatch data collection effort in 2000 (LakeWatch, 2000). These data, when compared to bathymetric data shown in a 1975 study of the lake (Mitsch, 1975), show a decrease in depth in the northern portion of the open water section of Lake Alice by 2-4 feet. This decrease in depth is in the vicinity of the inflow from a large stormwater pipe near Harmonic Woods and Village Drive. In addition to the discharge of mineral sediments into the lake, there is a history of eutrophication and expansion of floating aquatic plants on the lake. As these plants senesce seasonally or die due to herbicide treatment, they sink, adding organic sediments to the lake bottom and imposing an oxygen demand on the water column. This material settles creating a flocculant layer that provides nutrient recycling and enrichment. In the case of Lake Alice both the organic and mineral sediments have the potential for contamination due to the extensive history of campus and the historical use of chemicals, pesticides, and treated materials, as well as direct discharge of wastewater to the lake, untreated and treated, for decades. Particularly in the context of wastewater discharges, phosphorus was contributed at high concentrations to the lake for a long period of time. It is expected that this legacy phosphorus is at least partially to blame for current algal blooms observed during dry periods.

The primary way to manage sediments in lakes is using suction dredges to remove the material with dewatering conducted in geo-tubes. A separate method that can be used to bind nutrients without removal is application of materials that bind to the phosphorus, effectively controlling the release of these nutrients back to the water column. This study does not recommend dredging of the lake, but includes the following recommendations with regard to studying lake sediments:

- Collect bathymetric data to better understand the current depths in the lake and the potential need for sediment management.
- Collect cores across the lake to understand the chemical makeup of sediments that might be removed and parameters that might require special handling. Based on a core collected and analyzed in August 2023 by LakeWatch and the Geological Sciences Department, no specific chemicals of concern were identified, although additional analysis was recommended.
- Developing an estimate of accumulated sediment depth across the lake based on collected cores.
- Evaluate permitting approach and feasibility including a pre-application meeting with the SJRWMD.
- Develop an estimated cost for dredging based on sediment quality and required disposal.

After completing these analyses, the goals and objectives of dredging should be considered, and a decision should be made about moving forward. It is not the recommendation of this study that dredging proceed until the above data are collected and dredging costs are fully evaluated.

3.2.3.3 Campus Mitigation Bank

The Lake Alice Watershed includes approximately 123 acres of wetlands and the main campus includes approximately 196 acres of wetlands based on the wetland delineation of campus completed by WSP in 2023 for renewal of the stormwater permit (WSP, Inc., 2023). Given the acreage of wetlands on campus and the potential need for work in and around these areas associated with stormwater management and future development, it is the recommendation of this study that as the University begins to develop large stormwater projects on campus (e.g. Yulee Stormwater Park and Lake Alice South Stormwater Wetland) that include wetland components or enhancements, that a wetland mitigation bank be developed for campus.

Campus is located in an area that is outside the service boundary for any permitted mitigation bank. As such, the only option for projects that include wetland impacts is to provide project-related improvements, enhancement, or creation of wetlands that compensate for the proposed impacts. Development of a mitigation bank has the potential to provide larger wetland mitigation projects that will provide additional benefits and habitat that is of higher value than small mitigation efforts that provide limited benefits. Additional mitigation credits could also be developed as part of Conservation Area maintenance including the removal of invasive vegetation, re-vegetation, and stream stabilization.

Creation of a wetland mitigation bank for the University can be permitted as part of the proposed projects with credits usable only by the University. This would include calculation of wetland impacts for the proposed projects and estimates of the post-project wetland credits based on the Uniform Mitigation Assessment Method (UMAM). The credits developed for the mitigation bank project would then be requested as part of the ERP to be reserved for additional projects by the University of Florida on campus.

Development of mitigation credit requires an ongoing commitment to the maintenance of mitigation features in perpetuity. Typically, a minimum of five years of post-project annual monitoring is completed with success and sign-off from the regulatory agencies if the mitigation success criteria are met. This includes vegetative maintenance including maintaining minimal coverage by invasive, exotic vegetation. The implications of these requirements should be considered in the context of establishing a mitigation bank or mitigation projects.

3.2.3.4 Regional Stormwater Treatment

A large portion of the UF campus is already developed in a high-intensity manner. This is particularly true within the health science area and in the northeast portion of campus. These areas are collectively known as the “Red Box” within the Campus Framework Plan targeted for additional infill development. Because of their current condition, these areas offer limited opportunities for developing stormwater projects to meet the needs of re-development and infill. To accommodate projects in these and other highly developed areas it is recommended that the University develop regional stormwater projects for each of the primary drainages on campus. This approach would provide credit basins that could be used to meet the needs of future development without on-site, project-specific treatment. This approach is frequently used in highly developed areas like the City of Gainesville (e.g. 5th Avenue Stormwater Park and Depot Park Stormwater Park). For each of the drainages, a larger project would be developed lower in the watershed with credits derived based on the amount of water captured and the treatment implemented. Potential locations for implementing these projects are shown in Figure 18.

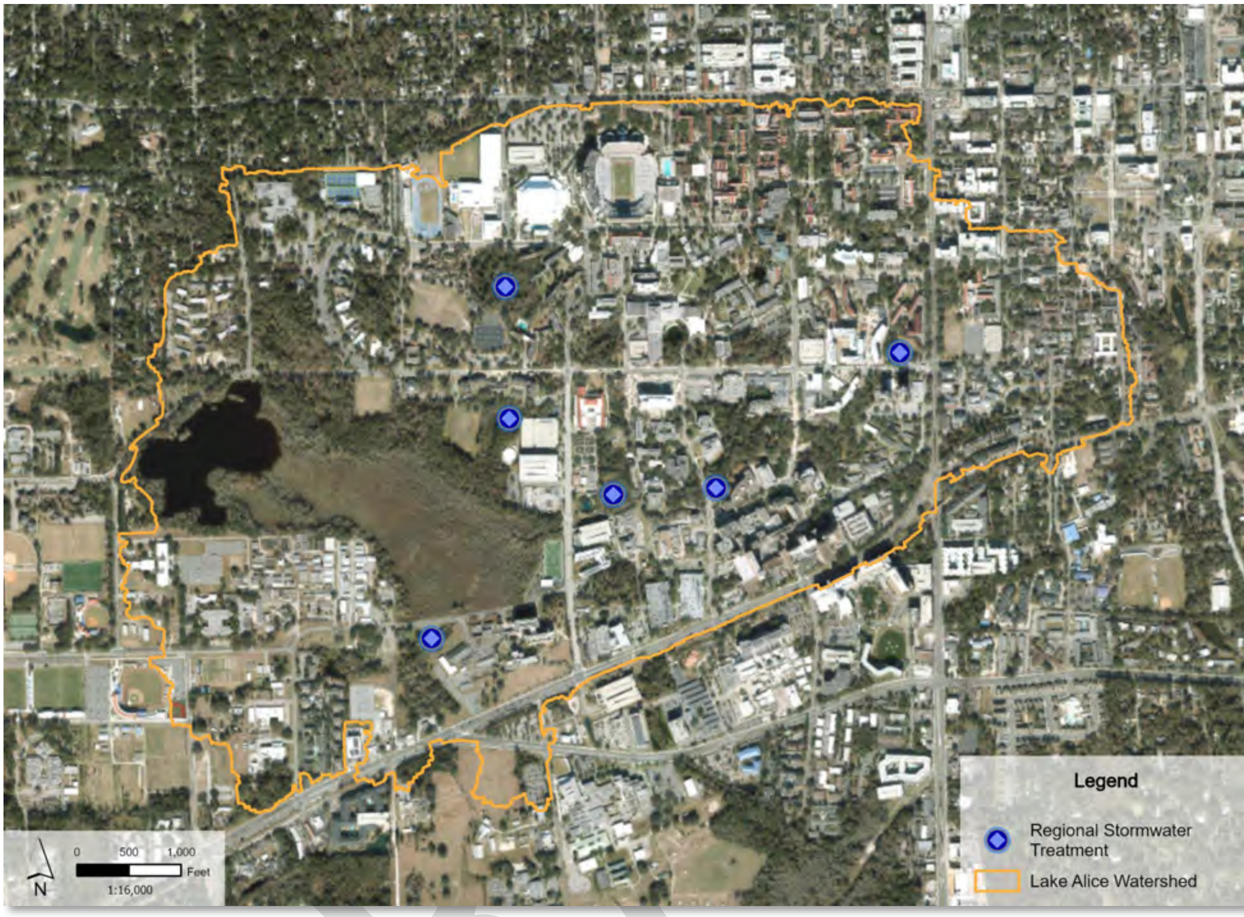

Figure 18. Potential Regional Stormwater Project Locations

The recommended projects in these areas could include a combination of wet detention, bio-retention, swales, stormwater wetlands, and dry retention. These treatment methods could be combined in series or implemented individually depending on location, site conditions, and project goals.

3.3 Water Quality Source Control Recommendations

The Lake Alice Watershed has a history of nutrient enrichment from the application of wastewater to Lake Alice until the wastewater was re-directed to the R-2 well in 1995. Since that time, primary sources of nutrients in the watershed have been from reclaimed water application on campus, erosion of the phosphorus-rich Hawthorn Formation in the creeks, and fertilizer application and runoff. This section discusses each of these sources and provides recommendations for controls. Given a lack of continuous data collection on campus, the best available information on nutrient sources and quantities was from the Waters of the University of Florida report (Wells et al., 2006). This report presented data collected in 2003-4 for 15 locations across the watershed. Three of these locations (Hume Creek, Medicinal Garden – Up, and Medicinal Gardens – Down) were observed to have significantly elevated concentrations of nitrogen with several separate stations showing elevated concentrations of phosphorus (Pony Field, Golf

Course Pond, Golf View Creek, 7th Fairway, and Shop Storm Pond). The source of the elevated nitrogen levels was evaluated further and believed to result from fertilization of athletic fields within their drainages. Each of the potential sources and possible controls is discussed in additional detail in the following sections.

3.3.1 Fertilizer Application and Irrigation

There are a variety of fertilized spaces on campus. Based on focus groups held with both UAA and Rec Sports, fertilizer is currently applied to all grass sports fields. Potentially exacerbating this application is that fertilizer is applied to fields that are under-drained and that are also irrigated. The UAA is charged with maintaining fields associated with the sports that are organized through the University including: football, baseball, softball, soccer, track, and lacrosse. Based on conversations with the UAA, fertilizer is applied to maintain turf condition. Soil testing is performed as part of this effort. UAA indicated that all fields use soil moisture sensors and that the fertilizer applied is the slow-release variety with some addition of foliar fertilizer. Some fields have also been amended with *Comand™* compost to reduce the need for fertilizer and water. Records are kept of fertilizer application and were requested but not provided by UAA for inclusion in this report. Soccer, Lacrosse and softball fields are irrigated with reclaimed water and the remaining fields have separate wells managed by UAA.

Rec Sports maintains Lake Alice Field, Flavet Field, and Hume Field within the Lake Alice Watershed. These fields are all fertilized between April and October using three different fertilizers depending on the month. Two of the three fertilizers are controlled release. All four fields have the potential to direct water toward the lake or toward stormwater features that direct the water toward the lake. Hume Field is not irrigated, but the remaining fields are all irrigated with reclaimed water. Soil moisture sensors and rainfall shut-offs are used on irrigated fields. Soil testing is conducted by IFAS 2-3 times per year. Nitrogen in reclaimed irrigation is not considered in the nutrient budget for the fields.

The following recommendations are made regarding fertilizer application on campus:

- Both UAA and Rec Sports should collaborate with IFAS with the specific goal of reducing fertilizer use to the maximum extent possible on all their managed fields.
- All fields that use reclaimed water should account for nutrients in the applied water when considering fertilizer needs.
- Irrigation scheduling post-fertilization should be optimized to reduce infiltration past the root zone and to eliminate runoff.
- All under-drained fields should have samples collected in their drainage system to evaluate the nutrient content of runoff.

3.3.2 Reclaimed Irrigation

Reclaimed irrigation is used extensively on campus to meet the irrigation demands of landscaped areas and the previously described athletic fields. The use of reclaimed is beneficial from the standpoint of reducing the use of potable water for irrigation but has the potential to increase nutrient loads if not properly managed and could violate the University's wastewater disposal permit. Reclaimed water is not permitted to enter any surface waters including creeks or Lake Alice without an NPDES permit for discharge and the University does not have an NPDES permit for discharge to Lake Alice, except for lake level control below an elevation of 69.5 feet (assumed to be NGVD29, but unspecified). Data were not collected on all reclaimed users on campus. The following recommendations will help reduce concerns with reclaimed irrigation.

- All sprayheads should be carefully aligned to irrigate vegetation and avoid irrigating hard surfaces.
- All irrigation systems should employ rainfall sensors that immediately discontinue irrigation after a threshold of 0.125" of rainfall is detected.
- Soil moisture sensors should be installed for all irrigated areas over one acre with irrigation discontinued as soon as the soil reaches field capacity.
- No more than ¾" of irrigation should be applied per irrigation day and irrigation should occur no more than twice per week.
- Regular inspections of reclaimed irrigation infrastructure should be completed to identify leaks or line breaks.
- Reclaimed water observed in creeks or the stormwater system should be traced back to their origin with repairs or modifications made to eliminate runoff of reclaimed water.
- All under-drained fields should have sensors installed in the under-drain system to stop irrigation as soon as water is sensed.

3.3.3 Erosion in Creeks

Increased flow rates in the stormwater system have resulted in erosion in many of the creek channels on campus. Much of the University is underlain by the Hawthorn Formation, a phosphorus rich clay unit. Erosion of surficial soils in many of the creeks has resulted in this layer being exposed and scoured, which results in mobilization of phosphorus into downstream waterbodies. Erosion and recommended improvements to reduce erosion are discussed throughout this section. These recommendations are not repeated here, but any measures to reduce erosion in the watershed should reduce this source of phosphorus.

3.4 Design and Review Recommendations

Given the size of campus and the University's ownership of almost all the property on the main campus, stormwater management and permitting are different than for other local areas. These differences mean that there is less oversight by permitting agencies and increased responsibility for the University to oversee stormwater management and impacts of their actions on other University assets.

Complicating stormwater management on campus is the design process, which considers stormwater differently depending on where projects are located. For projects within the Lake Alice Watershed, Lake Alice is considered the stormwater treatment system, with the creeks that feed the lake acting as principal stormwater conveyances. Projects in this basin have historically just listed the lake as the stormwater management system with a requirement to report annually on the additional area of impervious surfaces added to each subbasin of the lake. The same general approach has been applied within the depressional basins on campus that remain wholly on University property. For depressional basins that include areas not owned by the University, or that flow to urban creeks (Hogtown or Tumblin), projects are required to apply for individual permits from the SJRWMD and comply with stormwater permitting requirements under Chapter 62-330 FAC. This approach is being modified as part of the current permit renewal process, which will require a separate stormwater permit for each new project constructed anywhere on University property.

The current stormwater approach has been developed based on Lake Alice being treated as a stormwater feature that functions as a wet detention pond serving the entire watershed. Because the lake acts as the stormwater management feature, the creeks in concert with pipes and constructed channels act as stormwater conduits that route flows from developed areas to the lake. Since nearly all property is owned by the University, the ability for the creeks and associated stormwater pipes/channels to convey more flow without causing or exacerbating issues in the stormwater system are not considered. This means that additional runoff volume, higher energy flows, and/or higher peak flow rates are not required to show adequate capacity within the conveyance system. This has resulted in substantial damage within the conveyance system including erosion in the creeks, damaged stormwater infrastructure, and downstream flooding.

The following recommendations would increase accountability and oversight of stormwater and reduce the potential for new or worsening impacts. The following sections include recommendations focused on the design and review process, operations and maintenance, funding stormwater, and stormwater management during construction.

3.4.1 Stormwater Modeling Recommendations

The University of Florida contracted with Jones Edmunds to develop a campus-wide stormwater ICPR model in 2017 (Jones Edmunds & Associates, Inc., 2018). This model was subsequently partially updated by Chen-Moore as part of the Stormwater Master Plan permitting process and separately by WSP for several small stormwater projects near Lake Alice. For the purposes of this project and to support permitting moving forward, the original 2017 ICPR model was updated to use curve numbers instead of the Green-Ampt method for runoff and infiltration, a requirement from SJRWMD permitting. The model was also refined in several areas to reduce subbasin size and increase the resolution to evaluate additional structures and localized flooding. The stormwater model layout developed for this study is shown in Figure 19.

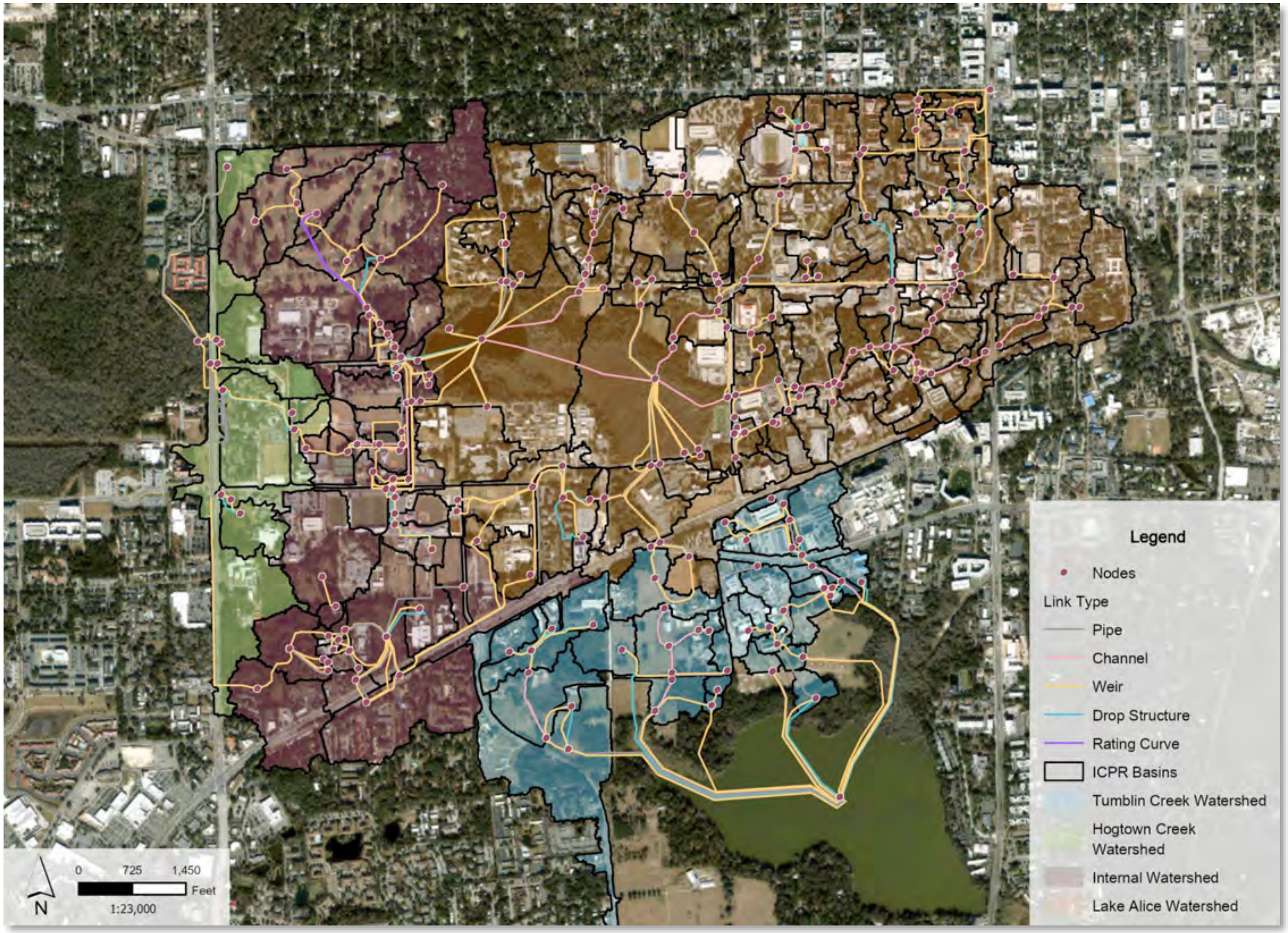
Legend
Nodes
Link Type
Pipe
Channel
Weir
Drop Structure
Rating Curve
ICPR Basins
Tumblin Creek Watershed
Hogtown Creek Watershed
Internal Watershed
Lake Alice Watershed
0 725 1,450
Feet
N
1:23,000

Figure 19. University of Florida Stormwater Model Layout

To evaluate future projects and their impacts on the existing stormwater system it is recommended that all new or redevelopment projects be incorporated in the stormwater model to examine the downstream impacts of projects and the need for improvements in the stormwater system. The following updates to the model should be made for each new or redevelopment project:

- Refining subbasin boundaries to provide adequate detail for the project,
- Incorporating survey information for new stormwater features,
- Verifying that hydrologic parameters reflect current conditions, and
- Following refinement of the existing conditions model, development of a proposed condition model that reflects the proposed changes.

Following model updates and refinement, the following comparisons should be made:

- Comparing pre-project flood elevations to post-project elevations,
- Comparing flow rates between the pre- and post-conditions model, and
- Ensuring no downstream flooding occurs in the stormwater system.

Stormwater modeling is a tool but will not capture all design deficiencies. Specifically, localized drainage may cause or exacerbate flooding within a single basin, or for an adjacent structure. Recommendations for the design and review process are discussed in the next section to capture these issues.

3.4.2 Design and Review Process

To reduce impacts to the existing stormwater infrastructure and Conservation Areas on campus, it is recommended that the design review process set forth include additional evaluation for stormwater infrastructure and downstream stormwater capacity using a tool similar to the Campus Master Plan Checklist (CMPC) . It is further recommended that additional information be required from design firms to allow for the evaluation of stormwater associated with new or redevelopment projects. These recommendations are specifically tied to other recommendations in this report. The following are recommended additions that should be included within the Evaluation Criteria of the CMPC:

- The most recent Campus Stormwater Model has been updated to include the proposed development. The model results demonstrate that the project does not increase flows downstream of the project, or that increased flows can be accommodated in downstream infrastructure without adverse impacts.
- Energy dissipation has been included as part of the stormwater system design for the construction and no increase in energy is being added to the stormwater system or creeks.
- The proposed stormwater management system provides required water quality treatment or adequate credit is available in a downstream regional basin and has been accounted for in the ledger for the regional basin.
- The site grading plan has been reviewed and provides positive drainage to the stormwater collection system and does not send overland flow offsite unless accommodation has been made and demonstrated to capture stormwater flows downgradient.

- The most recent Campus Stormwater Model, updated to include the project, has been run for the following design storms, 2.33-yr 24-hr, 5-yr 24-hr, 10-yr 24-hr, 25-yr 24-hr, 100-yr 24-hr, 100-yr 120-hr; and the proposed finished floor elevation for any buildings is at least 1 foot above the modeled floodplain elevation. Additionally, flows for all of these storms are conveyed in a way that does not cause adverse impacts to any adjacent buildings.

3.4.3 Third-Party Review

The University of Florida currently completes design review and manages construction projects through Planning, Design, and Construction within Business Affairs. It is the recommendation of this plan that third-party review be added for stormwater design and modeling to increase oversight for stormwater design and ensure that recommended stormwater modeling is completed accurately in a way that satisfies the recommendations of this report. This is a commonly contracted component of city, county, and municipality review because of the specialized expertise and software required to complete the evaluation. This is often structured as a time and materials, not-to-exceed annual contract with work performed on an as-needed basis. This approach has the added benefit for the University of separating design development, a collaborative process between PDC and the design firm, and stormwater review, a potentially adversarial process. Verification that design plans are appropriately modeled and do not contribute to flooding impacts of adjacent buildings and structures is critical to protect University assets.

3.4.4 Sustainable Infrastructure Planning

At least three rating systems have been used on campus: the Leadership in Energy and Environmental Design (LEED), LEED SITES, and WaterSense systems. These rating systems provide credits for implementing features or equipment that offer measurable benefits.

With the University's ongoing growth and development on campus that includes all types of civil infrastructure (buildings, roads, parking lots, outdoor spaces, sporting arenas, etc.) the current rating systems are not generally applicable for all construction types or planning processes. It is the recommendation of this report that the University evaluate potential benefits that might come from implementation of a more comprehensive and wholistic planning framework and certification process. One possible option is the Envision© framework originally created by the American Public Works Association (APWA), the American Society of Civil Engineers (ASCE), and the American Council of Engineering Companies (ACEC). This education and research nonprofit is now led by the Institute for Sustainable Infrastructure (ISI).

Key features of the Envision Sustainability Framework and Rating System include:

- The rating system is based on 64 sustainability and resilience indicators.
- Organized around five credit categories: quality of life, leadership, resource allocation, natural world, and climate and resilience.
- May be used as a collaboration tool to strengthen planning.
- Holistic and continuous review of organizational readiness around capital projects.
- Flexible format allows for modification to maximize applicability.

3.4.5 Operation and Maintenance Recommendations

The University currently performs operation and maintenance (O&M) for all of campus for all utility systems including electric, steam, water, wastewater, stormwater, building repair, and landscaping. This is similar or greater in scope than many municipalities and/or utilities. Specifically for stormwater, which does not receive direct funding for O&M, this process is generally reactive rather than proactive, often resulting in additional damage to University infrastructure before repairs are initiated. As recommended in the following section, specific funding of stormwater is recommended to ensure that systems can be proactively maintained or improved to reduce impacts to campus infrastructure. Specific inspection and O&M recommendations for the Lake Alice Watershed are provided in Attachment G. Included here are other recommendations that do not specifically relate to O&M of the stormwater system, or that are being highlighted.

3.4.5.1 Lake Alice Recharge Wells

The most critical pieces of stormwater infrastructure on campus are the two recharge wells on Lake Alice (R-1 and R-2). These wells were constructed in 1959 and provide most of the drainage from Lake Alice. Specific recommendations for well inspection and maintenance are provided as part of Attachment G, but several specific recommendations are provided here to emphasize their importance:

- The last documented well inspection for both of these recharge wells was in 1986 (Sheldon, 2008). At that time some issues were noted with both wells. It is recommended that inspections be completed immediately for both wells to ensure that no conditions may cause failure of these wells. These wells would be un-permittable today and timely replacement would be expected to be infeasible. In the 2008 report, alternative locations for discharging this water were explored, but options were limited and would be expected to carry extremely high capital costs and potentially be un-permittable.
- Lake Alice was observed to have higher water levels than expected in February 2024. This was brought to the attention of Facilities who dewatered and cleaned the intake screen to the R-1 well. This significantly increased flows post-cleaning. Draining this structure was challenging and is undesirable at the potentially frequent basis required. It is recommended that a recirculating pump be installed in the wet well to circulate flows and scour the screen automatically. It is also recommended that the inflow bar grates on the front of this structure, which appear to have been replaced since 2008, be redesigned to have an opening dimension that is the same or smaller than the well intake. The opposite is currently true, which allows for material to pass through the larger screen and collect on the harder to access wet well screen. The screen from the lake should also be designed to allow for regular cleaning and debris removal.
- Flow meters should be re-installed on both recharge wells and tied to the Supervisory Control and Data Acquisition (SCADA) system to track flows and provide notification of any change in flow conditions. This would allow for development of a flow rating curve for both wells and rapid response maintenance or repair as needed.

3.4.5.2 Stormwater Asset Inventory and Record-Keeping

Planning the proper operation and maintenance of stormwater assets requires a detailed asset inventory. This recommendation summarizes record-keeping recommendations included in other sections. The stormwater assets should be recorded in GIS and include the following:

Survey

- Date
- Source
- Method
- Datum

Gray Infrastructure:

- ID
- Type
- Description
- Size – Rise and Span
- Elevation datum
- Upstream invert
- Downstream invert
- Installation date
- Inspection date (this needs to be linked to AIMS)
- Associated ERP permit

Green Infrastructure:

- ID
- Type
- Description
- Size – area
- Size – flowrate
- Elevation Datum
- Upstream invert
- Downstream invert
- Installation date

- Inspection date (this needs to be linked to AIMS)
- Associated ERP permit

GIS should also record the locations of any flowage easements through private property, ERP permit boundaries, including permits issued to private landowners that discharge to the University's MS4. Permit conditions that require maintenance or operation should be recorded in GIS as well as AIMs.

3.4.5.3 Gainesville Clean Water Partnership

In 2001, Alachua County, the City of Gainesville and the Florida Department of Transportation formed a partnership to implement the National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Separate Stormwater Systems (MS4) program in the Gainesville Urbanized Area. The University is operating a MS4 in Gainesville, but is not currently in the partnership. Joining the partnership offers the University the following benefits:

- Clear communications with the operators of the adjoining MS4.
- Cost effective public education and outreach campaigns.
- Streamlined reports to satisfy the MS4 permit requirements including:
    - Stormwater pollution prevention efforts
    - Response to spills and complaints
    - Illicit discharge detection and elimination inspection reports

3.4.5.4 Landscape Maintenance

As part of this plan, data were collected on the vegetation composition by community for each of the Conservation Areas within the Lake Alice Watershed. Currently the CALM Plan is being updated to provide recommendations on the management of these areas and this document defers to that plan for management of these areas. This study did identify several specific vegetation management issues that are described below:

- Many of the Conservation Areas have edges that have grown an abundance of shrub-sized, often invasive vegetation because of increased light availability adjacent to the built environment. This decreases sight lines into these areas which reduces safety and enjoyment of their natural beauty. It is recommended that the LVL Committee consider a maintenance and planting aesthetic for the edges of each Conservation Area that can be conveyed to Grounds and the student body to reduce conflict and improve these areas. This should include recommended treatment and replanting approaches and be developed to not require separate approval by the LVL Committee for each individual maintenance and planting effort.
- Lake Alice is one of the most beloved and iconic locations on campus. The Campus Trails Master Plan identified recommended improvements on the northwest side of Lake Alice along Museum Road in the vicinity of the bat houses that included additional trails, boardwalks, and a viewing platform. Before this project is designed and built there is an opportunity to increase the vistas along this section of Lake Alice through vegetation management. Because of increases in the

levels in Lake Alice over the past five years, and lack of clear direction for Grounds, there has been growth of shrubs and trees along this edge of Lake Alice. It is recommended that the northwest fringe of the lake between Village Drive and the Baughman Center be managed for human use with the remainder of the lake edge kept in a more natural condition. This will encourage use in a smaller area that can be appropriately managed with trash receptacles and possibly restrooms. It is recommended that this edge have lower brush and trees in poor condition removed with installation of long-lived and hydrologically-appropriate trees installed and native emergent plants within the littoral zone (e.g. blue-flag iris, pickerelweed, and fireflag). This will also ease maintenance for Grounds by providing clear direction and allowing for access to this edge of the lake to be less impactful and safer.

3.4.5.5 Litter Management

Solid waste management on campus is challenging as a result of the number of people on campus, and litter contributions from the City, weather, and wildlife. Based on meetings with focus groups, wildlife scavenging from trash cans was identified as a major cause of the litter observed in the Conservation Areas. Without collection, this trash enters waterways on campus and is conveyed to Lake Alice. The following recommendations to reduce litter are based on site visits and observing the placement of trash receptacles and dumpsters on campus.

Source control is the most effective and cheapest alternative for managing solid waste. For this reason, it is recommended that dumpsters and trash receptacles be located outside of the floodplains, further from Conservation Areas, and away from stormwater conveyances. A campus-wide evaluation of trash receptacles should also be completed to determine if the current placement of bins is consistent with the need. The problem of litter in natural areas is particularly evident along Fraternity Row where excess garbage that is beyond the capacity of receptacles and dumpsters is thrown in the woods or left in the stormwater channels where it washes into Fraternity Creek. To reduce the impact of wildlife on litter it is recommended that all receptacles and dumpsters on campus be outfitted with tamper-proof closures to ensure that wildlife is excluded from bins. Additionally, an educational campaign should be launched that uses photos of litter in Conservation Areas and Lake Alice to educate students and faculty on the impacts of not properly disposing of their waste. This educational effort should be paired with both friendly competitions for clean houses in the Greek areas, and monetary fines for dumpsters that are left open. The focus group meetings also identified that at one point the University employed two people whose job on campus was to collect litter. It is recommended that the University consider adding at least one staff person whose primary responsibility is collection of litter on campus. This will result in cleaner grounds and improve the campus aesthetic for students, staff, and visitors.

3.4.6 Funding Recommendations

Stormwater is currently an unfunded utility on campus. This has often resulted in reactive rather than proactive management of stormwater and damage in the stormwater system. This delay in addressing deficiencies often results in increased repair costs or increased damage to the stormwater system or adjacent infrastructure. To avoid these issues and begin to repair and improve the stormwater system on campus, this report recommends the development of funding strategies for both deferred and new capital costs and ongoing operation and maintenance. The following sections discuss potential funding mechanisms for the maintenance and improvement of the stormwater system on campus. The list of options presented here is not intended to be exhaustive, and as this plan is considered and implemented into policies, other options for funding should be considered.

3.4.6.1 Deferred Capital Costs

The stormwater system on campus has been developed on an ad hoc basis over more than 100 years. This has resulted in a disparate system that is not sufficient to handle the current stormwater flows. If the University had been required to permit the campus stormwater system like that of off-campus areas, there would be a network of stormwater ponds across campus, with Lake Alice receiving treated stormwater at lower peak flow rates. This would mean less erosion in creeks, less failed infrastructure, and reduced flooding. Permitting would also have included verifying that new development or redevelopment would not cause impacts offsite.

The stormwater treatment and infrastructure that was not built, because it was not required, is money that the University "saved", although this money was not saved at no cost. Costs borne by the University have included infrastructure damage, increased maintenance, and impacts to the natural spaces on campus. The cost of improving the stormwater system to make it functional for current flows and loads can be considered as deferred capital costs. All the critical, near-term, and medium-/long-term projects described in this report are deferred projects that are proposed to repair and stabilize creeks and improve water quality.

The estimated capital costs of implementing the projects described in this report are:

- Critical Projects: Capital – $6-15 million
- Near-Term Projects: Capital – $7+ million (total is dependent on the scope of LID)
- Medium – and Long-Term Projects: Capital – $10+ million (total is dependent on final projects advanced)

Recommendations for funding these deferred projects are:

- Requiring new construction or redevelopment to pay for all improvements necessary to convey stormwater from the project site to Lake Alice, or
- Implementing a charge on all new construction or redevelopment based on impervious area and structure envelope to fund projects throughout the watershed.
- Implementing a stormwater utility fee like fees charges for other utility services.

3.4.6.2 Stormwater System Capital Costs

The University will continue to grow and evolve to meet the needs of current and future students, faculty, research, and support. This will include increased stormwater management to protect people, infrastructure, and the natural environment. New stormwater infrastructure necessary to support new or redevelopment projects should be funded as part of the design and construction for the development. As previously described, it is expected that each of these new projects developed in the Lake Alice Watershed will require either a general or individual permit. The costs to implement these projects are expected to be highly-variable depending on the type of development, location on campus, utility conflicts, and available site area.

3.4.6.3 Operation and Maintenance Costs

Existing and new stormwater infrastructure on campus will require ongoing operation and maintenance. This project estimated annual costs of $XXX,XXX per year to maintain stormwater infrastructure on campus. Some portion of these costs are currently being covered as part of Facilities and Grounds operation and maintenance. This estimate includes the following:

- Inspection of construction sites,
- Inspection of all stormwater infrastructure on campus every two years,
- Repair of stormwater infrastructure,
- Sediment removal from creeks, and
- Vegetative maintenance within Conservation Areas.

3.4.7 Construction Erosion and Sediment Control Recommendations

The University employs several staff trained and certified as FDEP Stormwater, Erosion, and Sedimentation Control Inspectors. This training teaches appropriate installation methods for sediment and erosion control measures and how to perform inspections of construction sites. While keeping all stormwater on a construction site is not possible under all circumstances, it is necessary to have sufficient erosion and sediment control as part of construction projects. On campus, maintenance of adequate stormwater controls is particularly challenging because of small project sites and proximity of adjacent structures. Furthermore, many areas of campus have significant slopes that increase the velocity of stormwater runoff. In these cases, the contractor may have to install and maintain interim measures during different phases of the project.

To ensure appropriate and adequate erosion and sediment controls are maintained throughout construction projects, it is recommended that enforcement authority increase so that construction may be stopped and fines may be issued to contractors for failures of their stormwater controls. If necessary, the authority for evaluating construction site stormwater practices could be contracted to a third-party which would reduce the internal conflict between delaying or fining contractors and the completion of construction projects. As with litter management, source control is the most effective and cheapest way of managing construction site erosion. Removal of this material after it has entered the stormwater system causes expensive clean-up and/or damage to natural systems and is effectively an externalized cost of construction.

3.5 Data Collection Recommendations

This study included collection of available electronic data for the Lake Alice Watershed. While intensive data collection efforts have occurred in the watershed for decades, much of these data are not available electronically. Additionally, with only a few exceptions, data collection has been discontinuous. The recommendations in this section describe opportunities for improved data collection and data maintenance.

3.5.1 Survey and Geotechnical Data

As a part of nearly all design and construction contracts, the University is having survey and geotechnical data collected for existing and as-built conditions. These data are typically collected for project-specific needs but have value for updating and maintaining an inventory of all assets and features on campus. Many of the surveyed features including pipes, structures, utilities, appurtenances, and finished floor elevations are not expected to change appreciably. By developing and maintaining an internal survey database, the University could avoid re-collecting and paying for collection of redundant information. While this might not be feasible for all project purposes, it would be expected to result in overall cost savings.

As with survey data, geotechnical borings are collected for most structural features on campus. These data could be compiled in a geodatabase and/or database to provide an improved understanding of subsurface conditions across campus that could inform future design projects and reduce the need for new geotechnical data collection.

Currently, design projects on campus rely on the NGVD29 datum, although reference to the datum is often excluded in design and as-built plans. It is recommended that all survey data collected on campus be referenced to the NAVD88 datum which is the more recent and higher accuracy vertical datum. It is also recommended that design review include a check that the vertical datum used for survey is noted on all plans and as-builts as conflicts between datums could result in costly construction conflicts due to the difference in elevations between the datums on campus of approximately 0.8 feet.

3.5.2 Lake Alice Treatment Volume

Lake Alice is comprised of approximately 21 acres of open water and 60 acres of emergent marsh. At the time of the 1987 permit, the imperviousness on campus was 34.4% in the Lake Alice Watershed (CH2M Hill, 1987). Between the 1987 and 2010 permits, the percent of impervious area increased to approximately 42% in the watershed.

The permitting strategy applied to Lake Alice in all the master permits issued for stormwater management have treated the lake as a wet detention pond. This requires capture, storage, and controlled release of one inch across the watershed, or 2.5 inches across the impervious area. At the time of the 1987 permit, one inch across the watershed provided the larger treatment volume, although this switched to the impervious area driving the required storage volume in the 2010 permit, after passing a threshold of 40% impervious. The estimated volume of the lake in 1987 was 270 acre-feet below a control elevation of 67.16 ft (NAVD88, 68 ft NGVD29). It was estimated that the lake had a treatment depth of approximately two feet while providing two feet of freeboard before exceeding the minimum overtopping elevation. This depth and the lake area was estimated to provide approximately 170 acre-feet of treatment volume, which was greater than the required detention volume of 79 acre-feet (CH2M Hill, 1987). This storage and treatment volume was slightly modified with an adjustment of 0.5 feet for the R-1 well in the 2000 report, which resulted in a decrease in the available treatment volume to 125 acre-feet. These values have been carried forward in subsequent permits in 2000, 2010, and in the 2024 stormwater report.

However, in 1996 as part of the UIC well permitting Barnes, Ferland and Associates (Barnes, Ferland and Associates, Inc., 1996) worked with CH2M Hill to change the working elevations of the recharge wells and to revise the Lake Level Operation Protocol. These changes were permitted through the wastewater permit and UIC, but do not appear to have been coordinated through the ERP. The 1996 lake level protocol relies on R-1 to receive most of the lake discharge, with R-2 operating only in high flow conditions, which are defined as flows over the 1-year, 24-hour storm event. The estimated capacity of R-1 was 3 MGD, resulting in a control elevation of 67 feet (datum not recorded) and a normal water level of 68 ft (datum not recorded, assumed as NGVD). The overflow elevation for R-2 was set at 69.5 ft (datum not recorded). The estimated storm response for the Lake, based on runoff volume is provided in Table 5.

Table 5. 1996 Lake Alice Level Operation Protocol

Event	Estimated Runoff Volume (1996) (acre-feet)	Stage of Lake Alice Ft (assumed as NGVD)
Normal		68
1-year, 24 -hour	133	69.5
5-year, 24 -hour	256	70.8
10-year, 24 -hour	320	71.4
25-year, 24 -hour	399	72.2
100-year, 24 -hour	526	73

Based on the most recent bathymetry available (LakeWatch, 2000) the storage volume of Lake Alice and the emergent marsh was estimated to be approximately 270 acre-feet assuming that the emergent marsh was on average three feet deep. This estimate was made based on lake conditions as of December 2023. Following additional investigation in February 2024 it was determined that the R-1 well was not functioning as designed and the lake was effectively at the overflow weir elevation for the R-2 well, approximately 68.45 ft (NAVD88, 69.29 ft NGVD29). This is approximately 2.65 ft higher than the concrete weirs into the R-1 well structure (65.8 ft NAVD88, 66.64 ft NGVD29). UF Facilities blocked the inflow grate for R-1, drained the wet well, and cleaned the grate on the inflow of the R-1 well. Upon restoring flows, the R-1 well was observed to have substantially increased flows with a subsequent decrease in lake level. With the improved drainage of the lake, it is expected that water levels in the emergent marsh and lake will decrease, resulting in a reduced storage volume.

To better understand the volume of Lake Alice and the current treatment volume it is recommended that the University collect updated bathymetric data for the lake, the weirs for the recharge wells, and associated structures in the vicinity of Lake Alice including the Baughman Center and support building, greenhouses, Museum Road, Mowry Road, and any other structures or roads located near the lake. This information can be used to inform development of an updated stage-storage relationship for the lake to ensure that infrastructure is protected. Furthermore, existing survey data for the recharge wells and structures are contradictory and do not match the 1987, 2000, 2010, or 2024 permit reports. Updating this information will allow for better decisions to be made about operations and ensuring that any new structures near Lake Alice are outside of the floodplain.

3.5.3 Hydrologic Data Collection

Multiple colleges at the University have experience in the collection of hydrologic data and have installed monitoring stations for research projects. This study recommends extensive collaboration between the University and on-campus departments. Given University-ownership of a majority of the watershed and the similarities between campus and other urban areas, this watershed should be heavily studied as results would have applicability in other locations. These data would have an added benefit for the University of demonstrating a commitment to data collection and research and the opportunity to identify potential cost savings in management of campus. The following data collection efforts are recommended at a minimum:

- Continued water level data collection on Lake Alice (currently collected by Facilities – Wastewater).
- Water level stations on campus waterbodies including Liberty Pond, Gator Pond, Ocala Pond, karst feature in the Surge Area, and the karst feature between Facilities and golf course.
- Development of flow rating curves for each creek with annual verification and water level monitoring.
- Installation and maintenance of one or more weather stations on campus with rainfall and evapotranspiration.
- Collection of updated Lake Alice bathymetry at least once per decade.

3.5.4 Water Quality Data Collection

Water quality data collection will allow the University an improved understanding of concentrations of parameters of interest in the watershed. Of particular interest are nutrients, which could have an impact on Lake Alice and the creeks on campus, and other contaminants that might cause impacts in the stream or lakes on campus (e.g. metals, fertilizers, and pesticides). Data collection has occurred as a part of studies by various departments on campus, but the duration of collection and spatial extents have generally been limited with few stations having very long periods-of-record. All electronically available data are presented in Attachment B.

It is recommended that as part of the hydrologic data collection described above that water quality stations be established across the Lake Alice Watershed. It is recommended that at a minimum two sampling stations be established in Lake Alice with additional stations at each of the primary creek inflows. Data collection should be completed monthly with samples collected in conjunction with flow measurements to allow for estimation of loading to the lake. Details of a sampling plan should be developed in conjunction with one or more professors on campus. It is further recommended that the sampling frequency and analytes be adequate to begin to develop a TMDL for the lake.

3.5.5 Other Data Collection

The expertise available on campus would allow for collection of a wide-variety of additional data. The collection of these data could allow for extensive analyses that would provide insights that are applicable to campuses and urban areas more widely. The following are some examples of data that may be collected by departments and professors on campus, although this list is far from exhaustive:

- Biologic sampling (mammals, birds, fish, reptiles, amphibians, insects, trees, vegetation, fungi, etc.)
- Human use and wellness
- Stormwater system performance
- Treatment for invasive, exotic species
- Alternative land management approaches
- Groundwater samples
- Soils and sediment samples
- Ecotourism

3.6 Total Maximum Daily Load (TMDL) Development

Lake Alice has been identified as an impaired waterbody by FDEP but has not had a TMDL developed for the lake. The TMDL process establishes the maximum amount of a pollutant that a surface water can receive while meeting the designated water quality classification. It is recommended that UF begin the data collection efforts necessary to establish a TMDL for Lake Alice. Establishing a TMDL for Lake Alice will allow for a better determination of acceptable loads which can then support allocation of loads based on sources. The steps for establishing a TMDL are summarized below:

- Evaluate whether the lake is meeting the relevant water quality standards.
- Establish and adopt a TMDL if the lake is found to be impaired as described in rule 62-304 F.A.C.
- Develop a basin management action plan (BMAP) with stakeholder input and begin implementation to work to achieve the TMDL.
- Re-evaluate progress.

3.7 Vegetation Management Recommendations

Vegetation management on campus is complex because of the wide variety of landscape and community types. This report considered two general vegetated landscape types: manicured and maintained within the urban setting and more natural within the Conservation Areas. Specific vegetative maintenance recommendations were not developed for the urban landscape types on campus except for the irrigation and fertilization recommendations described previously. Recommendations for Conservation Areas on campus were developed by community type. These recommendations are included in Attachment E and are not repeated here.

3.8 Plan Updates

Watershed management is an evolving process. Actions taken today reduce the needs tomorrow. Continuing investment in stormwater reduces the impacts of flooding, erosion, and sedimentation on existing and new infrastructure, the campus community, and the natural environment. This work also helps make campus a more beautiful place for students, faculty, and visitors.

As a preeminent institution, the University of Florida is a complex and changing campus. Like planning for the future development and redevelopment of campus facilities, re-visiting the watershed management plan presented here provides opportunities for the University to know the projects needed today and tomorrow. This knowledge provides the ability to have projects ready to take advantage of funding opportunities as they arise.

The recommendations included in this document were developed based on available information and current conditions (permitting, regulatory, hydrologic, vegetative, etc.). As projects are completed and new issues arise it is important to update this plan based on the new, best available information. It is recommended that this plan be updated every five years to ensure that the continual process of stormwater management is captured and that new issues can be identified and addressed proactively. These updates should include quality assurance and quality control for the stormwater model to ensure that the model accurately reflects current conditions.

Section 4.0 References

Barnes, Ferland and Associattes, Inc. (1996). *Groundwater Monitoring Plan Amendment—Volume 2—University of Florida Water Reclamation Facility* (p. 230).

Causseaux, Hewett & Walpole, Inc. (2010). *Low Impact Development Manual for the University of Florida: A Design Guide for Implementers and Reviewers* (p. 443).

CH2M Hill. (1987). *Permit Application Report and Stormwater Management Master Plan* (BR-161).

Chen-Moore & Associates. (2023). *University of Florida Stormwater Management Master Plan and Permit Application Renewal: SJRWMD Permit No. 4-001-15570-19* (p. 95).

Jones Edmunds & Associates, Inc. (2018). *University of Florida—Stormwater Modeling Final Report* (p. 52).

LakeWatch. (2000). *Florida Lakewatch Bathymetric Map—Lake Alice* [Map].

Mitsch, W. J. (1975). *Systems Analysis of Nutrient Disposal in Cypress Wetlands and Lake Ecosystems in Florida*. University of Florida.

Sheldon, H. A. (2008). *Engineering Report—2008 UIC Permit Renewal for the University of Florida's WWTP* (p. 55).

The Nature Conservancy. (n.d.). *UF Southwest Recreation Center Rain Gardens*. Retrieved April 2, 2024, from https://gsiphotosflorida.org/project/uf-southwest-recreation-center-rain-gardens/

University of Florida. (2021). *McKnight Brain Institute Creek Slope Stabilization—Permit Exemption Verification—Additional Information*.

Wells, A. O., Ankersen, T. T., Clark, M., Aldridge, M., Gregory, W., & Miralia, Q. (2006). *Waters of the University of Florida—A Plan for Achieving Sustainable Water Management in the Lake Alice Watershed* (p. 54). Conservation Clinic - UF Levin College of Law.

WSP, Inc. (2023). *University of Florida Master Permit Renewal Wetland Delineations* [Map].

Attachment A

History of the Lake Alice Watershed and Literature Review

Attachment B

Lake Alice Facilitation Report

Attachment C

Lake Alice Data Inventory and Analysis

Attachment D

Lake Alice Watershed Modeling Report

Attachment E

Lake Alice Conservation Area Vegetation Report

Attachment F

Lake Alice Stormwater Project Prioritization and Conceptualization

Attachment G

Lake Alice Watershed Stormwater Operation and Maintenance Recommendations