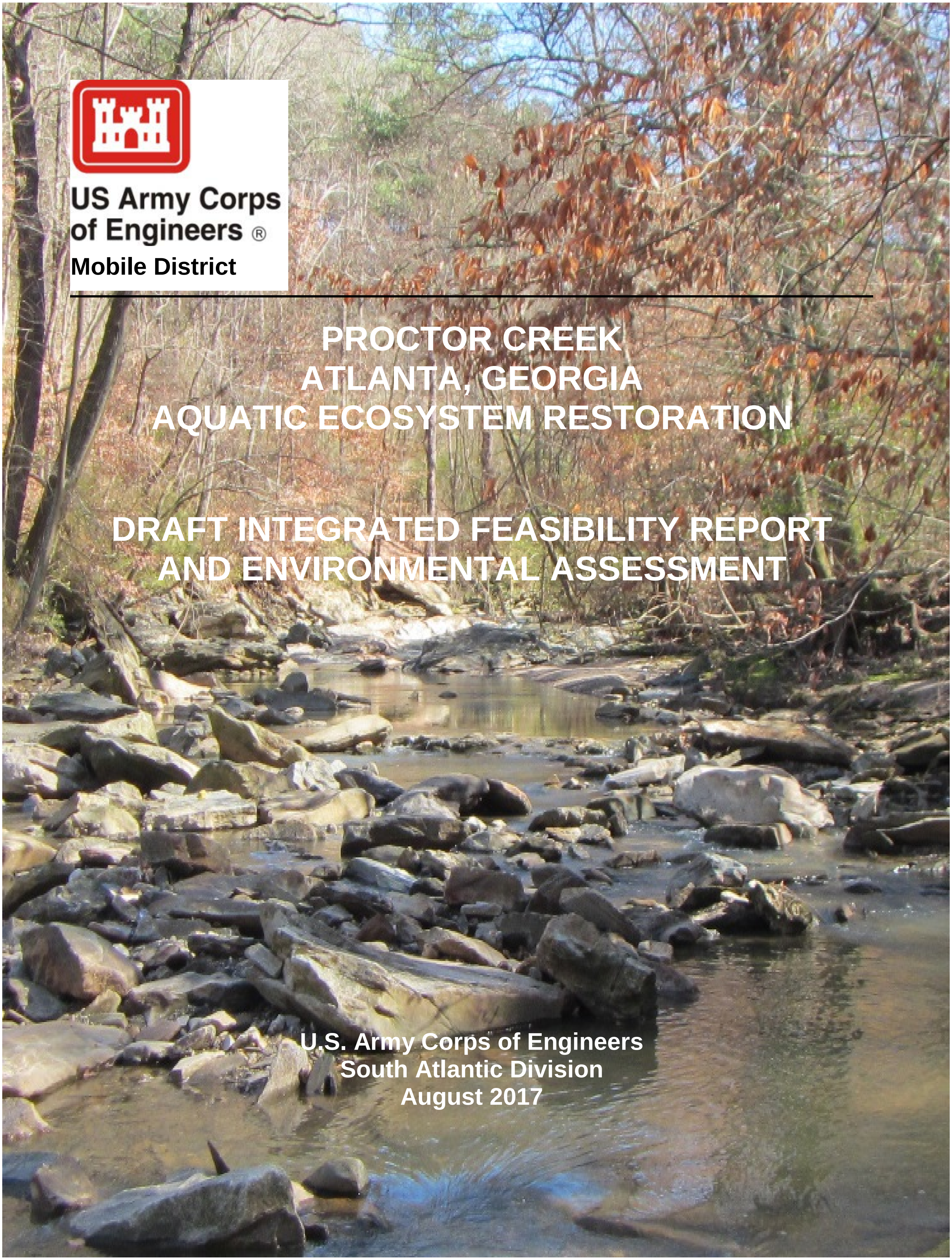

US Army Corps of Engineers ®
Mobile District

PROCTOR CREEK
ATLANTA, GEORGIA
AQUATIC ECOSYSTEM RESTORATION

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

U.S. Army Corps of Engineers
South Atlantic Division
August 2017

Pertinent Data

Description
The Tentatively Selected Plan (TSP) includes restoration of sections of lower and middle Proctor Creek and select sections on the Terrell Creek Tributary and the Grove Park Tributary.

Location
The Proctor Creek Watershed is located within the City of Atlanta, Fulton County, Georgia. The creek flows in a north-westerly direction originating in downtown Atlanta and terminating in the Chattahoochee River.

Plan Features
Restoration features of the alternative include restoration of the channel to a less degraded condition through bank stabilization, bank protection and in-channel bar shaping. Connectivity improvements include daylighting in the Grove Park Tributary and rock ramps at two sewer crossings in the watershed, one on Proctor Mainstem and one on the Terrell Creek Tributary. Riparian restoration features include invasive species removal and riparian plantings of native species. A detention feature is also included to aid in reducing flashiness in downstream reaches. This feature is located adjacent to I-20.

Economics
Costs and benefits are presented at the October 2016 (Fiscal Year 2017) price level and, where appropriate, are annualized at 2.875 percent over a 50-year period of analysis (2020 – 2070).

Costs		Benefits	
Fully Funded Cost	$8,756,000	Average Annual Habitat Units	12,866
Initial Project Cost	$7,552,000		
Average Annual Cost	$288,000	Average Annual Cost per Habitat Unit	$31.17
OMRR&R	$113,000		
Total Annual Cost	$401,000		

Real Estate Requirements
It is estimated that 96 parcels will be impacted, not including those lands which are currently vested to the Non-Federal sponsor. Based on the proposed engineering project footprints, this correlates to an approximate total of 44.33 acres to be acquired for the restoration construction, staging, access, and detention areas.

Cost Apportionment (FY 17 Price Levels)
Project construction will be cost-shared at 65 percent Federal expense and 35 percent Non-Federal expense. Because construction will not significantly impact environmental and historic resources, compensatory mitigation is not anticipated. Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) is the responsibility of the Non-Federal sponsor.

Item	Federal	Non-Federal	Total
Construction*	$5,691,000	$2,641,000	$8,332,000
LERRD's*	$0	$424,000	$424,000
Total Project Cost	**$5,691,000**	**$3,065,000**	**$8,756,000**

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Acronyms and Abbreviations

AAHUs	Average Annual Habitat Units
ACF Basin	Apalachicola-Chattahoochee-Flint Rivers Basin
ADM	Agency Decision Milestone
APE	Area of Potential Effect
ARC	Atlanta Regional Commission
BMP	Best Management Practices
CAA	Clean Air Act
CE/ICA	Cost-Effectiveness and Incremental Cost Analyses
CEQ	Council for Environmental Quality
CM	Construction Management
CW	Civil Works
CWCCIS	Civil Works Construction Cost Index System
DPR	Department of Parks and Recreation
EC	Engineer Circular
FWOP	Future Without Project Condition
GHG	Greenhouse Gases
HTRW	Hazardous, Toxic and Radioactive Waste
IEI	Index of Ecosystem Integrity
IWRM	Integrated Water Resource Management
LERRDs	Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas
MCACES	Microcomputer Aided Cost Engineering System
MCDA	Multi-criteria Decision Analysis
NED	National Economic Development
NER	National Ecosystem Restoration
NGO	Non-Governmental Organization
NHPA	National Historic Preservation Act
NPU’s	Neighborhood Planning Units
NRHPs	Nationally Registered Historic Properties/Places
O&M	Operations and Maintenance
OMRR&R	Operation, Maintenance, Repair, Rehabilitation and Replacement
OSE	Other Social Effects
P&G	Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies
PCEM	Proctor Creek Ecological Model
PDT	Project Delivery Team

Acronyms and Abbreviations (cont'd)

PED	Planning, Engineering and Design
PPA	Project Partnership Agreement
RED	Regional Economic Development
ROM	Rough Order of Magnitude
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
USACE	U. S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWFP	Urban Waters Federal Partnership
VT	Vertical Team

1. Introduction

1.1. Study Purpose and Need for Action

The U.S. Army Corps of Engineers (USACE), South Atlantic Division, Mobile District has prepared this draft ecosystem restoration integrated feasibility report ("study") and integrated environmental assessment for the Proctor Creek Watershed, Atlanta, Georgia, ecosystem restoration feasibility study ("study"). The purpose of this study is to identify problems in the watershed, including any related to ecosystem degradation, and investigate potential solutions for addressing those problems. The study includes input from the non-Federal sponsor, local governments, natural resource agencies, non-governmental organizations, and the public. The purpose of this study is to identify problems in the watershed, including any related to ecosystem degradation and investigate potential solutions for addressing those problems.

The Federal objective of water and related land resources project planning is to contribute to National Ecosystem Restoration (NER) and comply with National environmental statutes, applicable executive orders, and other Federal planning requirements (Principles and Guidelines [P&G], 1983). Water and related land resources projects are formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective. In addition to ecosystem restoration, this study puts forth solutions under an Integrated Water Resource Management (IWRM) framework to address problems that may not be under the USACE authority but can be addressed by another Federal agency, Non-Governmental Organization (NGO), or partner.

This draft report: (1) summarizes the current and potential water resource problems, needs, and opportunities for ecosystem restoration; (2) presents the results of the plan formulation for water resource management solutions; (3) identifies specific details of the Tentatively Selected Plan (TSP), including inherent risks; and, (4) details the extent of Federal interest and local support for the plan.

1.2. Study Authority

"1994 House Resolution 2445 - Review the reports of the Chief of Engineers on the Apalachicola, Chattahoochee, and Flint Rivers, Georgia and Florida…to determine whether modifications of the recommendations…in the interest of **environmental quality**, **water quality**, **water supply**, **flood damage reduction** and **other purposes**, including a **comprehensive, coordinated watershed master plan** for metropolitan Atlanta, Georgia.

1.3. Study Scope, Sponsor and History

This Feasibility Study is being conducted as a partnership between the City of Atlanta and the USACE, Mobile District. The purpose of the study is to investigate the feasibility and the extent of Federal interest in developing a plan for providing urban ecosystem restoration and recreational opportunities in the Proctor Creek Watershed.

USACE and the City of Atlanta have a long working relationship on various projects spanning several decades. This includes one previous flood risk management project that was built in 1992 within the Proctor Creek Watershed.

A Feasibility Cost Sharing Agreement (FCSA) was signed on 5 October 2015 between USACE and the Non-Federal Sponsor, the City of Atlanta, Georgia. This initiated the Proctor Creek Feasibility Study.

1.4. Study Area

The study area for the Proctor Creek Watershed consists of approximately 16 square miles of drainage area. The main stem of the creek is approximately 8.4 miles long and the main tributary, Center Hill Tributary (also known as Terrell Creek), is approximately three miles long. This creek drains northwesterly and directly into the Chattahoochee River. Proctor Creek lies within the City of Atlanta, Georgia. It is a priority watershed for the Environmental Protection Agency (EPA) and is one of the 19 watersheds selected nationwide to the Urban Waters Federal Partnership (UWFP) for a comprehensive study.

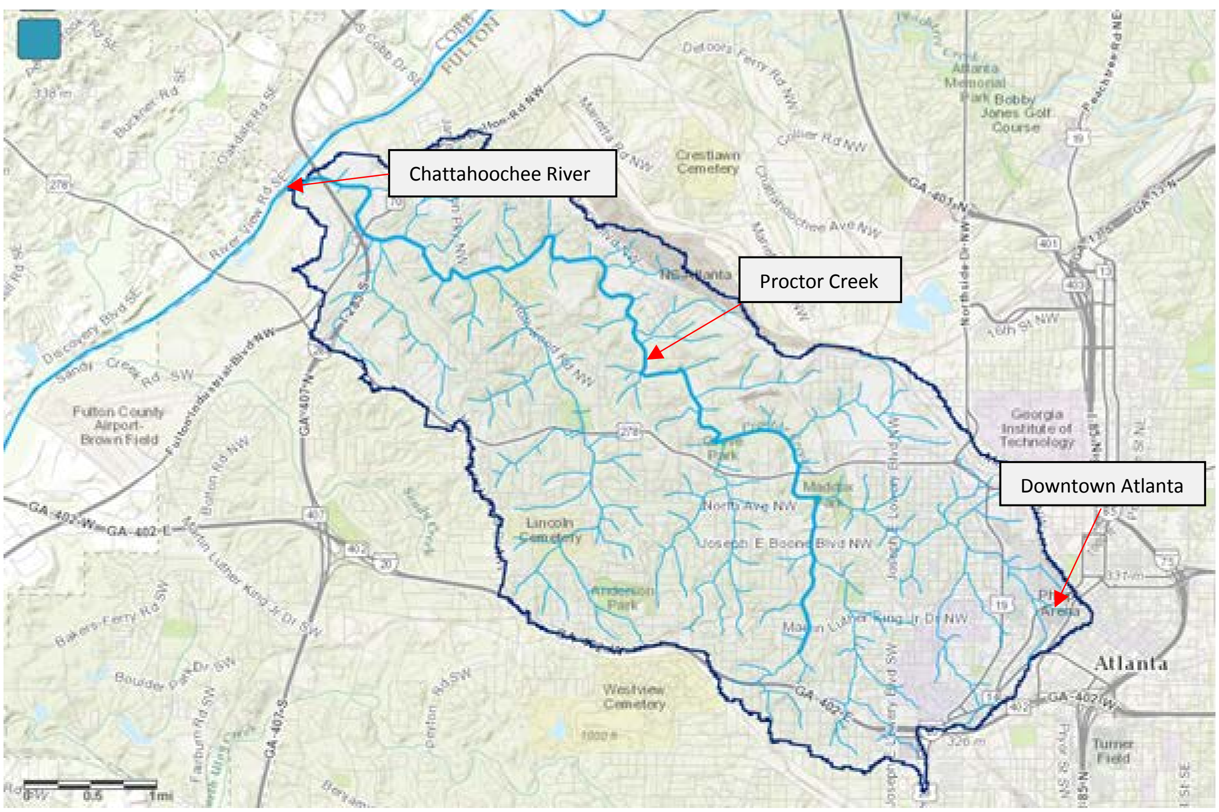


Figure 1: Proctor Creek Watershed Map

1.5. Prior USACE Studies and Reports

U.S. Army Corps of Engineers. (1992). Section 205 Proctor Creek Feasibility Study. Mobile: U.S. Army Corps of Engineers, Mobile District. USACE recommended structure removal for flood risk reduction.

1.6. USACE Planning Process and Planning Modernization

Beginning in 2012 USACE underwent a Civil Works Transformation process. As part of this transformation, USACE instituted the **"SMART"** planning paradigm for feasibility studies. Under this paradigm, USACE will deliver a study that has **Specific** and **Measurable** objectives and provides a recommendation that is **Attainable and Risk-informed** over a **Timely** study period (three years). USACE has identified key decision points, called milestones, throughout the study period. These milestones bring together the USACE Vertical Team (VT) and the non-Federal sponsor and confirm concurrence on the formulation, decision making, and risk evaluation, prior to moving forward. The five feasibility study milestones representing key planning decisions are shown in Figure 2 below and are the following: Alternatives milestone; TSP milestone; Agency Decision milestone; Civil Works Review Board milestone; Chief's Report milestone.

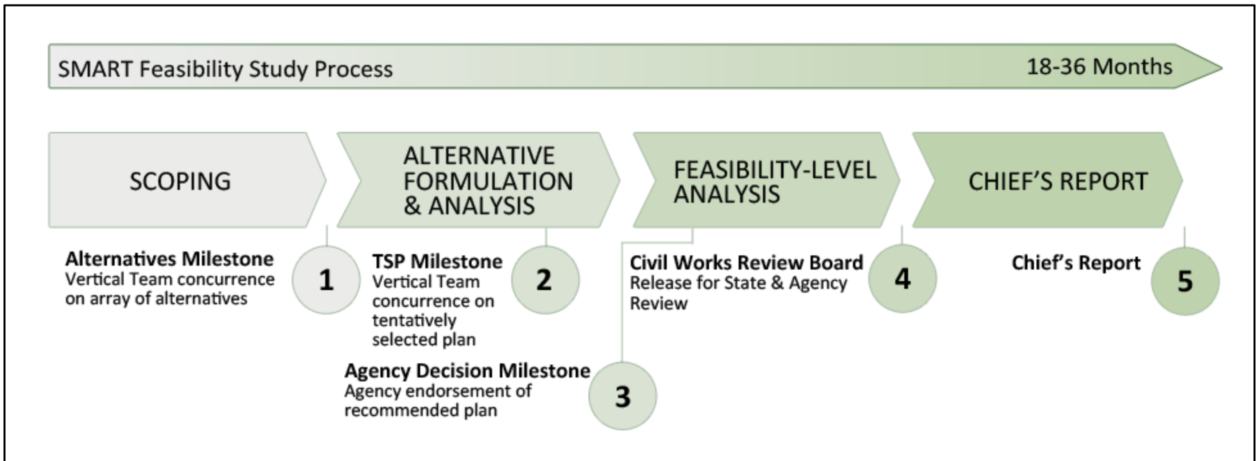


Figure 2: USACE SMART Feasibility Study Process

USACE maintains adherence to the six-step planning process as defined in the 1983 Principles and Guidelines (P&G) and the 22 April 2000 Planning Guidance Notebook (ER 1105-2-100) to:

1. Define the Problems, Opportunities, Objectives, and Constraints
2. Inventory the study area and forecast future with-out project and with-project conditions
3. Formulate alternative plans
4. Evaluate alternative plans
5. Compare alternative plans
6. Select a recommended plan

The PDT follows this planning process as laid out in the draft report. The formulation that leads to identifying the TSP is iterative. Section 4 discusses the formulation process leading to the final array of alternatives. Section 5 discusses the formulation process from the final array of alternatives to selection of the TSP.

2. Problems and Opportunities

2.1. Watershed Description and Location

The Proctor Creek Watershed is located in the Chattahoochee River Basin in the City of Atlanta, Georgia. The Chattahoochee River Basin is part of the larger Apalachicola-Chattahoochee-Flint Rivers Basin (ACF Basin), which flows south to the Gulf of Mexico and also drains portions of Alabama and Florida. Proctor Creek is located in western Atlanta and drains an area of approximately 16 square miles between downtown Atlanta and the Chattahoochee River. The drainage area encompasses portions of heavily developed downtown Atlanta, industrial areas, and residential neighborhoods (Figure 3).

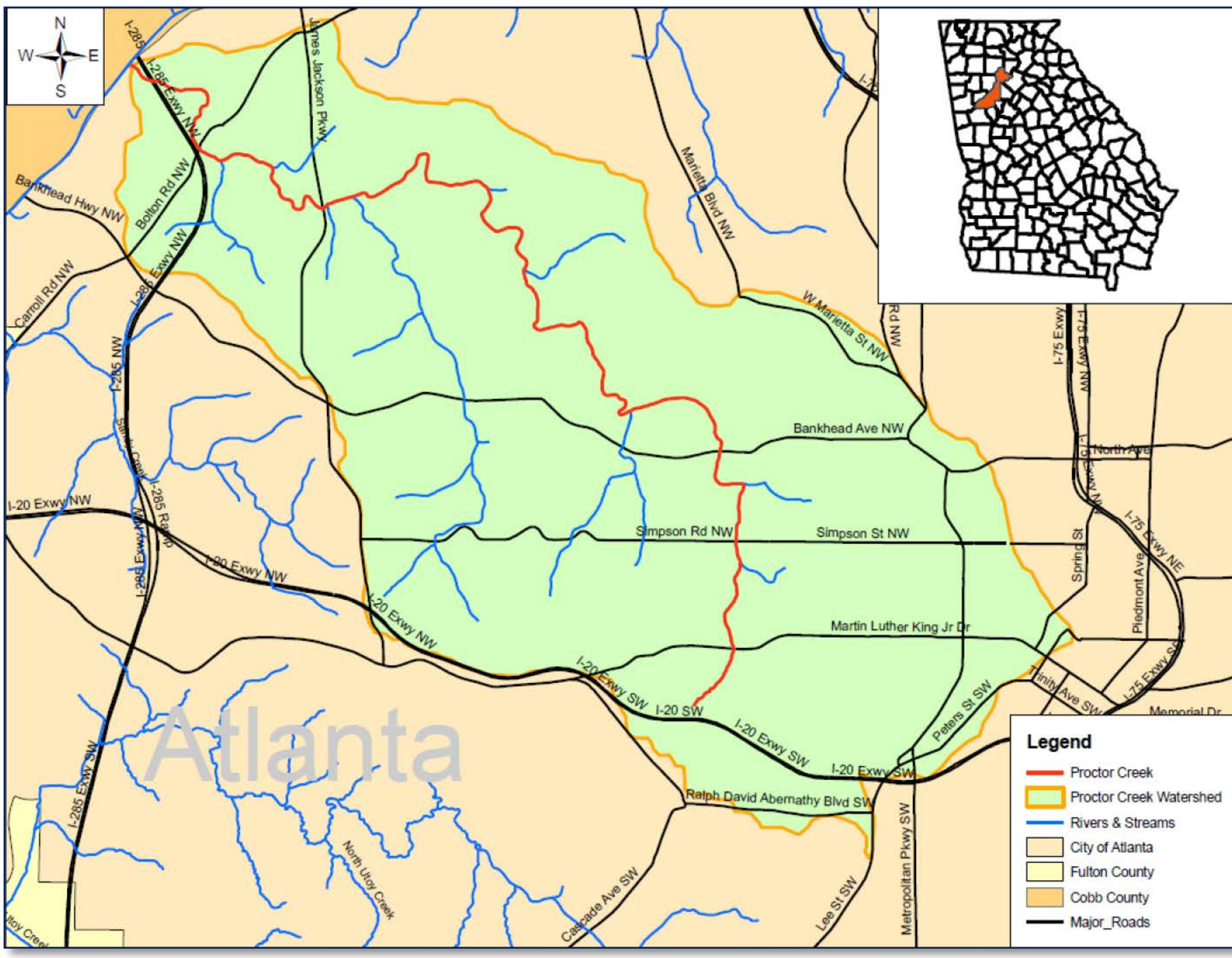


Figure 3: Proctor Creek Watershed Drainage Area

2.2. Problems

Proctor Creek is a highly urbanized watershed that has been developed over many decades. Problems that were identified by the stakeholders as well as through visual field assessment include:

- Accelerated bank erosion and failure in the watershed (Figure 4)

Figure 4: Bank erosion on Terrell Creek

- Proctor Creek is a non-swimmable/fishable stream due to a lack of access and stream contaminants
- The stream is currently on the 303d list for fecal coliform
- Periodic combined sewer overflows create public and ecological health risks
- Nuisance flooding in various parts of the watershed (Figure 5)

Figure 5: Flooding in Proctor Creek Watershed

- Drastically changed physical characteristics (morphology, lined channel, piping, etc.) of the stream due to land use practices over the last 200 years (Figure 6)

Figure 6: Upper Proctor Creek

- Limited recreational opportunities and access in and around Proctor Creek
- Trash disposal in the watershed (Figure 7)

Figure 7: Trash Disposal in the Watershed

- Riparian zone encroachment (degradation/removal) (Figure 8)

Figure 8: Riparian Zone Encroachment

- Presence of invasive species throughout the watershed (Figure 9)

Figure 9: Kudzu Overgrowth in Valley of the Hawks Area

- Lack of diversity in the aquatic habitat in the watershed
- Lack of aquatic habitat along various stretches of Proctor Creek (Figure 10)

Figure 10: Grove Park Tributary

2.2.1. Refined Problem Statements

Problem Statement #1 - Physical characteristics of the stream have drastically changed (morphology, lined channel, piping, etc.) due to land use practices over the last 200 years. These land use changes along with altered hydrology have significantly altered the velocity and depth regimes that would support a wide diversity of native species.

Problem Statement # 2 - Essential habitat for native fish, bird, reptile, amphibian, and small/medium size mammal species has been degraded and lost throughout the watershed. Only limited pockets of habitat capable of supporting reproduction and other critical life functions still exist.

Problem Statement #3 – Bank erosion is prevalent throughout the watershed with the resultant sediment load "burying" the aquatic habitat.

2.3. Opportunities

Through the January 2016 Proctor Creek Feasibility Study Charrette and additional coordination with stakeholders, the following opportunities were identified:

- Restore the aquatic ecosystem
- Develop an integrated framework for effective coordination and communication of stakeholders in developing a watershed masterplan
- Include stakeholders in the decision making and formulation process, not just during the review period
- Improve recreational access and experience
- Use Proctor Creek as a living learning laboratory
- Reconnect the residents with the stream

2.4. Conceptual Model

Conceptual ecological models are required for all USACE ecosystem restoration projects due to their utility to increase understanding, identify potential alternatives, and facilitate team dialog (Fischenich 2008, USACE 2011). Conceptual models also inform the development of quantitative ecological models used in the assessment of the environmental benefits of restoration (Grant and Swannack 2008, Swannack et al. 2012).

The Proctor Creek conceptual model (Figure 11) was iteratively developed by project team members during early project planning in conjunction with the identification of problems and opportunities, metrics, and potential alternatives. A seven-step conceptual model development process was followed (Fischenich 2008, Grant and Swannack 2008), drawing heavily from existing conceptual models addressing general stream processes (e.g., Channel Evolution Model, Simon 1989), urban streams (Wenger et al. 2009), and Appalachian Piedmont streams (McKay et al. 2011, McKay and Pruitt 2012).

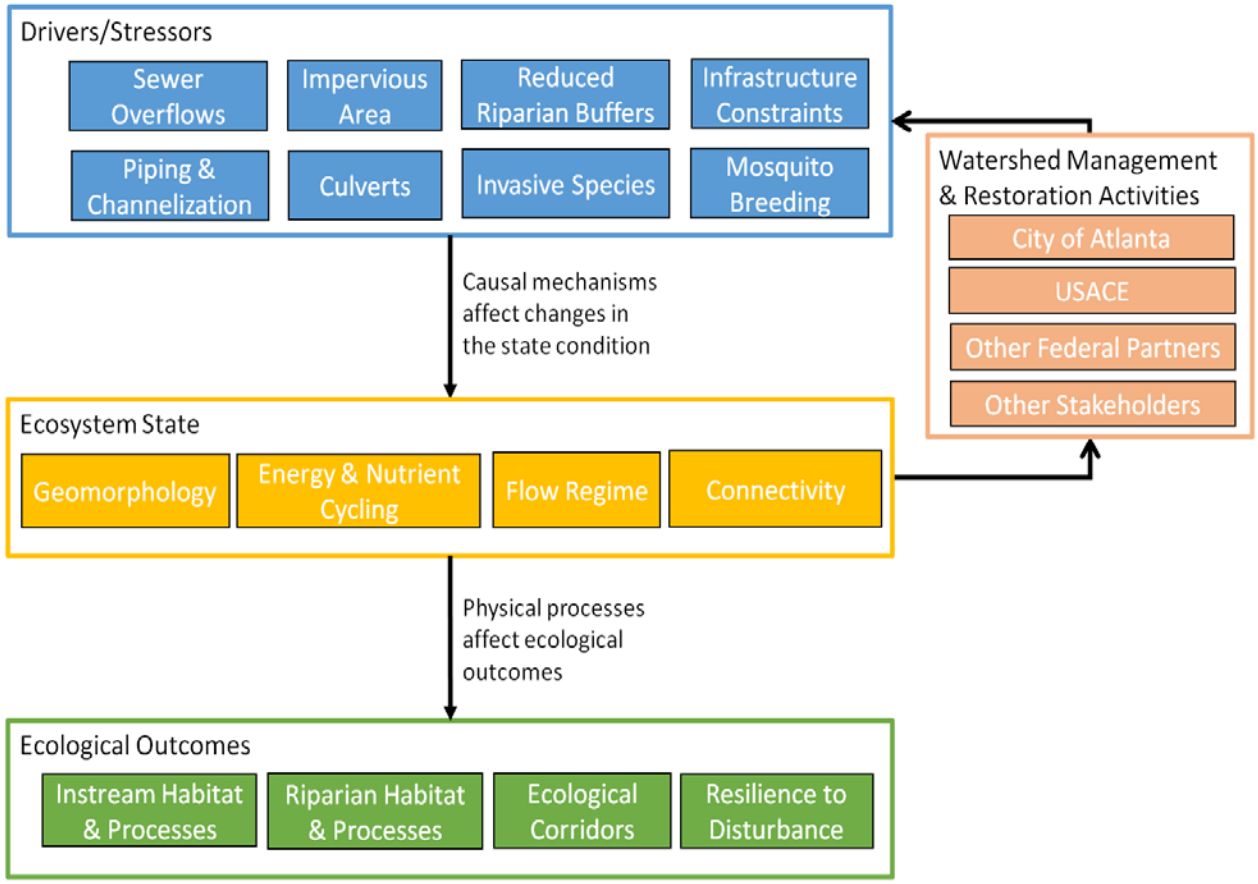


Figure 11. Proctor Creek Conceptual Ecological Model

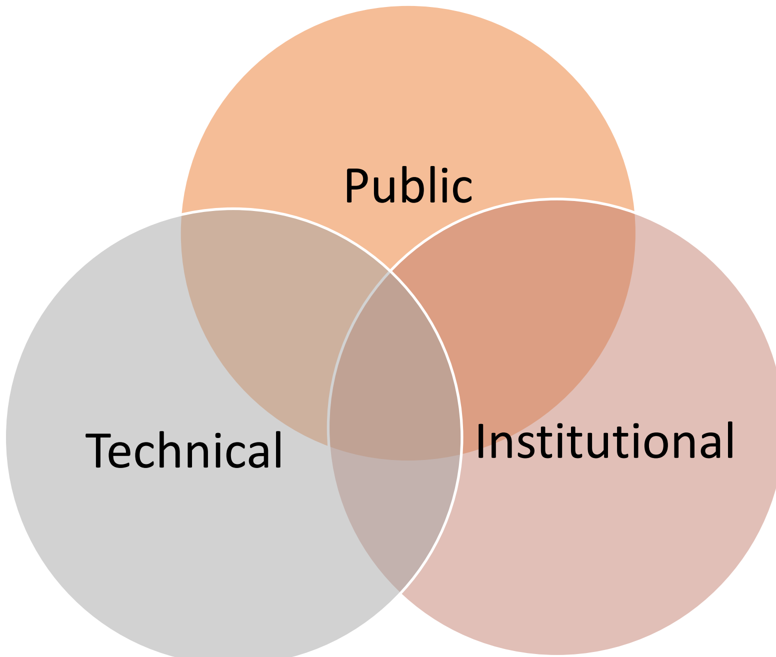
Table 1 presents the generalized conceptual modeling process along with its application to Proctor Creek. The ecological model was iteratively developed during and after team meetings, preliminary site investigations, and quantitative model development. The PDT opted for a simplified representation of the model due to the clarity of presentation relative to a complex urban system with many simultaneous ecological processes, feedback mechanisms, and drivers and stressors. Notably, the model includes drivers and stressors outside of the USACE authority and consideration (e.g., management of combined sewer overflows). These actions were included in the model to facilitate coordination with the Non-Federal sponsor (the City of Atlanta), other Federal agencies (an intimate part of the UWFP), and stakeholder groups. Although these actions are not being pursued in this project, they have the potential to influence project outcomes.

Table 1. Proctor Creek Conceptual Modeling Process

Step	Proctor Creek Application
1. State the model objectives	This model provides a basic understanding of the interaction between existing drivers and stressors, ecological outcomes, and the associate points for restoration interventions. The model is intended as a communication tool for working with partners and stakeholders and informing quantitative model development.
2. Bound the system of interest	The model was developed specifically for the Proctor Creek Watershed in Atlanta, Georgia. However, the model is relatively general and could likely be applied or adapted to other urban or Appalachian Piedmont streams. The model was designed to address stream corridors including the instream, riparian, and associated wetlands environments.
3. Identify critical model components within the system of interest	Using a basic driver-stressor model framework, a list of model components was compiled starting with key ecological outcomes, then drivers and stressors, then “functional state conditions” linking the drivers and services. Although drivers and stressors can influence streams in numerous ways, stream condition within the Piedmont can be summarized by a relatively small number of “functional states” characterized by geomorphic condition, flow regime, nutrient and energy flows, and the degree of connectivity.
4. Articulate the relationships among the components of interest	Given the communication-driven purpose of the model, the only model relationships shown are connections between drivers and stressors, ecosystem states, ecological outcomes, and restoration actions. Development of a mechanistic conceptual model was not pursued due to the inability to translate processes into a quantitative model within required development timelines.
5. Represent the conceptual model	A simple graphic representation of the conceptual model (Figure 11) was developed to facilitate communication between project team members and other interested parties.
6. Describe the expected pattern of model behavior	The team qualitatively assessed flow of logic between model components (e.g., culverts can reduce connectivity, which impacts ecological movement corridors and reduces capacity for recovery after disturbances). The team also addressed the role of restoration actions on altering existing state conditions by addressing the drivers and stressor directly.
7. Test, review, and revise as needed	The model was informed by current views of urban stream function (e.g., Wenger et al. 2009), developed by the team in isolation of other groups, and then subsequently presented to the non-Federal sponsor for input and revision.

2.5. Resource Significance and the Federal Interest

Resource Significance is defined in ER-1105-2-100 by three categories: Technical, Public, and Institutional. Establishing resource significance is required in order to show Federal Interest in an ecosystem restoration study.



2.5.1. Technical Significance

2.5.1.1. Status and Trends

For over two centuries streams in North Georgia and particularly the Metropolitan Atlanta region have been subjected to deforestation, realignment and degradation due to agricultural practices, development, and flood control activities. These land use practices have resulted in a significant decline in the quality and diversity of aquatic and riparian habitat types that have directly impacted biodiversity within the streams and rivers. Many of the streams now exist in heavily urbanized areas which continue to threaten the remaining fragmented habitats through altered hydrology, pollution, and the prevalence of man-made barriers to connectivity (both direct impacts from infrastructure crossings and indirect impacts from extensive reaches of severely degraded habitat). While it is unlikely that restoration activities can fully address these impacts, they can curtail additional degradation and reconnect remaining high quality habitat areas in order to promote biodiversity throughout the watershed.

Increases in riparian and aquatic habitat would provide essential habitat for native fish, bird, reptile, amphibian, and small/medium size mammal species. Prior to development and channelization, these species were prevalent throughout the watershed. These historic ecosystems and wildlife communities were degraded by the land use practices described above that have occurred across northern Georgia, further fragmenting habitat. Despite this degradation, the Proctor Creek Watershed still supports various wading and water fowl, raptors, resident/migratory song birds, river otters, opossum, beaver, aquatic snakes, turtles, frogs, and native fish species indicating that restoration activities can have a direct benefit to the ecosystem.

2.5.1.2. Connectivity

Throughout the Proctor Creek Watershed patches of stable, relatively high quality habitat are interspersed with highly degraded riparian and aquatic habitats. Restoration of these degraded habitats provides an opportunity to connect the large and small aquatic habitat patches via habitat corridors yielding improved conditions for recruitment and an increase in aquatic fauna biodiversity. These connections are especially important in current and proposed future greenspace areas where they provide direct connectivity to surrounding forest areas.

2.5.1.3. Limiting Habitat

The minnow family represented the group with the largest number of species from the 42 native fish species that historically occurred in the tributaries to the Chattahoochee River in the Metropolitan Atlanta region (USGS 1995). Minnows are important prey for larger fish, aquatic snakes, turtles, and wading birds such as herons. Spawning habitat for minnows, once prevalent in these streams, is rapidly disappearing due to increased sedimentation embedding the interstitial space and crevices of gravel, cobble, boulder, and woody debris substrates. Restoration measures that address sources of sedimentation and restore natural processes that maintain this limited habitat are critical to increasing and preserving the minnow diversity in Proctor Creek and the other species that rely on minnows for sustenance. This same habitat is also critical to the macroinvertebrate species that form the base of the food chain for minnows and other fish species.

2.5.1.4. Biodiversity

It is widely accepted that the southeastern United States possesses a highly diverse freshwater fauna and an abundance of endemic forms, with the southern Appalachian region being particularly rich. Two hundred years of historic land use practices including deforestation, agricultural development, and urban development have resulted in significant declines in freshwater fauna biodiversity throughout much of the southern Appalachian region. Georgia's freshwater resources support more than 300 species of fish, including 8 Federally listed species, 57 state listed species, and at least 8 endemic species. The United States Geological Survey (USGS) has identified 42 native fish species that historically occurred in the tributaries to the Chattahoochee River in the Metropolitan Atlanta region. Fish assemblage data collected in 2015 in the lower

Proctor Creek Watershed yielded only 15 native fish species and 2 non-native species. Habitat loss/degradation is recognized as a major contributor to declines in biodiversity and is prevalent throughout the Proctor Creek Watershed. Habitat restoration in the Proctor Creek Watershed, including restoring a portion of the river's natural processes, could support essential elements for fish habitat and yield an increase in biodiversity.

2.5.2. Institutional Significance

Recognized in law, plans, or policy statements of public agencies, tribes or private groups.

Proctor Creek is identified as part of the UWFP. This designation has only been given to 19 watersheds across the United States. The UWFP reconnects urban communities, particularly those that are overburdened or economically distressed, with their waterways by improving coordination among Federal agencies and collaborating with community-led revitalization efforts to improve our Nation's water systems and promote their economic, environmental and social benefits. Specifically, this partnership will:

- Break down Federal program structures to promote more efficient and effective use of Federal resources through better coordination and targeting of Federal investments.
- Recognize and build on local efforts and leadership, by engaging and serving community partners.
- Work with local officials and effective community-based organizations to leverage area resources and stimulate local economies to create local jobs.
- Learn from early and visible victories to fuel long-term action.

In the Proctor Creek Watershed goals of the UWFP include:

- Water Quality Improvements for the Creek
- Create greenspace and increase the use of green infrastructure
- Research how downtown development contributes to increased stormwater and decreased public health
- Plan and implement projects to offset threats using the Proctor Creek Community approved Proctor Creek North Avenue Study
- Engage communities to become stewards of Proctor Creek
- Advance economic development in the area

The Westside community of Atlanta which includes a portion of the Proctor Creek Watershed received a Promise Zone designation in 2016. A Promise Zone is a Federal designation, which characterizes areas of high poverty. Through this designation, national, local and philanthropic stakeholders, and community members are encouraged to develop partnerships, which address social and economic barriers within the assigned communities.

Proctor Creek is a tributary to the Chattahoochee River and nearby National Recreation Area (with over three million visitors annually). The ACF River Basin includes parts of Alabama, Georgia, and Florida and terminates in Apalachicola Bay.

2.5.3. Public Significance

Captures national, regional, or local expressions of public values and support

2.5.3.1. Stakeholder groups in the watershed

Multiple stakeholder groups are active in the watershed and address a diverse range of needs and concerns. These groups are as follows:

Proctor Creek Stewardship Council

The Proctor Creek Stewardship Council is a grassroots group who live and work in the watershed. Supported by partner organizations including the West Atlanta Watershed Alliance, Community Improvement Association, Eco-Action, Georgia State University, Westside Communities Alliance, and many others, the Council works together to identify solutions to the challenges facing the watershed and press for radical action.

Invest Atlanta

Invest Atlanta is Atlanta's Development Authority whose goal is to attract investment in the community and provide for increased opportunity and prosperity for Atlanta's residents. The Proctor Creek Watershed is currently undergoing redevelopment and Invest Atlanta is involved in many of those activities.

Park Pride

Park Pride helps communities enhance parks and greenspace through advocacy, volunteerism and capital improvements. They work with the community to achieve their vision of great parks. Park Pride is a partner in several park projects in the Proctor Creek Watershed.

West Atlanta Watershed Alliance

The West Atlanta Watershed Alliance is a community led organization that has mission areas of addressing environmental justice concerns and fostering environmental stewardship. In Proctor Creek they are focused on protecting greenspace in the community, providing education on environmental issues, and brining increased awareness to environmental concerns of the Proctor Creek community.

Westside Communities Alliance

The Westside Communities Alliance is a network of academic and community partners working collaboratively to tackle local challenges in Neighborhood Planning Units (NPUs) K, L, and T through research, education, and community engagement. Ongoing initiatives include a data dashboard, the Westside Resource Center, and expansion of Technology Enterprise Park.

Chattahoochee River Keeper's Neighborhood Water Watch

This a collaborative program between the Chattahoochee River Keeper and local groups, schools, and citizens within the watershed. The goal of the effort is to improve water quality in urban streams and protect the human health of surrounding communities. Data collection occurs at multiple locations within the Proctor Creek Watershed.

2.5.3.2. Educational Centers

Proctor Creek is also a hub for educational centers that are involved in ongoing work in the watershed including:

- Atlanta University Center
- Georgia Institute of Technology (Georgia Tech)
- Georgia State University
- University of Georgia
- Morehouse College

2.5.3.3. Historically Significant

Several historic properties are present within Fulton County that are important to local, regional, and national history. However the prehistory is poorly represented archaeologically - with only one recorded prehistoric site in the project area. Site Designation Number 9FU28 (Table 17) suggests a possible scatter of prehistoric shell, but the state site file records little information. The area was used during the Civil War, primarily during the Battle for Atlanta, with fortifications still present along the Chattahoochee River (9FU512). These resources are out of the project area, however other examples near and within the project area include Civil War era sites such as the Battle of Peachtree Creek and the Battle of Ezra Church (Figure 12). No evidence of earthworks or fortifications remain in the project footprint.

After the Civil War, the area was industrialized with archaeological evidence of historic rails, structures, and equipment scattered throughout the area with most determined to be ineligible for historic designation. One eligible site characterizing this industrialization is site designation number 9FU114, Atlanta's first municipal dump. The Nationally Registered Historic Properties (NRHPs) in the project area further highlight the industrial nature of the area primarily through Ashby Street Car Barn, E. Van Winkle Gin, and the Machine Works.

The NRHPs also illustrate the city's historic residential patterns particularly in the Collier Heights Historic District. The neighborhood, founded in 1915, boasts several famous and history making homeowners, such as Martin Luther King, Sr.; noted Civil Rights Attorney, Donald L. Hollowell; millionaire builder, Herman J. Russell; Ralph David and Juanita Abernathy, and Christine King Farris.

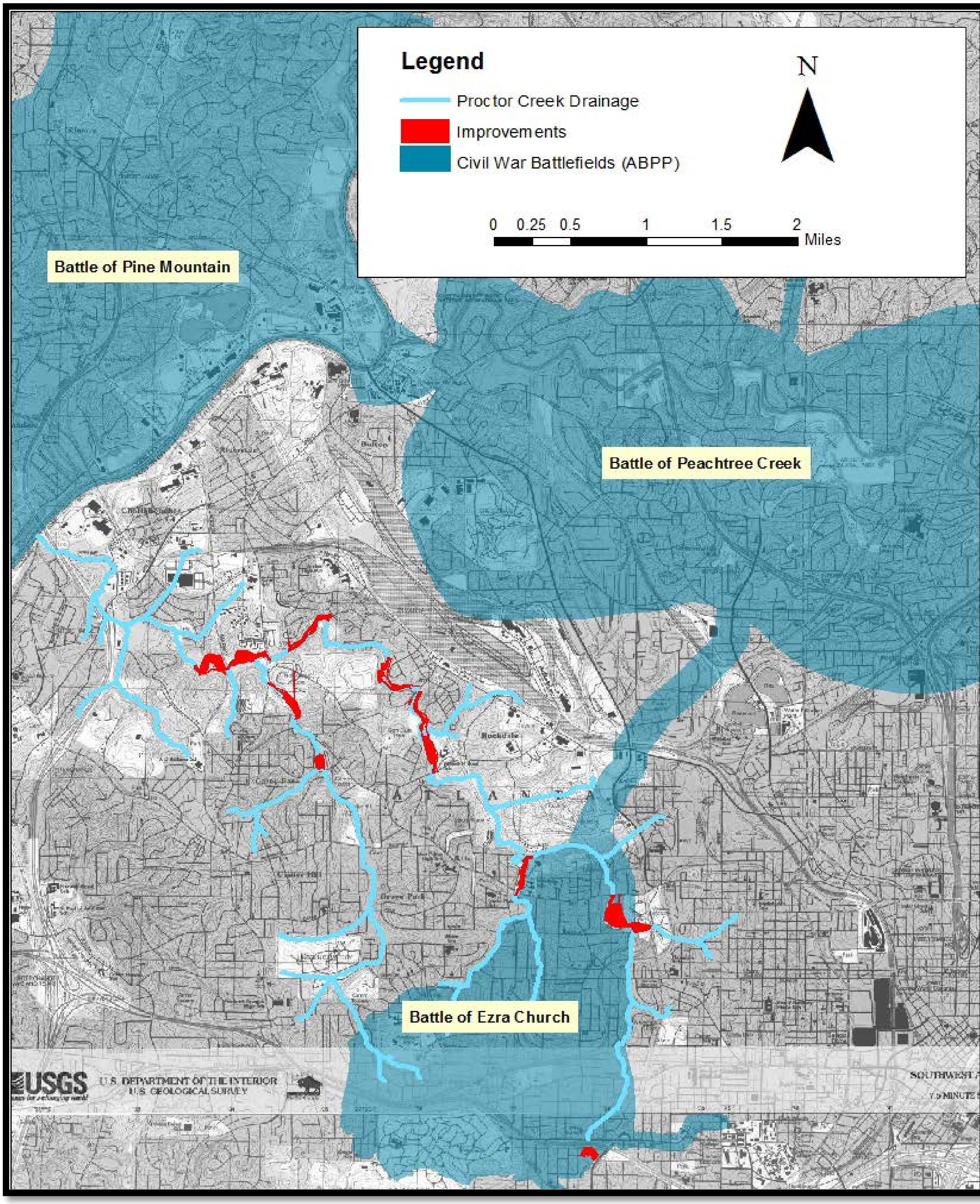


Figure 12: Civil War Battlefields near Proctor Creek Project

Additionally, Collier Heights has the distinction of being one of the first communities in the Nation built exclusively by African-American planners for the upcoming African-American middle class in Atlanta, Georgia. In 2008, the community began its bid to become the first community in the Nation to be registered on the National Register of Historic Places due to its significance of being the first community in the Nation built by African-Americans for their fellow African-Americans.

Several cemeteries in the project area are also historically significant, namely Hollywood Cemetery (ca. 1880s - present), Magnolia Cemetery (ca. early 20th century - present), and Lincoln Cemetery (ca. 1925 – present). These cemeteries represent the final resting places for the African-American, Jewish, and Caucasian populations of the West Atlanta area.

2.6. Integrated Water Resource Management (IWRM)

USACE developed a Future Directions Program to identify trends, emerging issues, opportunities, uncertainties, and threats that will shape its Civil Works (CW) mission in the future. The overall objective of this program is to assist in successfully moving the USACE water resources missions and roles forward into the future and to achieve USACE CW goal of IWRM.

2.6.1. Key Concepts of IWRM

The goal of IWRM is to sustainably manage water. This can only be accomplished by balancing the multiple objectives of different interests with consideration for economic development, social equity, and the environment for both current and future generations.

Coordination is critical for integration. Integrating water management efforts between and within different levels of government and other organizations, requires frequent coordination with recognition of the respective roles of each.

Encourage participation. In order account for the different perspectives and interests within a watershed or basin, the local public and stakeholders from all water use sectors should be involved.

Resources are connected. Holistic management recognizes the interconnectedness of land and water, surface water and groundwater, water quantity and water quality, freshwater and coastal waters, and rivers and the broader watershed.

Source: (Global Water Partnership Technical Committee (GWP), 2004; USACE, 2010).

2.6.2. IWRM Approach for Proctor Creek

The study objectives were developed to validate and refine key IWRM practices as a model for the entire USACE organization. The idea is that lessons learned from this study may be particularly useful for future urban watershed restoration efforts, but may also be applicable across all USACE activities. Based on the identified challenges within the watershed, current USACE strategic goals, and the nature of the Proctor Creek study, the strategies, methods, and objectives that will be undertaken in the Proctor Creek study are summarized below.

2.6.3. IWRM Objectives for Proctor Creek

USACE and the Non-Federal Sponsor, the City of Atlanta, developed the following objectives as part of its IWRM strategy for the study:

- **Include a Robust Stakeholder Engagement.**

  The Proctor Creek UWFP consists of 15 Federal agencies with the unified purpose of collaboration on projects within the watershed to maximize the Federal investment, promote economic development, and reconnect residents to their waterways. The partnership will also help guide stakeholders in setting watershed improvement goals, objectives, and criteria to measure the success and timing of future projects. This will be accomplished by engaging stakeholders through various meetings and workshops that will serve as forums for sharing information, aligning and integrating efforts for future projects, and guiding broader public communication efforts.

- **Broaden USACE Project Formulation.**

  USACE will conduct its planning study as broadly as is feasible, and will consider in its formulation and evaluation of alternatives, not only what projects that it could execute, but also identify projects that could be led by others. The USACE study will develop an Integrated Water Resources Development Plan that can be used by other agencies, the City of Atlanta, as well as other stakeholders. USACE will recommend a NER Plan that will incorporate Regional Economic Development (RED) and Other Social Effects (OSE) to the extent practicable.

- **Identify and Evaluate Alternative Delivery Mechanisms.**

  Alternative financing and delivery is a new approach for USACE. For the Proctor Creek Study, USACE will engage the UWFP to explore alternative delivery methods on a test-case basis. Conducting an exploratory workshop with stakeholders and partners and documenting results may be sufficient at this stage, and any promising and feasible ideas could be incorporated into USACE selected plan.

- **Incorporate Existing Technical Work and Leverage Other Organizations.**

Data gathering and plan development for the Proctor Creek Watershed have been performed, and on-going work undertaken by other agencies and organizations has helped reduce time, funds, and risk for this study. USACE will incorporate existing work and, more importantly, collaborate on technical work with other capable agencies and organizations. This will require enhanced coordination and project management, but can help USACE and its partners accomplish more in support of the planning effort over the timeframe of the study.

3. Existing Conditions

3.1. Topography, Geology, and Soils

Proctor Creek is located in the Chattahoochee River Basin, in the Piedmont ecoregion (GAEPD 1997). The Piedmont is dominated by highly dissected, rolling hills. The fault zones of the rocks, at the boundaries of the rock groups, run northeast to southwest and wield geologic control of the rivers and streams in the Upper Chattahoochee River Basin. The Chattahoochee River runs parallel to the Brevard Fault, and most streams have trellised and rectangular drainage patterns due to fault lines.

The Piedmont ecoregion is dominated by ultisols, which generally lack the original topsoil due to erosion during intensive cotton farming beginning in the 18th century (USGS 1996). Ultisols are characterized by sandy or loamy surface horizons overlying loamy or clayey subsurface horizons. These soils are formed in place through the deep long-term weathering of parent igneous and metamorphic bedrock. Although commonly called *red clay soil,* these soils range in color from bright orange to pale yellow-brown.

Within the vicinity of Proctor Creek, and outside the immediate riparian corridor, the most common soil type is listed as “Urban land” of the Ashlar-Rion, Cecil, Grover and Madison complexes. Within the riparian corridor of the creek and its tributaries, common soil types are Cartecay-Toccoa complex, Buncombe loamy sand, and Congaree sandy loam. These are all occasionally flooded soils typical of the riparian location. Soil descriptions were obtained from the Natural Resources Conservation Service Web Soil Survey (NRCS 2017)

3.2. Air quality and greenhouse gases

On November 30, 1993, the EPA published its final *General Conformity Rule* to implement Section 176(c) of the Clean Air Act (CAA) for geographic areas designated in CAA non-attainment areas and in those attainment areas subject to maintenance plans required by CAA Section 175(a). The CAA General Conformity Rule applies to Federal actions. National ambient air quality standards exist for six criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and particulate matter (PM10 and PM25). According to the EPA Greenbook for non-attainment areas (USEPA 2007), Fulton County, Georgia, is within the metropolitan area of Atlanta and is designated by the EPA as a “non-attainment” area for ozone. The Atlanta Metropolitan area is listed as a non-attainment area for particulates. The non-attainment designations are based on results of air sampling and resulting degree to which national ambient air quality standards, as defined by EPA, are not currently being met.

Both ozone and particulate matter are pollutants that originate primarily from internal combustion engines, especially those associated with automobiles and trucks, and secondarily from industrial sources. The residential areas around the Proctor Creek area typically experience little vehicular traffic; however the area's air quality is affected by cumulative population and accompanying traffic in the metropolitan area.

Greenhouse gases (GHG) are components of the atmosphere that contribute to the greenhouse effect and global warming. Some GHG occur naturally in the atmosphere, while others result from human activities such as burning fossil fuels. Federal agencies, states, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions. The major GHGs are carbon dioxide and methane. These GHGs have increased steadily as a percentage of the atmosphere and have dispersed globally since the preindustrial era. Sea level potentially changes as a result of climate change and USACE projects can be impacted as a consequence. In accordance with the guidance provided in USACE' Engineer Circular (EC) 1165-2-212 (USACE 2011), the first step in determining impacts is to decide whether the project would occur in a coastal/tidal/estuarine zone or in an area bordering such zones. Proctor Creek is not located in or adjacent to any coastal/tidal/estuarine zones.

3.3. Land Use

Existing land use, shown in Table 2, is based on data provided by the City of Atlanta (City of Atlanta, 2016). Over half of the land in the watershed is comprised of residential and industrial development. Except for forested areas within the riparian corridor and parks and other recreational areas, there is little open space. Agriculture is nonexistent.

Table 2. Watershed Land Cover

Land Use Category	Area (Acres)	Percent of Total Area (%)
Commercial	555	4.6%
HDR (High Density Residential)	17	0.2%
Industrial	2,750	22.8%
Institutional/Office	1,512	12.5%
LDR (Low Density Residential)	4,236	35.1%
MDR (Medium Density Residential)	738	6.1%
Parks	626	5.2%
Roads/ROW	1,630	13.5%
Total Acres	12,065	100%

3.4. Water Resources

3.4.1. Proctor Creek and Tributaries

According to the Atlanta Regional Commission (ARC), "The Proctor Creek impaired stream segment is a perennially flowing, warm, clearwater stream. The substrate is dominated primarily by sand (0.06 - 2mm diameter), but the segment also has areas that are composed of a mixture of gravel (2 -64mm), cobble (64 – 256mm), boulders (>256mm), exposed bedrock and small amounts of deposited silt and clay depending on the site at which the substrate is surveyed. One section, beginning downstream of Burbank Drive and ending downstream of Simpson Road, consists of an entirely concrete stream channel. The riparian zone on each bank consists of a partly shaded to shaded canopy which is dominated by trees with a thick underbrush in non-developed portions of the segment. Near residential area, utility crossings, and commercial areas, the canopy became much more open or was non-existent.

Evidence of both partial and full stream bed channelization is apparent throughout much of the nine-mile segment. Local water erosion (not including that which results from in-channel stormwater loads) is moderate in nature with stormwater ditches and sediment accumulation present within the impaired segment. There were isolated instances of wildlife damage to the stream banks where the banks had been worn down from beaver and deer accessing the creek. Rainfall has begun eroding these trails. Beaver activity was noted within the natural area and south to the confluence with the Chattahoochee River. This included signs of feeding, cut vegetation, scat, but no signs of dam building.

Natural restrictions were noted much more frequently in the headwaters than were noted further downstream where the creek was wider. There were several instances where sanitary sewer lines crossing the segment were blocking larger debris such as tree logs and wood pallets and flow is restricted at these points with a resulting accumulation of sediment and trash debris." (ARC 2011)

Field inspections by USACE and partner agencies in 2016 have confirmed the findings by ARC and those that would indicate that Proctor Creek is an impaired stream. High levels of stormwater inflow due to large scale construction of impervious surfaces has led to large pulse flows, streambed incision, bank erosion and channel widening. In other places, bank erosion and mass wasting has resulted in higher than normal sediment deposition and aggradation.

3.4.2. Surface Water quality

Proctor Creek is listed in Georgia's 2014 305(b)/303(d) List of Waters for being in violation of its fishing use classification (GAEPD 2014). The stream segment is listed for violating both fecal coliform standards and biological criteria for fish bioassessments, with the potential source of impairment listed as urban runoff. A Total Maximum Daily Load (TMDL) has been developed for fecal coliform, and for the impacted fish communities. The degraded water quality can be attributed largely to urban runoff. Non-point source discharges of fertilizers, pesticides, pet feces and other organic materials originating from urban landscaped areas contribute to altered water quality favoring more tolerant species of aquatic organisms.

Additional information is below regarding Consent Decree in Atlanta.

Per City of Atlanta Division of Watershed Management:

"Atlanta's Consent Decree Projects

In the late 1980s, Atlantans were accustomed to newspaper articles and television pieces regarding the trash that accumulated along streambanks whenever it rained, trash that included toilet paper, condoms, syringes and other undesirable items. What Atlantans didn't know was the name of the problem – sewer overflows. That changed when Atlanta agreed to overhaul its combined and separated sewer systems pursuant to two federal consent decrees.

The first consent decree, governing combined sewer overflows or CSOs, involved several massive projects, including separation of three sewer basins and construction of a 27-foot-diameter tunnel to transfer flows that would previously have supercharged the City's seven CSO treatment facilities to a new dedicated treatment plant. The separation project significantly increased sewer capacity in the McDaniel, Greensferry (in the Proctor Creek Watershed) and Stockade sewer basins. The CSO consent decree was completed in December 2008.

The second – or First Amended – consent decree governs sanitary sewer overflows or SSOs throughout the separated system. Under this consent decree, the City has constructed two tunnels, the eight-mile-long, 16-foot-diameter Nancy Creek Tunnel and the two-mile-long, 14-foot-diameter South River Tunnel. Additionally, as part of the second consent decree, the City has undertaken a Sewer System Evaluation Survey and related rehabilitation, under which every inch of Atlanta's 1,900 miles of sewer pipe have been inspected and repaired, if necessary. This year, a federal court judge extended the deadline for completion of the second consent decree to 2027.

Together, these projects have reduced sewer spills by about 70 percent since 2000. Below is a graph showing the decline of SSOs in the Proctor Creek watershed, specifically. There have been no major spills in Proctor Creek since 2010. There has been some fluctuation in spills, but on average, the number of spills in Proctor Creek has dropped by roughly 9.5% per year since 2002."

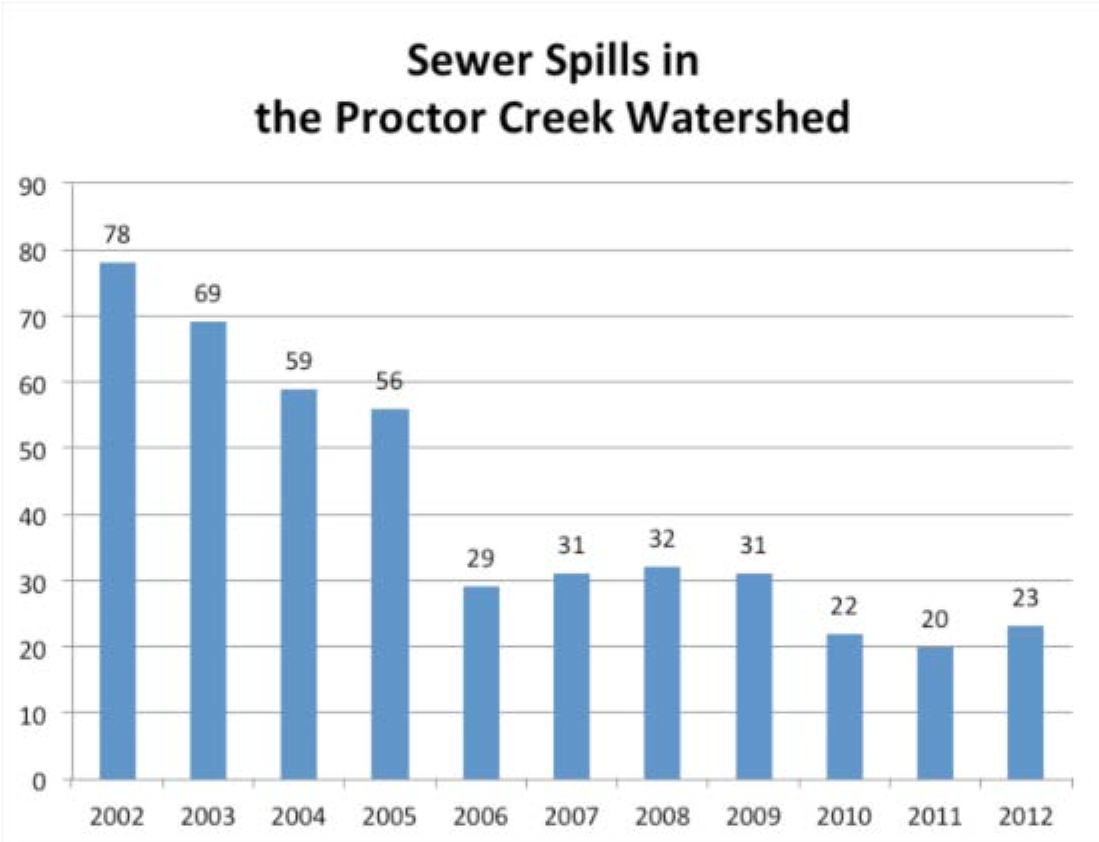


Figure 13: Sewer Spills in Proctor Creek

Source: www.atlantawatershed.org, Accessed May 2017

3.4.3. Groundwater

The Proctor Creek Watershed, and the Piedmont region generally, is in an area of low groundwater recharge potential and few productive groundwater aquifers. In northern Georgia, ground water has not been a major source of supply because of its sporadic occurrence in the crystalline rocks of the Piedmont Physiographic Province (USGS 2017). The USGS is using geologic and geophysical techniques to address the feasibility of using ground water as a supplemental source of supply in this region. The USGS also is evaluating how changes in surface and ground water withdrawals affect regional water availability, and areas where ground water resources are overused or underused.

3.5. Biological Resources

3.5.1. Vegetation

Natural vegetation is generally limited to the riparian corridor of Proctor Creek and its tributaries. Even there, the vegetation is highly disturbed, dominated by second-growth forests and understory species typical in urban environments. There is a high incidence of invasive and exotic species throughout the basin. In areas of relatively less disturbed riparian vegetation there is a mixture of second growth scrub and forest habitat in a riparian setting. This provides potentially adequate habitat for a variety of urban- and suburban-tolerant animal species. Dominant plant species include tulip poplar (*Liriodendron tulipifera*), loblolly pine (*Pinus taeda*), Oaks (*Quercus spp*.), box elder (*Acer negundo*), black cherry (*Prunus serotina*), kudzu (*Pueraria montera*), Japanese honeysuckle (*Lonicera japonica*), greenbriar (*Smilax spp*.), Chinese privet (*Ligustrum sinese*) and tall goldenrod (*Solidago altissima*).

3.5.2. Wildlife

Prior to its current human dominated use, the area undoubtedly provided ample habitat for a variety of large animals such as white-tailed deer (*Odocoileus virginianus*) and wild turkey (*Meleagris gallopavo)*. Currently, due to dense urbanization in the surrounding areas, generally only animals that are more tolerant of small, fragmented acreages and altered habitats are found on the site. These could include rabbit (*Sylvilagus* spp.), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*) and gray squirrel (*Sciurus carolinensis*), as well as other non-game birds, waterfowl, amphibians, and reptiles which are normally found in these types of upland and riparian areas. During field investigations by USACE in 2016, white-tailed deer and river otter (*Lontra Canadensis*) were observed. Introduced mammals, which may also be found in the area, include the Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), and domestic dogs and cats. Small forested patches such as those in the project site could provide resting places for birds or nesting areas for generalist species such as mourning dove (*Zenaida macroura*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), mockingbird (*Mimus polyglotus*), starling (*Sturnus vulgaris*) and others. The highly disturbed condition of the site combined with ongoing human disturbance and widespread presence of invasive vegetation severely limits habitat for most species.

3.5.3. Fish

The City of Atlanta conducted fish surveys in 2015 at three locations in the Proctor Creek Watershed. A total of 17 fish species were observed; 14 native species and three introduced species. However, four species represented over 80 percent of the species collected. These species were the redbreast sunfish (*Lepomis auritus*), bluefin stoneroller (*Campostoma pauciradii*), longjaw minnow (*Notropis amplamala*), and the red shiner (*Cyprinella lutrensis*). The red shiner is an invasive species and the redbreast sunfish is an important recreational fish species in the southeast.

3.5.4. Waters of the US including Wetlands

Wetlands in the Proctor Creek Watershed are rare except for several small areas adjacent to the creek. These wetlands, Figure 14, are shown on the U.S Fish and Wildlife Service National Wetland Inventory website mapper (USFWS 2017a). The wetlands that do occur are listed as palustrine forested wetlands. Such wetlands would typically be impacted under the existing stream condition since stream incision tends to lower local water tables and reduce floodplain connectivity upon which wetlands are dependent.

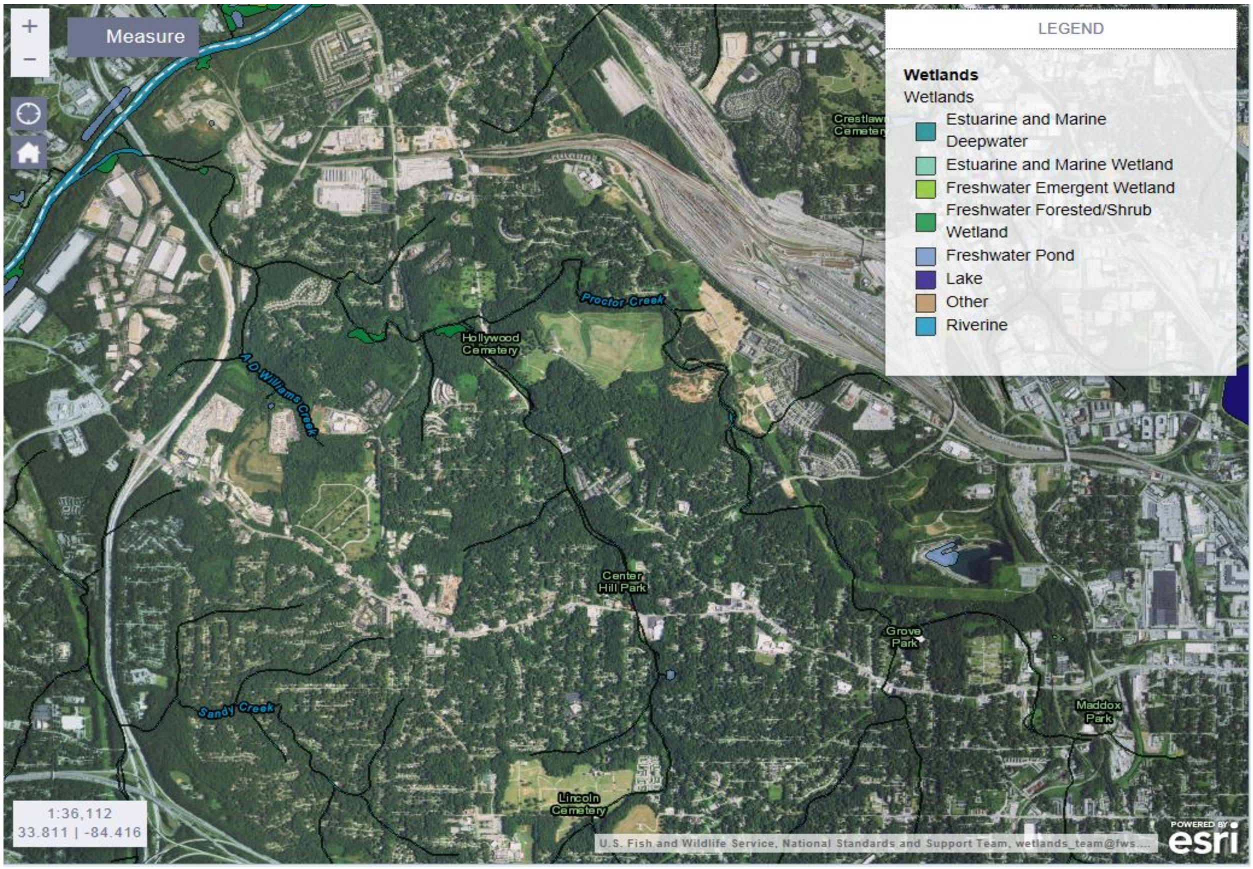


Figure 14: Wetland Areas in Proctor Creek Watershed

3.5.5. Special Status Species

The U.S. Fish and Wildlife Service (USFWS) database for the project site and surrounding lands in Fulton County, Georgia was consulted (USFWS 2017a). Habitat descriptions were accessed at the Environmental Conservation Online System (USFWS 2017b). One listed species was found, a plant, Michaux's Sumac (*Rhus michauxii*) (endangered). The plant is described as occurring in sandy or rocky open woods, sometimes in association with circumneutral soils. In all of its habitats, it is dependent upon some form of disturbance to maintain the open quality of its habitat. Because it is not described as occurring in highly urban environments such as the Proctor Creek Watershed, it is highly unlikely that the species occurs at the project site. Furthermore, the USFWS has been conducting aquatic surveys in the watershed over the last two years and has not identified this species in the watershed.

3.5.6. Wildlife Corridors

Riparian corridors typically provide important routes of migration for a variety of wildlife, including terrestrial, aquatic and airborne animals. Even in highly urbanized areas such as Proctor Creek, there is sufficient vegetative ground cover and forested habitat to provide a more or less continuous zone of refuge, breeding and foraging habitat to allow adapted species to continue to flourish.

3.6. Cultural Resources

As per the requirements outlined in Section 106 of the National Historic Preservation Act (NHPA), the lead Federal agency must consider the effects of the proposed action on historic properties. USACE is the lead for this project for Section 106 compliance. In order to ensure historic properties (i.e., archaeological sites, buildings, structures, objects, or districts listed on or eligible for the National Register of Historic Places [NRHP]) are not affected by ground disturbing activities associated with the proposed ecosystem restoration project at Proctor Creek, an in-depth analysis was conducted to ensure no impacts to known cultural resources would occur. Most of the work areas have prior archaeological survey coverage, and at least one eligible resource has been identified in the project footprint. Measures to avoid, minimize, or mitigate impacts to cultural resources are discussed in Section 6.

3.6.1. Cultural Resource Setting

The cultural resources analysis generally indicated that much of the area of potential effect (APE) has been heavily disturbed in the past by late 20th century industrial, sewer line, and land-fill construction. Portions not affected by industry generally consisted of a narrow floodplain surrounded by steep slopes, razed neighborhoods, and/or dumping sites. It should also be noted that three historic cemeteries, Hollywood Cemetery (ca. 1880s - present), Magnolia Cemetery (ca. early 20th century - present), and Lincoln Cemetery (ca. 1925 – present) are located adjacent to or nearby several of the work areas identified in the Proctor Creek restoration. Archival research indicates that these cemeteries do not extend into the current APE. However, care should be taken that they are not inadvertently impacted by heavy machinery or erosion associated with the proposed project.

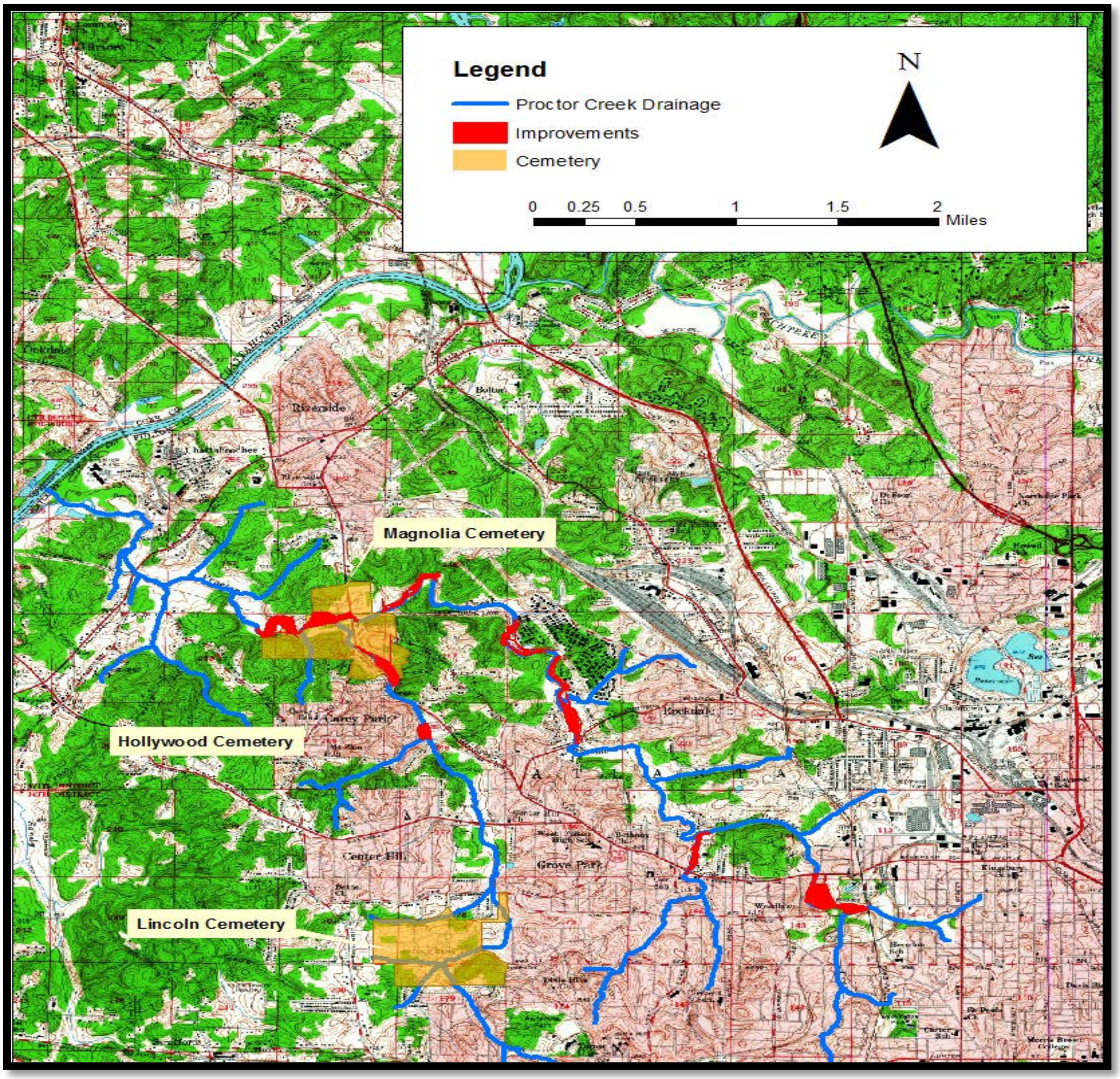


Figure 15: Recorded Cemeteries near Proctor Creek Project

3.7. Traffic and Circulation

The important highway transportation arteries in the area include Interstate Highways I-75/I-85 and I-285 and numerous city thoroughfares. Within the immediate project area, transportation is composed of local streets designed for residential traffic. Traffic tends to be light at most times in the residential areas and generally heavy to very heavy on the major routes leading to Atlanta.

3.8. Noise

There are no specific studies related to the existing noise conditions in the residential areas near the project site. However, noise levels in typical urban residential areas range from 58 decibels (dB) to 72 dB (USACE, 1998). The residential areas around the project site are similar to other urban and suburban areas of similar size and density. Therefore, the study cited is considered representative as an approximation of the current noise levels.

3.9. Recreation and Public Access

The City of Atlanta's park system includes a total of 368 parks and greenspaces comprising approximately 3,622 acres. Within the Proctor Creek Watershed, there are 60 parks, gardens, and conservation areas totaling more than 340 acres (City of Atlanta, 2016). In addition, four greenways are located in the watershed – Atlanta University Center (AUC) Greenway, Baker Road North Avenue Greenway, Hunter Hills Greenway, and JP Brawley Greenway.

In an effort to increase the amount of greenspace citywide, the City of Atlanta adopted the "Atlanta Project Greenspace" in 2008 as part of the City's Comprehensive Development Plan. The purpose of this was to provide a framework for guiding the City to creating a world class greenspace system by the year 2030.

As the City and its partners continue to work toward implementing Atlanta's Project Greenspace and the individual community specific greenspace plans, the City's Department of Parks and Recreation (DPR) continues to support implementation of the stormwater management program through staff training in pollution prevention techniques, including the use and management of pesticides and herbicides. The DPR tracks the use of pesticides in parks and greenspaces by employees and records the date applied, the brand or product name, location of treatment, size of area treated, total amount applied, the targeted species for control, and signature of the employee conducting the application. In addition to pollution prevention, DPR also actively collects and disposes of litter in City parks in support of the City's litter ordinance and the stormwater management program.

3.10. Aesthetics

The forested corridor associated with Proctor Creek provides a degree of greenspace in the urban environment that most people would consider having some aesthetic benefit. However, these areas have been highly disturbed and are degraded in terms of the natural landscape relative to a less disturbed site in a non-urban environment. Dumping and litter contribute to reducing the aesthetic quality in the watershed. Aesthetics is a subjective determination, and for that reason there is likely a diverse range of opinion on the aesthetic value of the property.

3.11. Public Health and Safety including Hazardous, Toxic and Radioactive Waste (HTRW)

Signs are posted along Proctor Creek that state no fishing or swimming in the stream. Non-specific public hazards indicated: during flooding events, persons on foot or in vehicles entering or falling into the water are potentially at risk of drowning. For persons on foot along the banks of the creek there are risks of trips and falls as well as encounters with snakes and insects.

The PDT received information from the EPA delineating know brownfield parcels and industrial sites within the Proctor Creek watershed. There are no known HTRW sites located within the project footprint.

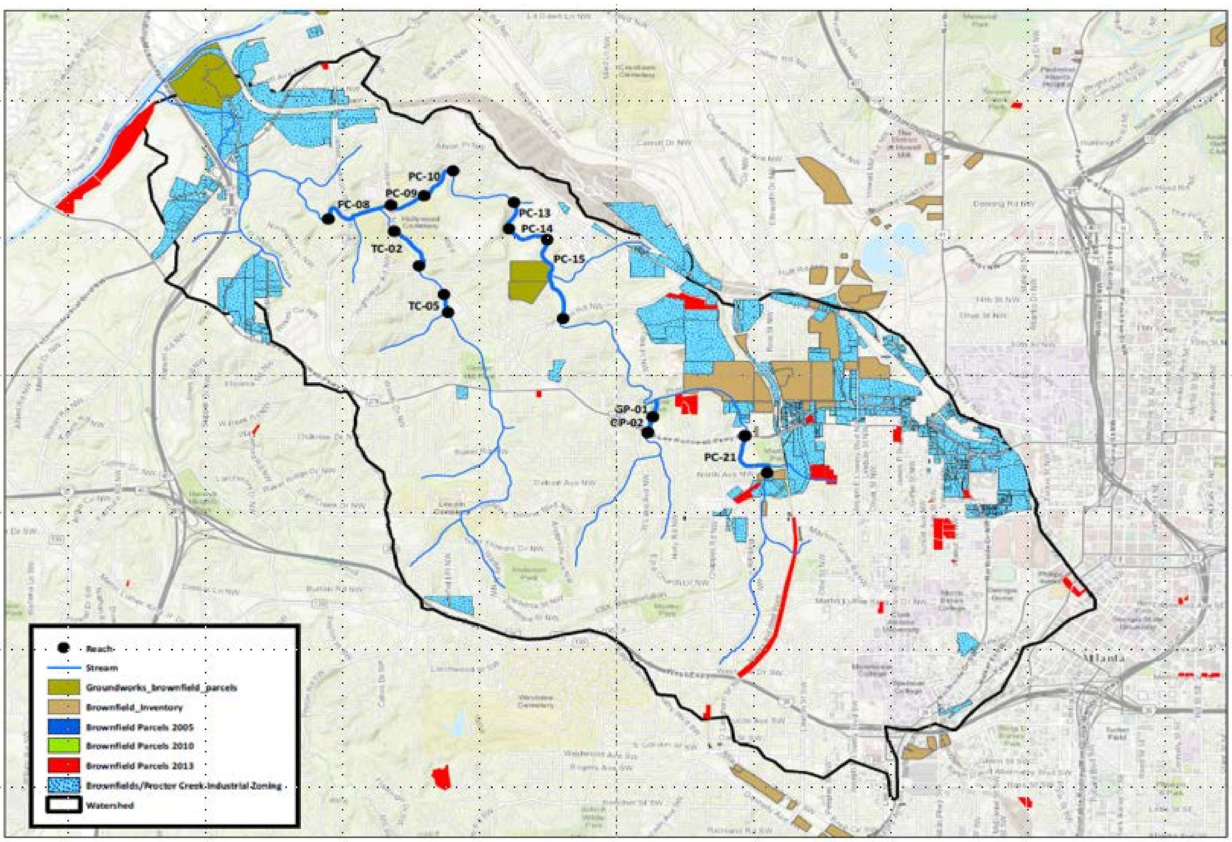


Figure 16: Brownfield and Industrial Sites within the Watershed

3.12. Climate Change

Green House Gases (GHGs) are components of the atmosphere that contribute to climate change. There are several GHGs, but the two that have the most direct impact on climate change are carbon dioxide (CO_2) and methane. Federal agencies, states, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions. These GHGs have increased steadily as a percentage of the atmosphere and have dispersed globally since the preindustrial era. From the preindustrial era (ending about 1750) to 2004, concentrations of CO_2 increased globally by 35 percent. Since 1900, the Earth's average surface air temperature has increased by about 1.2–1.4 ºF. The warmest global average temperatures on record have all occurred within the past 10 years. (USEPA 2007). Sea level potentially changes as a result of climate change and USACE projects can be impacted as a consequence. In accordance with the guidance provided in USACE EC 1165-2-212 (USACE 2011), the first step in determining impacts is to decide whether the project would occur in a coastal/tidal/estuarine zone or in an area bordering such zones.

3.13. Socio Economics and Environmental Justice

Proctor Creek Watershed has a population of approximately 50,000 persons in the 2010 census. The area has experienced a population decline since the 2000 census of approximately 21 percent. Proctor Creek Watershed is predominately an African American community compared to Fulton County as a whole which has a racial makeup that is 46 percent white, 46 percent African American and 8 percent other. The Proctor Creek Watershed can also be characterized as economically disadvantaged where approximately 42 percent of the population live at or below the poverty level. Additional information on population, income, and employment is available in Appendix C.

4. Formulation of Alternative Plans

Plan formulation is the process of building plans that meet planning objectives and avoid planning constraints. It requires the knowledge, experience, and judgments of many professional disciplines. Planners define the combination of management measures that comprise a plan in sufficient detail that realistic evaluation and comparison of the plan's contributions to the planning objectives and other effects can be identified, measured, and considered. Plan formulation requires the views of stakeholders and others in agencies and groups outside USACE to temper the process with different perspectives. Plan formulation capitalizes on imagination and creativity wherever it is found, across technical backgrounds and group affiliations.

4.1. Planning Objectives and Constraints

Planning objectives are the things we want to accomplish with a plan. They are the desired changes between the without and with-project conditions.

4.1.1. The Federal Objective

According to the USACE Planning Guidance Notebook, ER 1105-2-100, USACE objective in ecosystem restoration planning is to contribute to NER. Contributions to NER (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units). These net changes are measured in the planning area and in the rest of the Nation. Single purpose ecosystem restoration plans shall be formulated and evaluated in terms of their net contributions to increases in ecosystem value (NER outputs), expressed in non-monetary units.

4.1.2. Specific Planning Objectives

- Improve in-channel conditions suitable for a diversity of aquatic organisms
    - Restore channel geomorphic conditions to less disturbed conditions
    - Reduce sediment loading from stream bed and banks
    - Increase in-stream habitat for a diverse assemblage of local fauna
- Improve riparian conditions supportive of a diverse aquatic and riparian community
    - Restore natural sources of organic carbon (i.e., energy) within the system
    - Increase nutrient uptake within the basin
    - Improve temperature regimes
    - Increase riparian habitat to support native biodiversity
- Restore flow regimes to best attainable conditions achievable in altered urban environments

    - Decrease peak flows induced by high levels of impervious areas
    - Increase baseflows through increased watershed infiltration and shallow groundwater
    - Decrease flashiness of the “peaky” urban hydrograph
    - Minimize the difference between altered and unaltered hydrographs

- Promote an interconnected system resilient to foreseen and unforeseen disturbances
    - Increase connectivity of movement corridors for aquatic and riparian species
    - Increase the capacity to absorb natural and anthropogenic disturbance

- Reconnect residents to aquatic and historic landscapes
    - Increase recreational access

- Make the creek a living laboratory for learning about local waters
    - Provide educational opportunities for both residents and tourists
- Maintain or decrease existing levels of flood risk

- Reduce health risks to neighboring communities
    - Reduce exposure to contaminated water
    - Decrease mosquito breeding areas to reduce vector borne disease transmission

4.1.3. Planning Constraints

The formulation of alternatives to address the study objective is limited by planning constraints. Constraints are statements of effects that the alternative plans should avoid. Constraints are designed to avoid undesirable changes between without and with-project future conditions.

Constraints could include resources, legal, or policy constraints. Constraints which are applicable to this study, are:

- HTRW sites
- Increasing levels of flood risk
- Impacts to existing structures and infrastructure whenever practical
- Impacts to cultural and historic resources
- Adverse social and economic impacts on community residents

4.1.4. Future Without Project Conditions

To help define the future conditions, a numerical modeling toolkit, the Proctor Creek Ecological Model (PCEM), was developed. Figure 15 provides further insight into the four individual modules of the PCEM, as well as the overarching index of ecosystem integrity. The future without project condition (FWOP) provides a baseline condition for the current status and future trajectory of the Proctor Creek Watershed. The FWOP also provides the basis for comparing the ecological effects of restoration actions (ER 1150-2-100). For this preliminary site screening, the following assumptions about the FWOP were made:

- Land use change is static. Due to the long history of development in the area, no additional development beyond currently levels of imperviousness will occur.

- No climate change is considered due to variable forecasts in the region (< +0.5 to > +4 ^{0}C minimum and maximum temperature anomalies and < –10 to > +25 percent change in precipitation) based on statistically downscaled General Circulation Model projections for the Chattahoochee Watershed in year 2090 (Lafontaine et al. 2015).

- No additional invasive species expansion. Invasive species currently occur in every reach of Proctor Creek with some reaches dominated. Expansion beyond the current extent will be minimal.

The future without project condition (Figure 17) provides further insight into the individual modules of the Proctor Creek Ecological Model (PCEM) as well as the overarching index of ecosystem integrity. The instream condition in Proctor Creek ranges from extremely poor to reasonably high quality, often in conjunction with underlying geomorphology (i.e., bedrock grade controls and confined valley types). Riparian zones in the watershed are reasonably intact but often contain significant invasive species disturbance and resultantly have fair quality scores. The current hydrology module emphasizes impervious areas as a key hydrologic driver, and thus, upper reaches of the Proctor Creek mainstem have low quality (due to high impervious cover), Terrell Creek and Grove Park Tributaries have fair quality, and mainstem quality improves as tributaries provide a dilution effect on the mainstem. Connectivity in Proctor Creek is relatively high due to few fish barriers, but piped and channelized segments and utility crossings serve as full and partial barriers disconnecting the mainstem from headwater reaches. Overall, the Index of Ecosystem Integrity (IEI) indicates that headwaters are the most impacted portions of Proctor Creek, and the subsequent improvement of those headwater reaches would likely benefit downstream areas via hydrologic enhancements. Likewise, fish passage improvement would enhance connectivity to headwaters upstream and increases the IEI for these reaches.

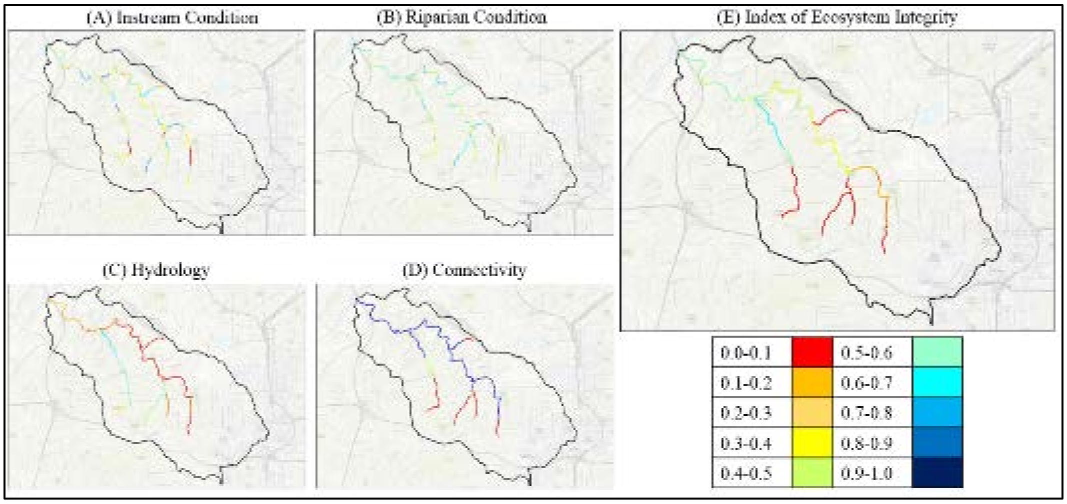


Figure 17: Future Without Project (FWOP) Conditions

4.2. Reach Delineation

The PDT Divided Proctor Creek into a total of 46 reaches (sites) that were identified from stream walks. Based on restoration opportunities, the 46 sites were screened down to 38 sites. These were initially classified based on a quality factor of low restoration potential to high restoration potential for both instream and riparian zones. The reaches are shown in Figure 18.

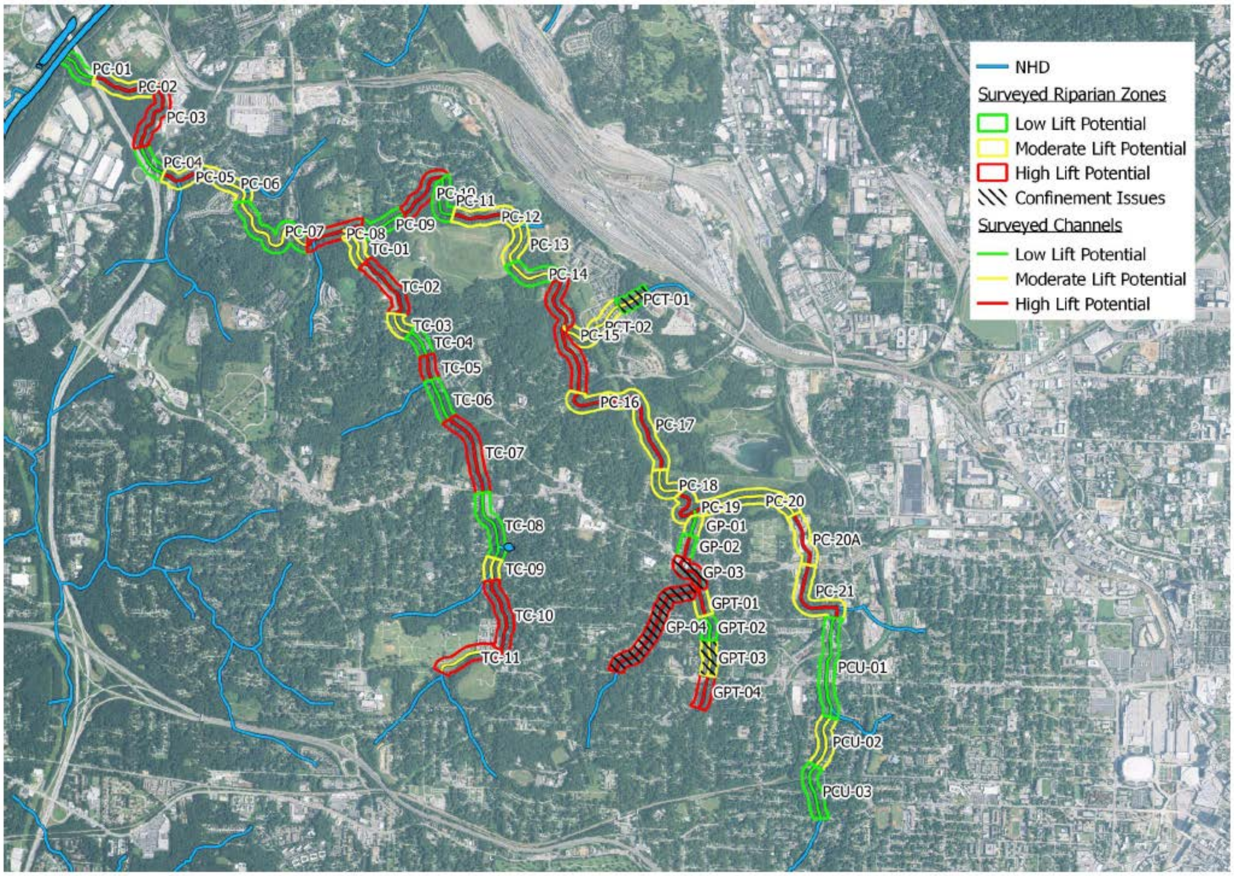


Figure 18: Proctor Creek Reach Delineation

4.3. Measure Development and Screening

Prior to the February 2016 field investigation, the PDT conducted a review of common urban stream restoration actions (FISRWG 1998, NRCS 2007). The review resulted in ten general categories of measures with some examples shown of each measure type. This list is not exhaustive, but instead provided a means to characterize the general breadth of restoration measures considered. Not all of these measures are appropriate for USACE restoration missions; given the breadth of the UWFP, opportunities related to all of these alternatives were carried forward to field investigation. The restoration measures considered were:

- Streambank protection: local erosion control (e.g., rootwads, plantings, etc.), bank reshaping, structural measures (e.g., deflectors), bank armoring (e.g., riprap, walls)
- In-channel actions: daylighting, dechannelization (e.g., removing concrete or riprap lining), dredging sediment deposits
- Riparian buffer management: tree planting, Federally led invasive species management, citizen-led invasive species management

- Fish passage: culvert repair, barrier removal, passage structures
- Floodplain connectivity: low benches accessing riparian zones, wetland creation, flow diversion
- Flow attenuation: culvert modification, inline detention, offline detention, infiltration measure (e.g., pervious surfaces, rain gardens, etc.), floodplain buy-outs coupled with reforestation
- Recreational improvement: signage, trails, access points, shelters, amphitheaters
- Nutrient management: fertilizer education, fecal control programs (e.g., dog disposal bags), nutrient trading programs
- Litter control: education campaigns, trash pickup or pricing programs, trashracks, tire pickup programs

In February 2016, field teams walked 13.0 miles of the Proctor Creek Watershed to collect data on the existing conditions and identify potential restoration actions. In each reach, team members proposed competing plans and ideas for restoration and developed a site-specific alternative composed of one or more of the above measures (Table 3). Measures were screened and applied to each reach based on the project objectives and the problems specific to that particular reach. Reach identification abbreviations provided a quick reference of a geographic location that is ordered from downstream (Chattahoochee River) to upstream (headwaters) and whether it is main-stem (PC - Proctor Creek) or a tributary (GP - Grove Park and TC - Terrell Creek).

There was no minimum level of output used to meet any single planning objective. The PDT formulated measures based on best professional judgment in order to maximize objectives within a reach and balance objectives across the watershed. Solutions were uniquely developed for that reach, as an example, for Reach ID PC-09 there was a fish barrier which impacts connectivity on all reaches upstream. The measure applied to that reach was improving fish passage with a rock ramp. From the fish data collection which showed the IBI for Proctor Creek to be poor to very poor, maximizing increased habitat and habitat diversity was key for overall ecosystem improvement.

Table 3: Potential Non-Detention Restoration Alternatives Presented by Reach

Reach ID	Restoration Alternative
PC02	Channel reshaping, bank protection, invasive removal
PC03	Channel reshaping, bank protection
PC05	Stabilize right bank, create point bars, woody debris features
PC06	Move bars to decrease width
PC07	Move mid-channel bars and stabilize
PC08	Bank protection, invasive removal
PC09	Barrier improvement (rock ramp)
PC10	Bank protection, invasive removal, plantings, bar shaping
PC12	Cross vanes, channel redesign, invasive removal, plantings
PC13	Invasive removal, plantings, minor bar reshaping
PC14	Add woody debris
PC15	Reshape bars, bank protection
PC16	Channel reshaping, bank protection, plantings
PC17	Bar reshaping, bank protection
PC18	Improve left bank/bar
PC19	Bank protection, channel reshaping
PC20	Bank protection, invasive removal
PC20A	Bank protection
PCU02	Left bank wetland area, bank protection (minimal)
TC01	Invasive removal, trash removal (local)
TC02	Right bank wetland, channel reshaping, invasive removal, plantings, recreation access
TC03	Left bank flood buyout, riparian wetland creation
TC05	Barrier improvement (rock ramp) at sewer, left bank wetland, channel reshaping
TC07	Bank protection, connect to floodplain, possible wetland detention, dechannelization
TC09	Barrier improvement at Baker Road
TC10	Dechannelize and create natural channel
TC11	Right bank layback, plantings
GP01	Bank protection, plantings
GP02	Daylighting with plantings
GP03	Bank protection
GPT01	Fish barrier improvement
GPT02	Bank protection, invasive removal, plantings

Hydrologic modification is a common source of geomorphic and ecological degradation in urban waters (Bledsoe et al. 2012). Flow attenuation via riparian zones, rain gardens, inline detention, and offline detention provides a suite of actions to manage “peaky” urban hydrographs. In addition to reach scale alternatives, the team examined aerial photographs of the watershed to identify potential detention locations. During field investigation, these sites were further assessed based on site conditions (e.g., nearby homes, feasibility, etc.). From these methods, 24 sites were identified as having the potential for flow detention with meaningful downstream effects on hydrologic conditions and subsequent ecological outcomes. Each site was then assessed relative to the detention basin properties (e.g., area, storage volume, excavation requirements, etc.) and the watershed hydrology (e.g., degree of urbanization, watershed area). This screening identified nine non-feasible sites, with the remaining 15 sites carried forward into the array of alternatives. Each detention site was then assigned to the closest downstream reach for application in the PCEM (Table 4).

Table 4. Flow Attenuation Opportunities

Reach ID	Detention Description	Volume Stored (ft^3)
PC10	Offline detention (D22) on right bank	262,400
PC20	Offline detention (D15) on right bank	110,539
PC20A	Offline detention (D7) on right bank	226,148
PC21	Offline in Valley of the Hawks (D10), Inline at Mosquito Hole (D11), Offline in English Ave (D16)	245,938
PCU03	Inline detention (D17) upstream of I-20	179,682
TC02	Hollywood Rd right bank wetland (D19)	33,868
TC03	Left bank flood buyout and wetland at Spring Rd (D20)	73,012
TC06	Tributary detention pond (D4) on Ridge Ave.	106,734
TC08	Tributary detention pond (D3) upstream of Hollowell Boulevard	113,373
TC11	Tributary detention pond (D1) upstream of cemetery	124,967
PCT02	Two inline ponds (D8=D21)	276,039
PCT01	Inline detention (D12) upstream of Perry Rd	94,399

4.4. Phase 1 Model Approach

The USACE team required a scientifically defensible, analytical approach for forecasting the ecological benefits of multiple restoration actions at many sites throughout the Proctor Creek Watershed. A two-phase modeling framework was developed to meet the needs of the SMART Planning paradigm and planning milestones. Phase 1 (summarized here and presented fully in Appendix E) informs the screening of potential restoration actions at many sites in the watershed down to a smaller set of restoration actions for consideration during the “Alternatives Milestone” stage. This phase emphasizes a static view of futures with and without project, and time-dependent forecasts are not used. Furthermore, this phase uses general descriptions of alternatives and preliminary costs. In the later stages of the plan formulation process, Phase 2 modeling (presented in Appendix E) was performed to help inform selection of the TSP. Phase 2 includes site-specific restoration designs, temporal forecasts of restoration benefits, and refined cost estimates.

The Phase 1 analysis (site-selection) provides the basis for quantifying environmental benefits of different combinations of restoration actions and documents the development of a numerical modeling framework for the Proctor Creek Ecosystem Restoration Study. The PDT followed a common ecological modeling process of conceptualization, quantification, evaluation, and application (Grant and Swannack

2008, Swannack et al. 2012, Figure 19). Notably, model development was constrained by the need for rapid development and application under USACE SMART Planning paradigm, which required less than four months for field study, model development, and project application. As such, many components of the model rely on existing data, professional judgment, or rapid field assays. The model framework (Figure 19) was designed to be applied under these constraints, but also be adaptable for future applications, where additional data or modeling inputs may be available.

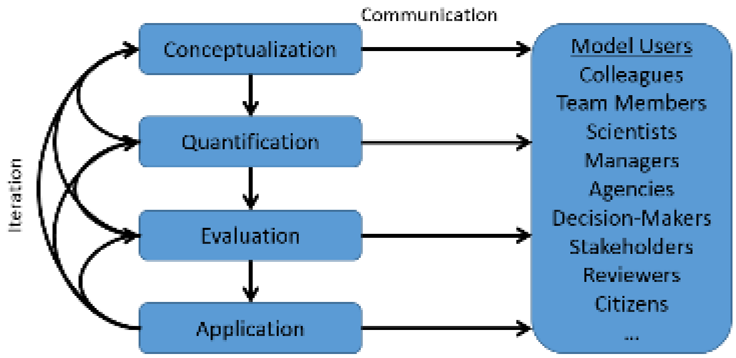


Figure 19: Ecological Model Development Process

4.5. Screening of Reaches

Site screening required not only an estimate of the benefits of restoration, but also and assessment of the costs involved. For instance, a site providing 1,000 linear feet of stream restoration may not be competitive (from a cost-effective standpoint) for $500,000, but may be "worth it" for $100,000. Detailed cost estimates for the 38 proposed restoration reaches were unfeasible given the rapid screening timeline, so a cost estimation technique was developed to provide relative cost differences between alternatives. These costs should not be construed as exact or comprehensive, therefore we refer to these Phase 1 screening level estimates as "relative costs" rather than "actual cost." Key assumptions that apply to all of these estimates are:

- Estimates omit site preparation activities (e.g., access roads, land clearing).
- Estimates omit real estate differences.
- Estimates assume recreational and educational costs are equivalent at each site and thus do not provide a relative measure of change to screen alternatives.
- Costs include subcontractor and prime contractor overhead and profit.
- Costs do not include any contingencies.
- All costs have been adjusted to account for location in Atlanta, Georgia.

Restoration alternatives often relied on similar recommended measures (e.g., bank protection). Costs were developed on a unit cost basis for uniform application across the watershed for bank protection, riparian planting, invasive species management, and channel shaping. The quantity of restoration within a given reach typically depends on the level of degradation. For instance, a severely degraded reach with high, failing banks would require more earth moving and planting than a segment having a couple of bank failure "hot spots." As such the instream and riparian assessment scores were used to estimate the quantity of restoration within each reach in feet, acres, or cubic yards as appropriate. These quantities were then coupled with unit costs for each technique with the following assumptions:

- Bank protection and stabilization: initial and final bank slopes of ½H:1V and 3H:1V, riprap toe armoring, 50 percent off-site haul and 50 percent onsite haul, one rootwad every 100 linear feet, willow staking at three plants per square yard of bank slope, grass seeding and coir rolls

- Riparian planting: adapted costs from other restoration projects

- Invasive species management: manual herbicide application

- Channel shaping: excavation and movement of 75 feet with a skid steer loader, mobilization and demobilization excluded

Some sites did not conform to these unit cost rules and generalized estimates were made based on cost engineering judgment for the remainder of the restoration actions including detention sites, stream daylighting, de-channelization, and fish passage improvement. The relative cost estimates including all proposed actions at each site are shown in (Table 5).

Table 5. Restoration Relative Cost Estimate by Reach

Reach ID	Restoration Alternative	Relative Cost
PC02	Channel reshaping, bank protection, invasive removal	170.8
PC03	Channel reshaping, bank protection	226.7
PC05	Stabilize right bank, create point bars, woody debris features	143.9
PC06	Move bars to decrease width	2.7
PC07	Move mid-channel bars and stabilize	60.4
PC08	Bank protection, invasive removal	221.8
PC09	Barrier improvement (rock ramp)	0.4
PC10	Bank protection, invasive removal, plantings, bar shaping, Offline detention (D22) on right bank	819.2
PC12	Cross vanes, channel redesign, invasive removal, plantings	307.2
PC13	Invasive removal, plantings, minor bar reshaping	8.9
PC14	Add woody debris	2.3
PC15	Reshape bars, bank protection	699.8
PC16	Channel reshaping, bank protection, plantings	111.8
PC17	Bar reshaping, bank protection	277.9
PC18	Improve left bank/bar	26.2
PC19	Bank protection, channel reshaping	255.7
PC20	Bank protection, invasive removal, Offline detention (D15) on right bank	94.5
PC20A	Bank protection, Offline detention (D7) on right bank	987.3
PC21	Offline in Valley of the Hawks (D10), Inline at Mosquito Hole (D11), Offline in English Ave (D16)	443.2
PCU02	Left bank wetland area, bank protection (minimal)	58.3
PCU03	Inline detention (D17) upstream of I-20	38.4
TC01	Invasive removal, trash removal (local)	1.3
TC02	Channel reshaping, invasive removal, plantings, recreation access, Right bank wetland (D19)	234.9
TC03	Left bank flood buyout, riparian wetland creation Left bank flood buyout and wetland at Spring Rd (D20)	78.2
TC05	Barrier improvement (rock ramp), left bank wetland, channel reshaping	67.3
TC06	Tributary detention pond (D4) on Ridge Ave.	17.6
TC07	Bank protection, connect to floodplain, possible wetland detention, dechannelization	140.4
TC08	Tributary detention pond (D3) upstream of Hollowell Blvd	204.8
TC09	Barrier improvement at Baker Rd	0.2
TC10	Dechannelize and create natural channel	140.0
TC11	Right bank shaping, plantings, Tributary detention pond (D1)	374.9
GP01	Bank protection, plantings	48.4
GP02	Daylighting with plantings	150.0
GP03	Bank protection	101.6
GPT01	Fish barrier improvement	0.1
GPT02	Bank protection, invasive removal, plantings	36.3
PCT02	Two inline ponds (D8+D21)	424.7
PCT01	Inline detention (D12) upstream of Perry Rd	22.4

4.6. Final Array of Alternative Plans

4.6.1. Formulation Strategy

In keeping with the tenets of SMART Planning, the PDT considered a variety of formulation strategies for identifying and developing alternatives. The PDT determined that evaluating an exhaustive list (~275 billion combinations are possible) was not possible due to limited resources in both time and money. Therefore, the overarching formulation strategies the PDT considered were:

- One action per plan
    - Looks at efficacy of individual sites and alternatives
- Combinations of actions throughout the watershed
    - Looks for “nestedness” in planning sets
- Logical watershed-wide plans
    - All proposed actions
    - Proctor Creek main stem only
    - Proctor Creek downstream of Johnson Road
    - Proctor Creek upstream of Johnson Road
    - Terrell Creek only
    - Grove Park Tributary only
    - Proctor Creek Tributary only

All combinations of 0-4 alternatives were analyzed (i.e., 82,993 plans), sites were screened, and all combinations of the remaining sites were analyzed. These combinations could not be analyzed using the Institute for Water Resources (IWR) Planning Suite due to cumulative effects and dependencies between actions at the watershed scale. Therefore, all of the combinations of alternatives were prepared and analyzed within the PCEM. Benefits and costs were computed for all plans with 0-4 alternatives, and sites were screened based on this preliminary cost-effectiveness. Two criteria were applied in screening sites. First, if a site appeared in any of the current cost-effective plans it was maintained. Second, a cost-effectiveness plot was developed highlighting each site. Visual inspection of these plots allowed for removal of additional sites from the analysis. Figure 20 shows these basic steps in graphical format: (a) preliminary cost-effectiveness plot for all plans, (b) example of a site screened out from visual inspection, and (c) plot showing all sites that were removed from future analysis. Based on this screening, 19 sites were preserved for additional analysis (Table 6).

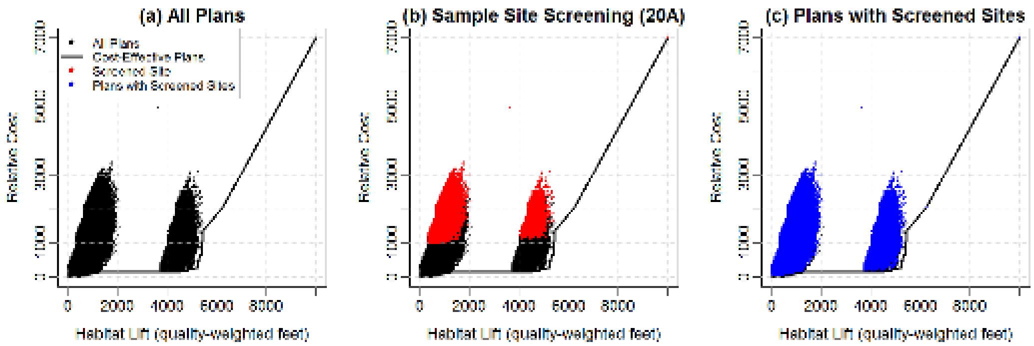


Figure 20: Preliminary Cost-Effectiveness Analysis

Table 6. Summary of Sites Maintained for Development of Additional Plan Combinations

Reach	In cost effective plans	Visual Inspection	Maintained?
PC06	Y	Y	Y
PC09	Y	Y	Y
PC13	Y	Y	Y
PC14	Y	Y	Y
PC15	Y	Y	Y
PC18		Y	Y
PC21	Y	Y	Y
PCU03	Y	Y	Y
TC01	Y	Y	Y
TC02		Y	Y
TC05	Y	Y	Y
TC06	Y	Y	Y
TC07		Y	Y
TC09		Y	Y
GP01		Y	Y
GP02	Y	Y	Y
GPT01	Y	Y	Y
GPT02	Y	Y	Y
PCT01	Y	Y	Y

4.6.2. Preliminary Cost-Effectiveness and Incremental Cost Analysis

The surveyed portion of Proctor Creek is 13.02 miles long. Ideally, there could be 13.02 miles of quality habitat (68,746 feet) throughout the watershed. However, current levels of habitat degradation have significantly impacted the quality in the study area to only 4.05 miles of habitat (21,369 feet). If all proposed USACE actions were executed the maximum obtainable habitat (including the existing) is 5.94 miles of habitat (31,384 feet).

All habitat units were converted to “lift” above the future without project condition (i.e., the net benefit of restoration actions) for the Cost Effectiveness-Incremental Cost Analysis (CE/ICA). Based on the forecasted costs and benefits (Figure 21), 143 plans were identified as cost-effective (i.e., maximum benefits for a given level of cost and/or mini-mum cost for a given level of benefit). These plans were then manually subjected to an incremental cost analysis following existing methods (Robinson et al. 1995). Based on these analyses, 18 “best” plans were identified (Table 7).

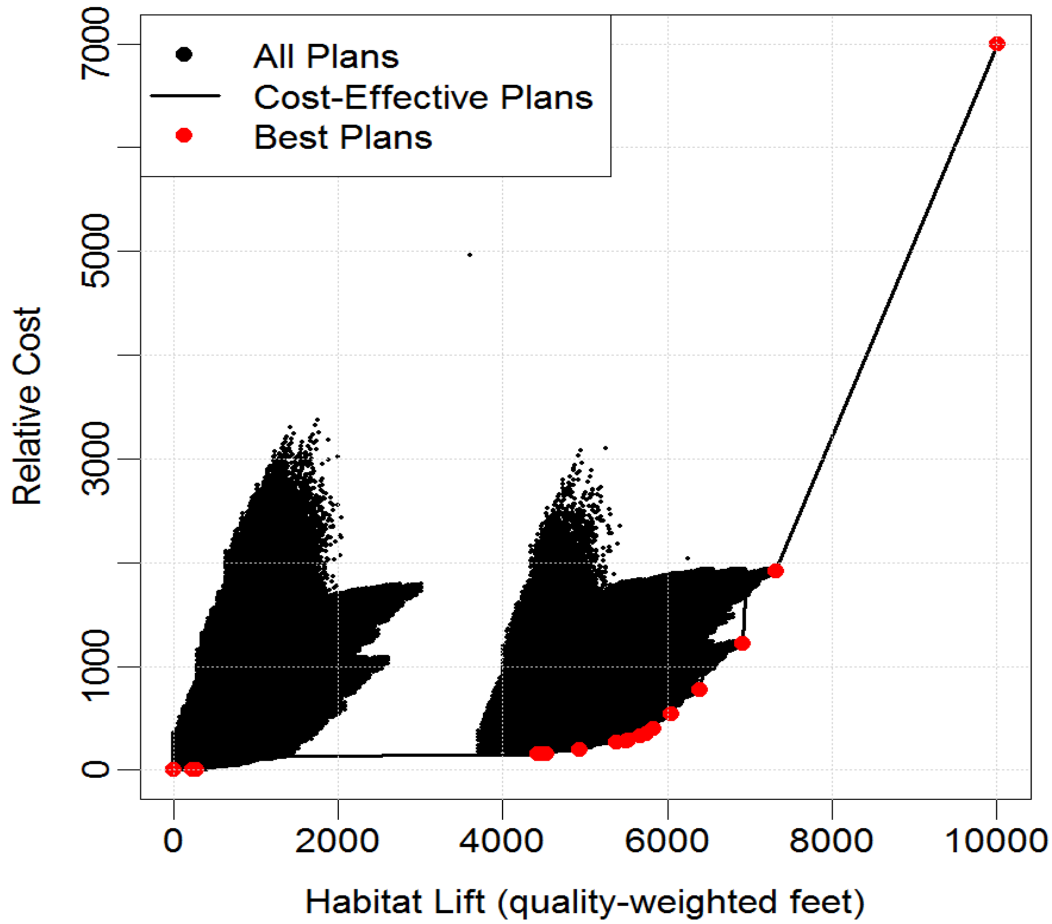


Figure 21: Screening level cost-effectiveness analysis

The focused array of plans consisted of 17 plan alternatives and the no action alternative. The alternatives ranged from $0 (No Action Alternative) to $7 million (All proposed sites). These alternatives were presented as the focused array of alternatives at the Alternatives Milestone Meeting in March 2016.

Table 7. Final Array of Alternatives

Alternative Plan	Habitat (HU)	Relative Cost	Incremental Cost / HU	Number of Sites	Sites Included
2	31,384	7,000.4	1.887	38	All proposed sites
1,092,461	28,688	1,914.3	1.725	17	PC06, PC09, PC13, PC14, PC15, PC21, PCU03, TC01, TC02, TC05, TC06, TC07, GP01, GP02, GPT01, GPT02, PCT01
1,091,856	28,283	1,214.5	0.851	16	PC06, PC09, PC13, PC14, PC21, PCU03, TC01, TC02, TC05, TC06, TC07, GP01, GP02, GPT01, GPT02, PCT01
1,088,891	27,762	771.3	0.693	15	PC06, PC09, PC13, PC14, PCU03, TC01, TC02, TC05, TC06, TC07, GP01, GP02, GPT01, GPT02, PCT01
1,078,883	27,422	536.4	0.629	14	PC06, PC09, PC13, PC14, PCU03, TC01, TC05, TC06, TC07, GP01, GP02, GPT01, GPT02, PCT01
1,053,662	27,199	396.0	0.551	13	PC06, PC09, PC13, PC14, PCU03, TC01, TC05, TC06, GP01, GP02, GPT01, GPT02, PCT01
1,004,485	27,111	347.6	0.305	12	PC06, PC09, PC13, PC14, PCU03, TC01, TC05, TC06, GP02, GPT01, GPT02, PCT01
928,603	27,038	325.2	0.260	11	PC06, PC09, PC13, PC14, PCU03, TC01, TC05, TC06, GP02, GPT01, GPT02
834,605	26,898	288.9	0.237	10	PC06, PC09, PC13, PC14, PCU03, TC01, TC05, TC06, GP02, GPT01
750,235	26,861	280.1	0.157	9	PC06, PC09, PC14, PCU03, TC01, TC05, TC06, GP02, GPT01
669,102	26,749	262.5	0.149	8	PC06, PC09, PC14, PCU03, TC01, TC05, GP02, GPT01
614,806	26,299	195.2	0.097	7	PC06, PC09, PC14, PCU03, TC01, GP02, GPT01
585,834	25,902	156.8	0.058	6	PC06, PC09, PC14, TC01, GP02, GPT01
274,650	25,863	154.5	0.043	5	PC06, PC09, TC01, GP02, GPT01
50,964	25,800	151.8	0.036	4	PC09, TC01, GP02, GPT01
270	21,655	1.7	0.026	2	PC09, TC01
17	21,605	0.4	0.002	1	PC09
1	21,369	0.0	na	0	None

4.7. Refinement of Final Array of Alternative Plans

At the Alternatives Milestone Meeting, the PDT received direction from the VT to screen down the alternatives (including number of reaches) to approximately 10 for a better assessment of realistic solutions. The PDT conducted a second field visit to Proctor Creek in order to develop conceptual designs and to refine measures developed for each site. Once the field visit was conducted, sites PC-06, PC-18, PCT-01, TC-01, TC-06, TC-07, GPT-01, and GPT-02 were screened out by the PDT based on an assessment of the implemented measures being able to achieve the objectives. While in the field, the PDT also added reach PC-08 back into the analysis for evaluation and developed conceptual designs. The reaches shown in Figure 22 were then evaluated in the Phase 2 PCEM model and grouped into combinations of reaches to form alternatives.

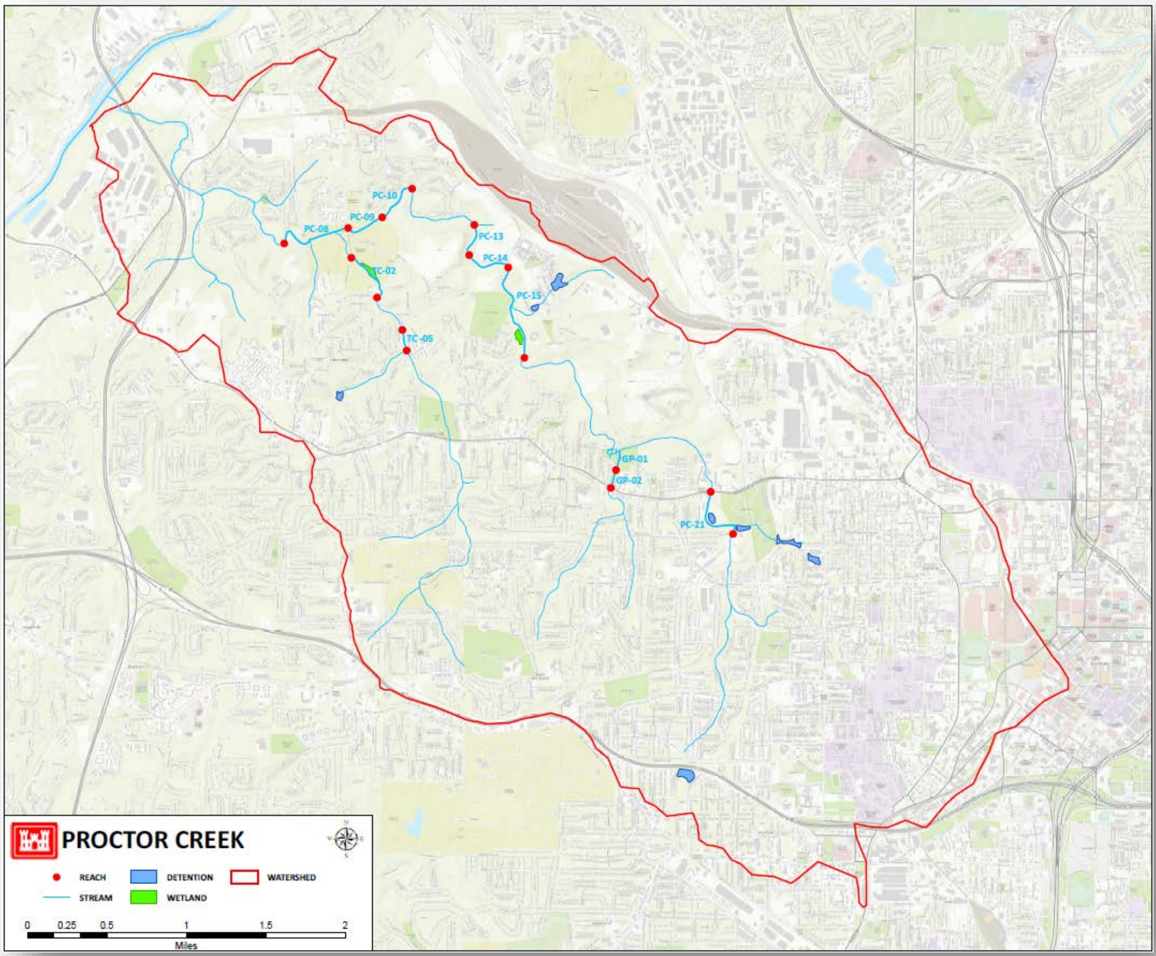


Figure 22: Reaches Considered for Phase 2 Modeling

5. Tentatively Selected Plan

5.1. Identification of the Tentatively Selected Plan (TSP)

The PDT used the refined focused array of alternatives (Figure 20) as the basis for further formulation towards the TSP. The PDT performed detailed environmental, engineering, and economic analysis, which are discussed along with the results in the subsections of 5.6 through 5.11

Alternative plans are evaluated by applying numerous, rigorous criteria. The PDT compared plans by contribution to planning objectives. Per the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, four general criteria are considered during alternative plan screening.

- Completeness: Completeness is the extent that an alternative provides and accounts for all investments and actions required to ensure the planned output is achieved. These criteria may require that an alternative consider the relationship of the plan to other public and private plans if those plans affect the outcome of the project. Completeness also includes consideration of real estate issues, operations and maintenance (O&M), monitoring, and sponsorship factors. Adaptive management plans formulated to address project uncertainties also have to be considered.
- Effectiveness: Effectiveness is defined as the degree to which the plan will achieve the planning objective. The plan must make a significant contribution to the problem or opportunity being addressed.
- Efficiency: The project must be a cost-effective means of addressing the problem or opportunity. The plan outputs cannot be produced more cost-effectively by another institution or agency.
- Acceptability: A plan must be acceptable to Federal, state, and local government in terms of applicable laws, regulation, and public policy. The project should have evidence of broad-based public support and be acceptable to the non-Federal cost sharing partner.

Evaluation Criteria: There are also specific technical criteria related to engineering, economics, and the environment, that also need to be considered in evaluating alternatives. These criteria are:

Criteria 1: What are the construction and O&M costs for each alternative in the focused array?

Criteria 2: Do the alternatives increase flood risk?

Criteria 3: For alternatives that contain detention features, are the storage volume assumptions made during the initial alternative screening process achievable/accurate?

Criteria 4: What is the impact to cost and constructability if rock is present in excavation?

Criteria 5: Does the non-Federal sponsor support the alternative?

Criteria 6: How many Habitat Units are produced for each alternative?

Criteria 7: Which alternatives are best buy alternatives?

Criteria 8: What real-estate acquisition is required to implement the restoration alternative?

5.2. Phase 2 Proctor Creek Ecological Model (PCEM)

Phase 2 of the PCEM is a refined version of the Phase 1. The PDT used the Phase 1 PCEM model to calculate ecological improvement for site selection and defining the focused array of alternatives prior to reaching the Alternatives Milestone. The Phase 2 model provides detailed ecological output for evaluation in support of selecting the NER Plan. Table 8 summarizes the refinements between the Phase 1 model and the Phase 2 model.

Table 8. Phased Modeling Approach Summary

Model Element	Phase 1 (PCEM1)	Phase 2 (PCEM2)
Primary Use	Informed site-selection and prioritization leading into the Alternatives Milestone	Informed the Tentatively Selected Plan (TSP) recommendation and feasibility-level design
Data Sources	Remotely sensed data Rapid, field survey at the stream segment and watershed scales	Remotely sensed data Field measurement at down-selected set of high potential restoration sites
Cost	Rapid, relative cost estimates for purely comparative purposes	Site-specific, rough order of magnitude (ROM) cost engineering analyses
Treatment of Time	Snapshot of futures with and without projects	Temporal trajectories over 50-year horizon based on restoration recovery rates
Treatment of Un-certainty	None	Rapid examination of expected, worst, and best case scenarios and stochastic simulation across a range of model inputs
Actions by Others	Neglected	Examined through scenario analysis of the recommended plan
Quantity	Length of stream from NHD	Length of stream from NHD
Quality Sub-Model: Instream Condition	Simple visual surveys of generalized condition	Field-based measurements and targeted visual surveys explicitly associated with project sub-objectives

Table 8 (cont'd). Phased Modeling Approach Summary

Quality Sub-Model: Riparian Condition	Simple visual surveys of generalized condition	Field-based measurements and targeted visual surveys explicitly associated with project sub-objectives
Quality Sub-Model: Hydrology	Ad hoc unit hydrograph model based on Gotvald and Knaak (2011) and Inman (2000). Crude measurement of storm volume only.	Spatially explicit watershed model based on land use and rainfall data (i.e., HEC- HMS). Addresses multiple aspects of the hydrologic flow regime and hydrologic function of the watershed.
Quality Sub-Model: Connectivity	Network-scale model of cumulative passability from the Chattahoochee River based on qualitative passability scores	Network-scale model of cumulative pass- ability from the Chattahoochee River based on quantitative barrier passability estimates from Coffman (2004) and Collins (2016)

The evaluation metrics used in the PCEM model are related directly to the ecosystem restoration objectives discussed in Section 4.1.2 of this report. Table 9 provides a reference between the ecosystem restoration objective and the evaluation metric

Table 9. PCEM Evaluation Metrics

Objective	Sub-Objective	Metric / Model Variable
1.1 Improve in-channel conditions suitable for a diversity of aquatic organisms	Restore channel geomorphic conditions to less disturbed conditions.	*Vbkf* – Percent difference in bankfull channel area relative to a regional hydraulic geometry curve.
	Reduce sediment loading from stream bed and banks.	*Vbehi* – Bank Erosion Hazard Index scoring system for assessing bank stability (Rosgen 2001).
	Increase instream habitat for a diverse assemblage of local fauna.	*Vibi* – State-wide visual fish habitat assessment for measuring biotic integrity (GA DNR 2005).
1.2 Improve riparian conditions supportive of a diverse aquatic and riparian community	Restore natural sources of organic carbon (i.e., energy) within the system.	*Vcarb* – Visual assessment protocol reflecting carbon sources and the basis of the food web.
	Increase nutrient uptake within the basin.	*Vnut* – Combination of variables assessing lateral connectivity of the river and floodplain and potential for root uptake by riparian plants.
	Improve temperature regimes.	*Vtemp* – Ratio of riparian canopy height to bankfull channel width as a proxy for temperature regulation.
	Increase riparian habitat to support native biodiversity.	*Vhab* – Extent of invasive species in riparian areas.

Table 9 (cont'd). PCEM Evaluation Metrics

1.3 Restore the flow regime to the best attainable condition	Decrease peak flows.	*Vpeak* – Peak discharge from 2-year rainfall.
	Decrease hydrologic flashiness.	*Vflash* – Hydrograph width for 2-year rainfall.
	Improve the capacity of the watershed to attenuate flows.	*Vatt* – Visual assessment of the capacity of a reach to attenuate floods primarily via hydraulic roughness.
1.4 Promote an interconnected system resilient to disturbances	Increase connectivity of movement corridors for aquatic and riparian species.	*Vcon* – Watershed connectivity to the Chattahoochee River for small-bodied native fishes. This single metric is used to reflect both objectives as the resilience of an urban stream often depends on its ability to recolonize following disturbance (e.g., repopulate following chemical spill).
	Increase the capacity to absorb natural and anthropogenic disturbance.	

5.2.1. Phase 2 Model Outputs

Average Annual Habitat Units (AAHUs) were calculated in the Phase 2 model based on the metrics discussed in Section 5.2. AAHUs were calculated for all plan combinations within the Phase 2 model as opposed to combining the reaches into plans in IWR Planning Suite. Over 8,000 plan combinations were possible during the Phase 2 modeling.

Plan combinations that are displayed in Table 10 are the plan combinations that were identified after the cost-effective incremental cost analysis. Columns 5 through column 17 display the reach names. If the plan contains that reach a "1" is shown in that column. The largest plan contains all reaches carried forward for Phase 2 modeling.

Table 10. Restoration Plan Outputs

Plan Number	AAHU	Lift (AAHU)	Number of Actions	PC08.01	PC08.02	PC09	PC10	PC13	PC14	PC15	PC21	PCU03	TC02.02	TC05	GP01	GP02
1	18,827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	25,611	6,785	1	0	0	1	0	0	0	0	0	0	0	0	0	0
66	28,167	9,340	2	0	0	1	0	0	0	0	0	0	0	0	0	1
410	29,220	10,394	3	0	0	1	0	0	0	0	0	0	0	1	0	1
1600	29,499	10,673	4	0	0	1	0	0	0	0	0	1	0	1	0	1
4401	29,715	10,888	5	0	0	1	0	0	1	0	0	1	0	1	0	1
9385	30,198	11,371	6	0	0	1	0	0	1	1	0	1	0	1	0	1
15998	30,437	11,610	7	0	0	1	0	0	1	1	0	1	1	1	0	1
19430	30,666	11,840	8	1	0	1	0	0	1	1	0	1	1	1	0	1
25629	31,080	12,253	9	1	0	1	0	0	1	1	1	1	1	1	0	1
28918	31,294	12,467	10	1	1	1	0	0	1	1	1	1	1	1	0	1
31414	31,491	12,665	11	1	1	1	1	0	1	1	1	1	1	1	0	1
32453	31,602	12,776	12	1	1	1	1	0	1	1	1	1	1	1	1	1
32718	31,693	12,866	13	1	1	1	1	1	1	1	1	1	1	1	1	1

5.3. Conceptual Design

The PDT created conceptual designs in the field for each reach of the TSP. The conceptual designs are at approximately at the 10 percent design stage. Conceptual designs were used to assess the costs and effects that the measures will have on the stream reaches. Below is an example of the conceptual design displaying the features contained in Reach PC-21. Additional conceptual designs are located in Attachment 1 of Appendix A.

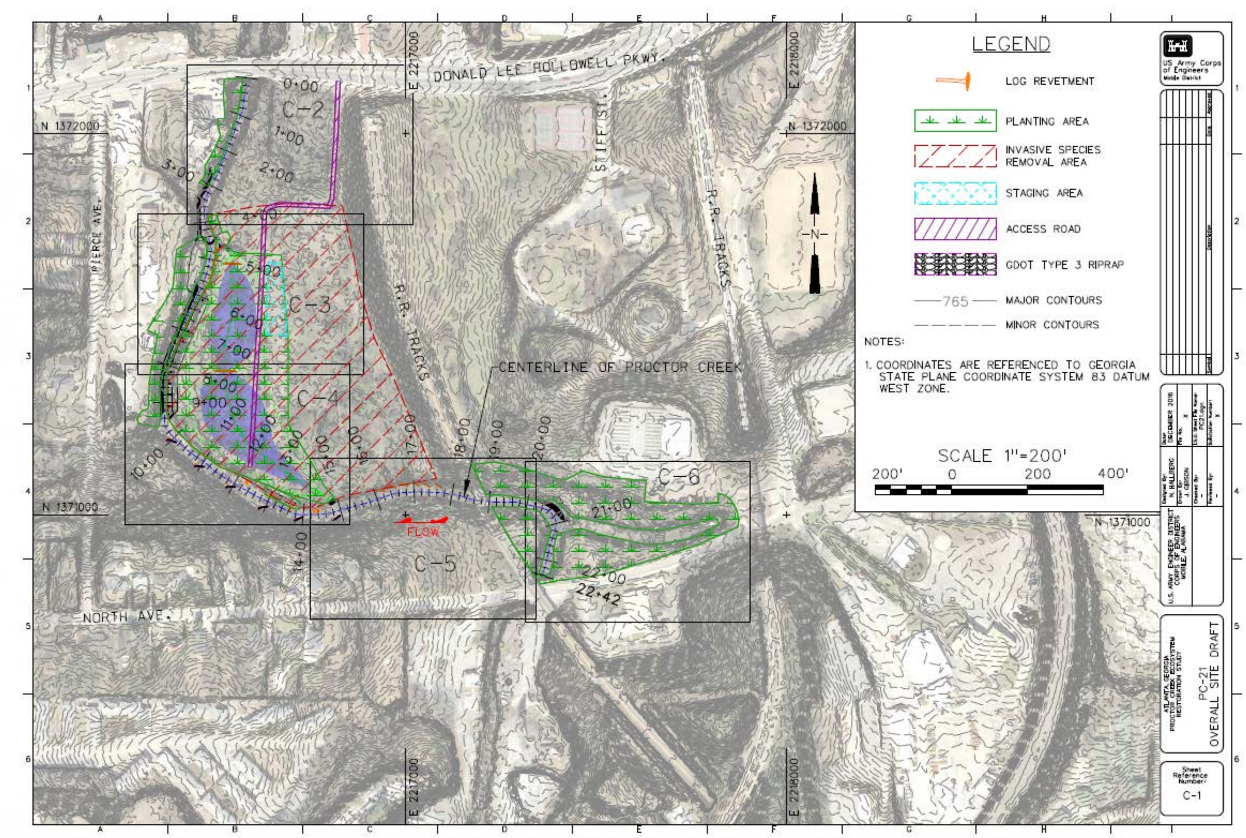


Figure 23: Conceptual Design of Reach PC-21

5.4. Rough Order of Magnitude (ROM) Cost Estimates

The PDT developed costs for each component of the TSP. Three costs were developed for each component: the Estimated Cost (Table 11), the Project First Cost (Table 12), and the Total Project Cost (Table 13). The Estimated Cost, which is the construction cost developed using the Micro-Computer Aided Cost Engineering System Second Generation (MCACES) software with the Real Estate costs, Planning, Engineering and Design (PED) costs, and Construction Management (CM) costs has a price level of 1st Quarter Fiscal Year (FY) 2017. The Project First Cost has a price level set to 1st Quarter FY 2020 based on anticipated approval and budgeting to begin PED and real estate acquisition in 1st Quarter FY 2020. This price level is used in the economic analysis. The Total Project Cost is escalated based on the midpoints of the

PED and construction, which varies slightly among the different reaches. The midpoints of construction are either the 2nd or 3rd Quarter of FY 2022. Escalation is based on the September 2016 Civil Works Construction Cost Index System (CWCCIS), EM 1110-2-1304. For the construction costs, MCACES cost book prices were used, except as noted otherwise, as modified by local wage rates(custom Labor Library) and equipment rates (2014 Region III Equipment Library).

Table 11. Estimated Cost by Reach (in $ 000s)

Reach	Construction	Lands	PED	CM	Contingency	Total
PC08-1	276	76	105	25	127	609
PC08-2	313	67	108	29	139	656
PC09	140	1	84	12	63	300
PC10	340	24	110	30	146	650
PC13	169	33	92	16	87	397
PC14	124	19	83	11	63	300
PC15	556	43	143	49	222	1,013
PC21	609	61	146	55	253	1,124
TC02	328	21	109	30	140	628
TC05	196	20	94	18	90	418
GP01	216	5	95	19	96	431
GP02	389	3	120	35	139	686
D17	135	18	83	12	62	310
Total	3,791	391	1,372	341	1,627	7,522
Not all rows and columns add up to the totals due to rounding in the TPCS worksheets.						

Table12. Project First Cost by Reach (in $ 000s)

Reach	Construction	Lands	PED	CM	Contingency	Total
PC08-1	292	80	117	28	136	655
PC08-2	331	71	121	32	149	705
PC09	148	1	94	13	68	325
PC10	360	26	123	34	156	699
PC13	179	35	103	18	93	428
PC14	131	20	93	12	68	325
PC15	589	46	160	55	238	1,087
PC21	645	65	163	62	270	1,204
TC02	347	22	122	34	150	675
TC05	208	21	105	20	97	451
GP01	229	5	106	21	103	465
GP02	412	3	134	39	149	738
D17	143	19	93	13	67	335
Total	4,014	414	1,535	381	1,745	8,089
Not all rows and columns add up to the totals due to rounding in the TPCS worksheets.						

Table13. Total Project Cost by Reach (in $ 000s)

Reach	Construction	Lands	PED	CM	Contingency	Total
PC08-1	306	82	143	30	147	709
PC08-2	348	73	147	36	161	765
PC09	155	1	119	15	76	365
PC10	378	26	150	37	169	760
PC13	187	36	128	20	102	472
PC14	137	21	117	13	76	364
PC15	592	47	189	60	247	1,134
PC21	664	66	191	65	283	1,270
TC02	365	23	148	37	162	735
TC05	217	22	130	22	105	496
GP01	239	5	132	23	112	512
GP02	433	3	161	43	162	802
D17	147	20	117	15	73	371
Total	4,168	424	1,873	416	1,874	8,756
Not all rows and columns add up to the totals due to rounding in the TPCS worksheets.						

5.5. Cost-Effectiveness and Incremental Cost Analysis (CE/ICA)

As stated previously, CE/ICA techniques were used to assist in determining the most cost effective restoration alternatives and to help determine whether obtaining additional environmental benefits is worth the additional costs. A *cost effectiveness analysis* is conducted to ensure that the least cost plan alternative is identified for each possible level of environmental output; and that for any level of investment, the maximum level of output is identified. Subsequent *incremental cost analysis* of the cost effective plans is conducted to reveal changes in costs as output levels are increased. The cost effective plans are examined sequentially (by increasing scale and increment of output) to ascertain which plans are most efficient in the production of environmental benefits. Those most efficient plans are called “best buys”. They provide the greatest increase in output for the least increase in cost. Typically, “best buys” have the lowest incremental cost per unit of output. Proposed restoration alternatives were evaluated in terms of average annual cost per average annual habitat unit using a 50-year period of analysis with the FY 2017 interest rate of 2.875 percent. The target year, the year following construction, is scheduled for FY 2020. This would be when benefits should begin. Benefits would continue to increase and then level off as the stream channel reaches its full restoration potential. The 50-year period of analysis would end in year 2070.

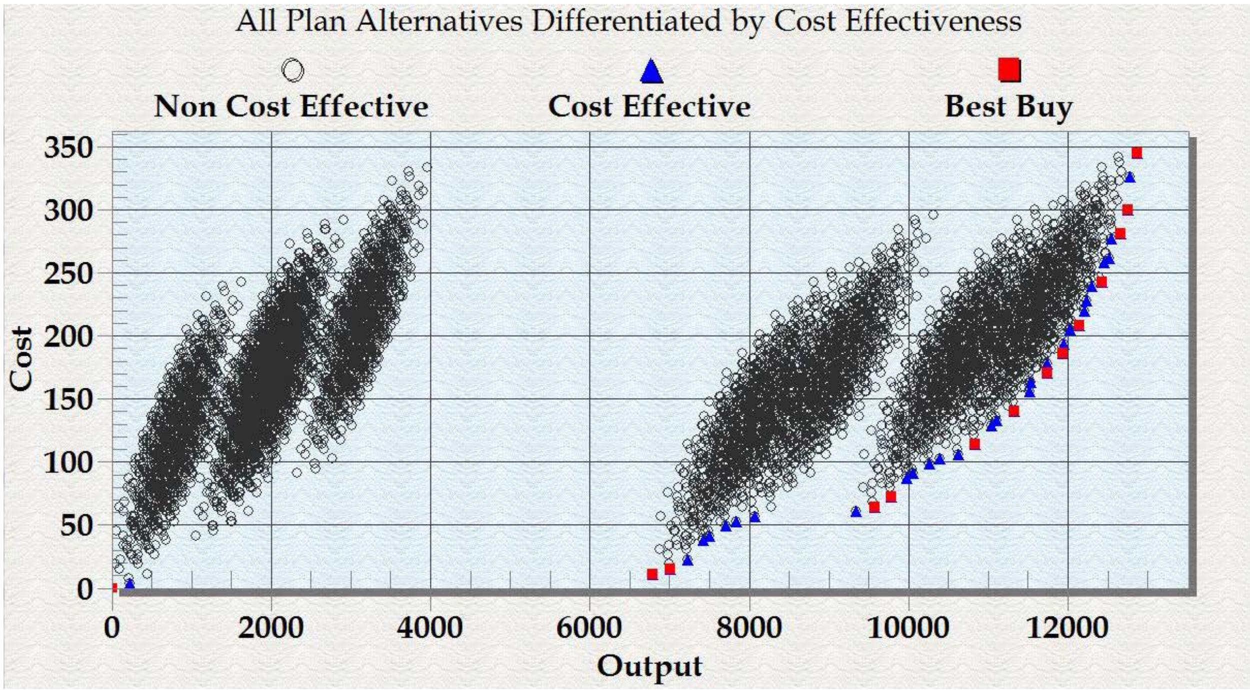


Figure 24: Cost Effectiveness of Alternative Plans

5.5.1. Cost Effectiveness by Location

Plan formulation by reach location was not a strategy used to select the TSP. Reach combinations were evaluated on overall lift to the watershed. The alternatives that include only Proctor mainstem reaches were screened out as not cost effective except for Alternative 6 which was a single site alternative that included PC-09. Additional information was requested during the TSP meeting to isolate the cost-effectiveness by location. Terrell Creek and Grove Park each contain only two sites (TC-02 and TC-05) and (GP-01 and GP-02) evaluated for Phase II analysis.

Terrell Creek Tributary and Grove Park Tributary each have two “best buy” plans. For Terrell Creek the first Best Buy alternative contains TC-05 and the second Best Buy alternative contains TC-05 and TC-02. For Grove Park the first Best Buy alternative contains GP-02 and the second Best Buy alternative contains GP-02 and GP-01.

Due to the number of reach locations within Proctor Creek mainstem a “Proctor Only” CEICA analysis was conducted in IWR Planning Suite to identify the cost effectiveness of “Proctor Mainstem Only” alternatives. Figure 25 displays the cost effectiveness of Proctor Mainstem Only” alternatives. Figure 26 displays the incremental cost analysis for “Proctor Mainstem Only” alternatives.

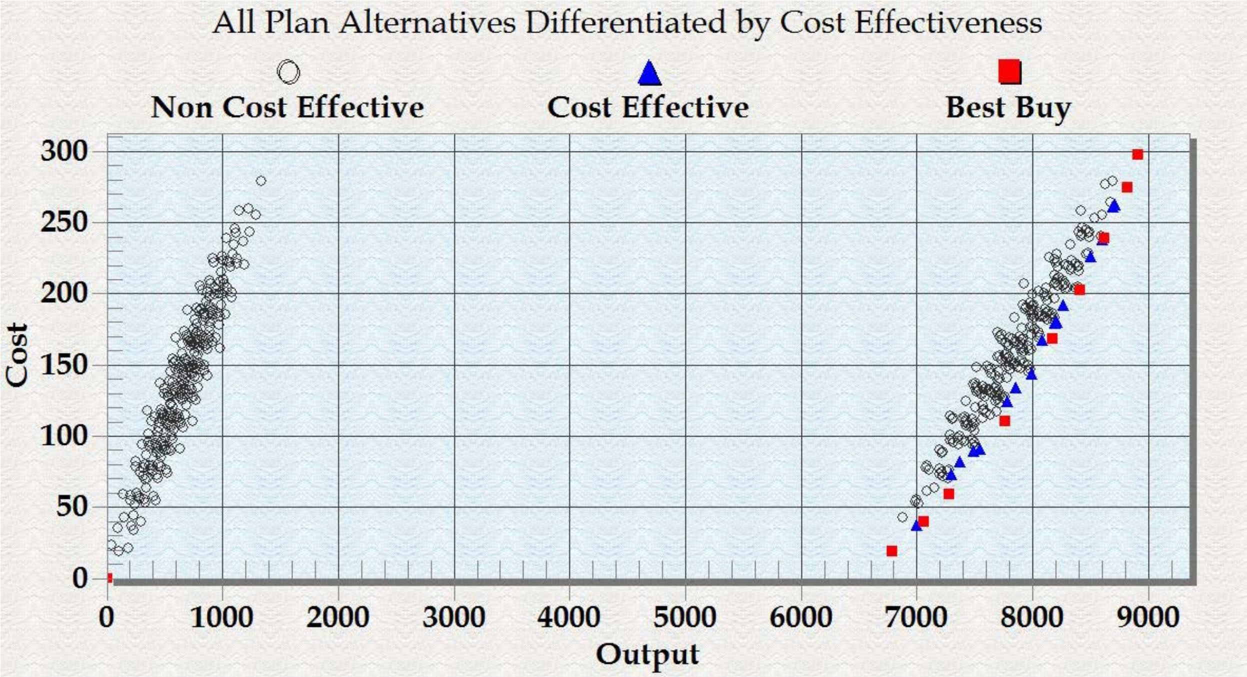


Figure 25: "Mainstem Only" Alternatives Cost Effectiveness Analysis

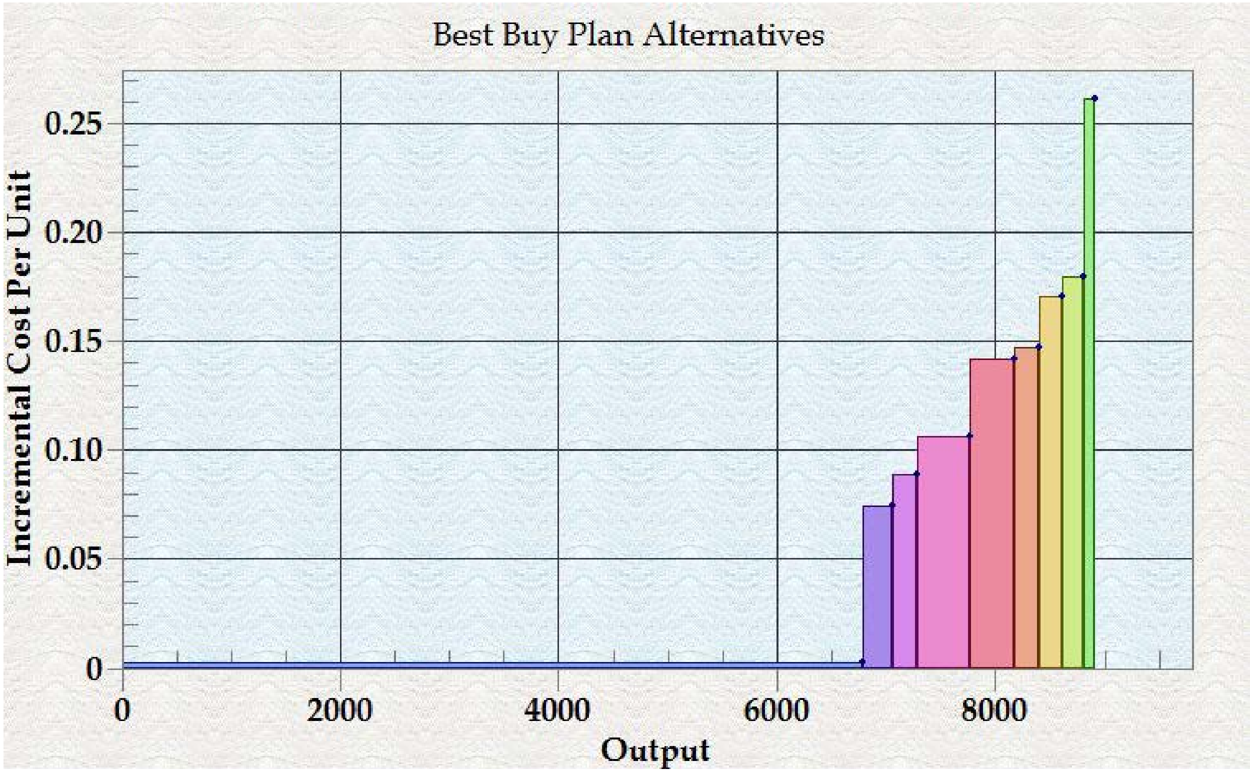


Figure 26: "Mainstem Only" Best Buy Incremental Cost Analysis

5.6. Comparison of Best Buy Plans

The alternatives evaluated provide an increase in average annual habitat units ranging from 36 percent to 59 percent over the Alternative 1, which is the No Action Alternative. Four Best Buy Plans in addition to the No Cction were selected for comparison and included in the summary of accounts. The PDT selected these plans based on break points in the cost effective incremental analysis as well as the differences in type and quantity of ecosystem restoration features. The Best Buy plans include: Best Buy 3, 6, 10, and 13. Descriptions of these project features are provided under "Plan Description" in Table 14.

The PDT selected Best Buy 13 (Alternative 32,718) as the TSP. It provides the maximum habitat lift of 12,866 AAHUs from the screened array of sites. It provides a variety of ecosystem restoration features including daylighting, wetland creation, bank stabilization, invasive species removal, native planting, riparian planting and detention. Best Buy 13 was selected over other plans for several reasons. The other Best Buy plans do no reasonably maximize the restoration connections. Best Buy 13 connects multiple reaches of improved habitat with other reaches that were in stable condition or where no restoration activities were warranted. Best Buy 13 also addresses restoration improvements throughout the middle and lower mainstem Proctor Creek as well as on both tributaries (Terrell Creek and Grove Park). Best Buy 13 fully addresses all four of the specific planning objectives whereas the other plans address only one or two objectives or partially address the planning objectives.

Other opportunities for ecosystem restoration remain in the watershed, but were screened out earlier in the analysis.

5.6.1. Summary of Accounts

A method of displaying the positive and negative effects of various plans is to use the System of Accounts as described in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. The accounts are categories of long-term impacts, defined in such a manner that each proposed plan can be easily compared to others. The four accounts typically used to compare proposed water resource development plans are National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE).

The NED account is the account that includes the estimates of project benefits and costs used to calculate net economic benefits, upon which the economic feasibility of traditional plans rests. The EQ account is a means of evaluating various environmental criteria. The RED account is intended to illustrate the effects that the proposed plans would have on regional economic activity, specifically, regional income and regional employment. The OSE account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic, and man-made and natural resources.

The alternatives are also compared with respect to the planning objectives and constraints, their institutional, technical, and public significance, and to the System of Accounts as previously described. The System of Accounts is displayed in Table 14.

Table 14: System of Accounts

Item	Alternative 1 (No Action)	Alternative 410 (Best Buy 3)	Alternative 9385 (Best Buy 6)	Alternative 28,918 (Best Buy 10)	Alternative 32,718 (Best Buy 13)
PLAN DESCRIPTION	No Federal Action	PC-09, GP-02, TC05 - provides connectivity improvements in main stem and two tributaries, instream habitat and riparian habitat improvement on Terrell Creek at 1 location	PC-09, GP-02, TC05, D17, PC-14, and PC-15, provides connectivity improvements, flow regime improvement and instream habitat and riparian habitat improvement	PC-09, GP-02, TC05, D17, PC-14, and PC-15, TC-02, PC-08-1, PC-21, and PC-08-2.provides connectivity improvements, flow regime improvement and instream habitat and riparian habitat improvement	PC-09, GP-02, TC05, D17, PC-14, and PC-15, TC-02, PC-08-1, PC-21, and PC-08-2, PC-10, GP-01, and PC-13 provides connectivity improvements, flow regime improvement and instream habitat and riparian habitat improvement
(1) Project Cost	-	$1,404,000.00	$3,027,000.00	$5,345,000.00	$7,522,000
(2) Interest During Construction	-	$12,000.00	$25,000.00	$45,000.00	$63,000
(3) Average Annual First Cost	-	$54,000.00	$115,000.00	$204,000.00	$288,000
(4) Annual O&M	-	$24,000.00	$49,000.00	$83,000.00	$114,000
(5) Total Avg. Annual Costs	-	$78,000.00	$164,000.00	$288,000.00	$401,000
IMPACT ASSESSMENT					
National Economic Development					
Benefit-Cost Ratio/ Net Benefits	No effect	Not Applicable; project was formulated for National Ecosystem Restoration outputs; the ecosystem restoration alternative was formulated to maintain the current level of flood risk reduction benefits.	Not Applicable; project was formulated for National Ecosystem Restoration outputs; the ecosystem restoration alternative was formulated to maintain the current level of flood risk reduction benefits.	Not Applicable; project was formulated for National Ecosystem Restoration outputs; the ecosystem restoration alternative was formulated to maintain the current level of flood risk reduction benefits.	Not Applicable; project was formulated for National Ecosystem Restoration outputs; the ecosystem restoration alternative was formulated to maintain the current level of flood risk reduction benefits.

Table 14 (cont'd). System of Accounts

Regional Economic Development					
Impacts to employment	No effect	Proposed activities will provide jobs during the period of construction.	Proposed activities will provide jobs during the period of construction.	Proposed activities will provide jobs during the period of construction.	Proposed activities will provide jobs during the period of construction.
Impacts to tax base	No effect	It is assumed that this work will improve ecosystem function and appearance. Therefore, this could have a positive improvement on the area tax base.	It is assumed that this work will improve ecosystem function and appearance. Therefore, this could have a positive improvement on the area tax base.	It is assumed that this work will improve ecosystem function and appearance. Therefore, this could have a positive improvement on the area tax base.	It is assumed that this work will improve ecosystem function and appearance. Therefore, this could have a positive improvement on the area tax base.
Other Social Effects					
Impact to public health and safety	No effect	No effect	The proposed improvements will have minimal reductions in velocities and therefore minimal to no effect on health and public safety..	The proposed improvements will have minimal reductions in velocities and therefore minimal to no effect on health and public safety.	The proposed improvements will have minimal reductions in velocities and therefore minimal to no effect on health and public safety.
Create public facilities	No effect	No effect	No effect	No effect	No effect
Impact traffic and transportation	No effect	No effect	No effect	No effect	No effect
Aesthetics	No effect	Channel and riparian improvement result in a more natural channel appearance	Channel and riparian improvement result in a more natural channel appearance	Channel and riparian improvement result in a more natural channel appearance	Channel and riparian improvement result in a more natural channel appearance
Environmental Justice	No effect	Project is located in one of the most populated, historically African-American, and economically disadvantaged areas of the City of Atlanta.	Project is located in one of the most populated, historically African-American, and economically disadvantaged areas of the City of Atlanta.	Project is located in one of the most populated, historically African-American, and economically disadvantaged areas of the City of Atlanta.	Project is located in one of the most populated, historically African-American, and economically disadvantaged areas of the City of Atlanta.

Table 14 (cont'd). System of Accounts

Public Access/Recreation	No effect	Increased access to the creek for hiking, and other recreational activities.	Increased access to the creek for hiking, and other recreational activities.	Increased access to the creek for hiking, and other recreational activities.	Increased access to the creek for hiking, and other recreational activities.
Environmental Quality - Contributions to Planning Objectives					
Improve in-channel conditions suitable for a diversity of aquatic organisms	No	Yes. Only addresses improvements at 1 location on Terrell Creek	Yes. Provides additional improvements at PC-14 and PC-15	Yes. Provides additional improvements at PC-08,PC-21 and TC-02	Yes. Provides additional improvements at PC-10,PC-13 and GP-01
Improve riparian conditions supportive of a diverse aquatic and riparian community	No	Yes. Only addresses improvements at 1 location on Terrell Creek	Yes. Provides additional improvements at PC-14 and PC-15	Yes. Provides additional improvements at PC-08,PC-21 and TC-02	Yes. Provides additional improvements at PC-10,PC-13 and GP-02
Restore flow regimes to best attainable conditions achievable in altered urban environments	No	No	Yes. D-17 Provides detention near I-20.	Yes. D-17 Provides detention near I-20.	Yes. D-17 Provides detention near I-20.
Promote an interconnected system resilient to foreseen and unforeseen disturbances	No	Yes. Address connectivity issues on both tributaries and the main stem	Yes. Address connectivity issues on both tributaries and the main stem	Yes. Address connectivity issues on both tributaries and the main stem	Yes. Address connectivity issues on both tributaries and the main stem
					Response to Evaluation Criteria
a. Acceptability	No	Yes	Yes	Yes	Yes
b. Completeness	No	Yes, but does not address instream or riparian objectives on main stem proctor creek.	Yes, but does not include riparian or instream improvements on lower Proctor Creek.	Yes, but leaves gaps on Proctor main stem (PC-10 and PC-13)	YES. Provides continuous stretches of aquatic ecosystem improvement in lower and middle Proctor Creek.
c. Effectiveness	No	Provides an additional 10394 AAHUs over the No Action Alternative.	Provides an additional 11371 AAHUs over the No Action Alternative.	Provides an additional 12467 AAHUs over the No Action Alternative.	Provides an additional 12866 AAHUs over the No Action Alternative.
d. Efficiency (Cost-Effectiveness; i.e., most efficient use of Federal and Non-Federal Funds)	No	Yes	Yes	Yes	Yes

5.7. Tentatively Selected Plan (TSP) Components

Alternative 32,718 (Best Buy 13) was determined to be the TSP (shown in Figure 27). Restoration features of the alternative include restoration of the channel to a less degraded condition through bank stabilization, bank protection and in-channel bar shaping. Connectivity improvements include daylighting in the Grove Park Tributary and rock ramps at two sewer crossings in the watershed, one on Proctor Mainstem and one on the Terrell Creek Tributary. Riparian restoration features include invasive species removal and riparian plantings of native species. A detention feature is also included to aid in reducing flashiness in downstream reaches. This feature is located adjacent to I-20. Features of the TSP are discussed in more detail in Section 3.6 of Appendix A.

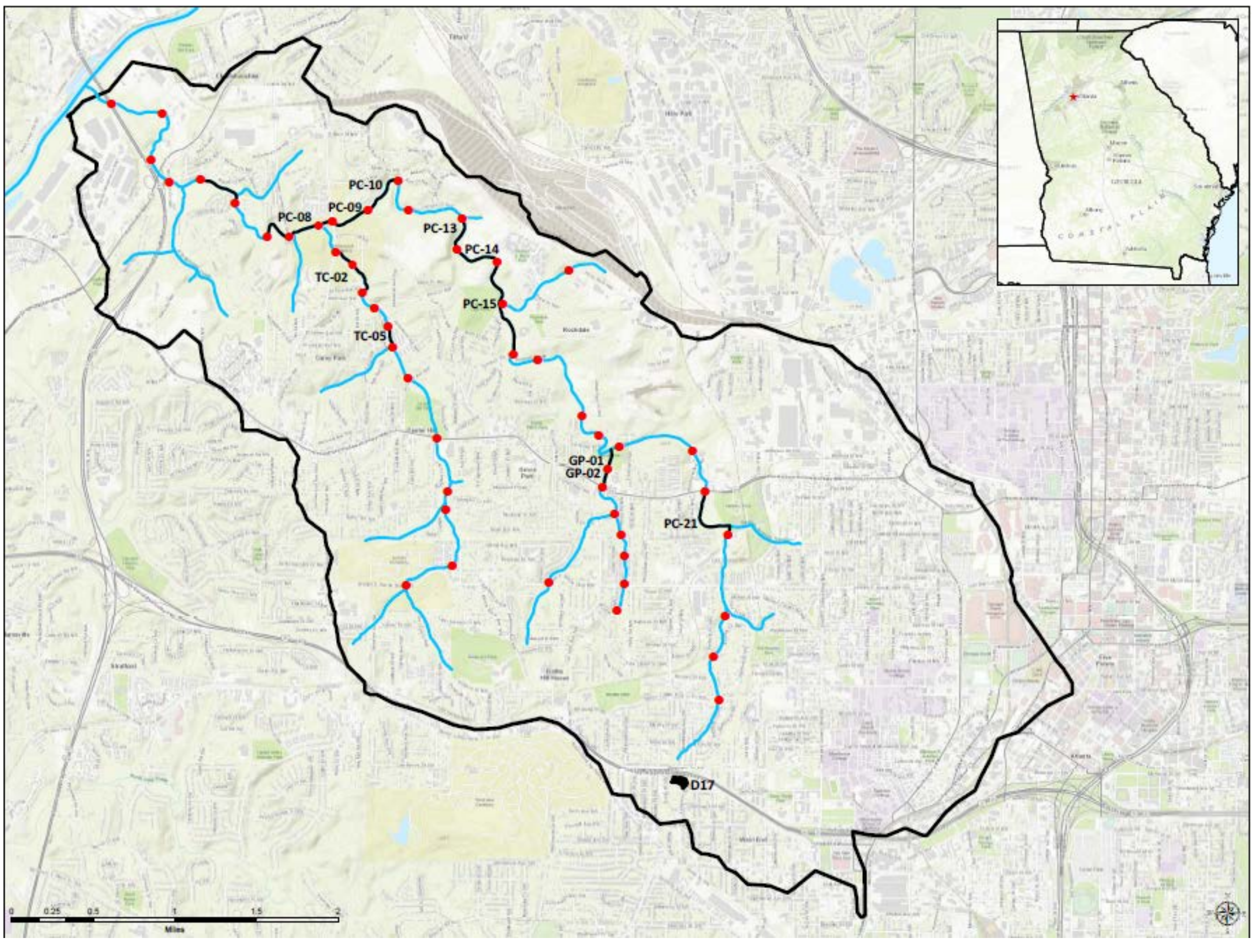


Figure 27: Tentatively Selected Plan Locations

5.8. Benefits of the TSP

Alternative 32,718 (Best Buy 13) includes restoration of approximately 2.43 miles of stream which is approximately 27 percent of the total stream miles in the watershed. Approximately 12,866 AAHUs would be provided which is a 59 percent increase over the without-project condition of 18,827 AAHUs.

5.9. Cost of the TSP

The risk based fully funded cost estimate for the TSP is shown in Table 15. Among other items, the cost estimate includes the cost for construction, Lands, Easements, Rights-of-Way, Relocation, and Disposal (LERRD). A more detailed derivation of project costs can be found in Appendix B.

Table 15. Project Costs

COST TYPE	AMOUNT
CONSTRUCTION	$4,168,000
LERRD'S	$424,000
PED	$1,873,000
CONSTRUCTION MANAGEMENT	$416,000
CONTINGENCY	$2,039,000
TOTAL	**$8,756,000**

5.10. Real Estate

The Non-Federal Sponsor, the City of Atlanta, is responsible for LERRD costs and activities.

The requirements for LERRDs should include the rights to construct, operate, maintain, repair, replace, rehabilitate, and patrol channel/streambank improvements, ecosystem restoration works, and best management practices (BMP) retention basin retrofits (if applicable) within the project area. The areas proposed for restoration will be acquired in fee by the non-Federal sponsor or by means of a formally approved Channel Improvement Easement, depending on the scope of restoration actions for the reach.

Of the 10 proposed project reaches, it is estimated that 96 parcels would be impacted, not including those lands which are currently vested to the non-Federal sponsor. Based on the proposed engineering project footprints, this correlates to an approximate total of 44.33 acres to be acquired for the restoration construction, staging, access, and detention areas. Further details regarding Real Estate requirements can be found in Appendix G.

5.11. Operation and Maintenance, Repair, Replacement and Rehabilitation Considerations (OMRR&R) Considerations

In compliance with authorizing legislation and cost-sharing requirements, the non-Federal sponsor must assume responsibility for OMRR&R of project features for as long as the project remains authorized. Operation and maintenance costs will include control of invasive plant species, trash removal, and periodic replanting of habitat areas damaged by flood events. The expected average annual cost of OMRR&R is $114,000. Further details of O&M assumptions can be found in Appendix B.

5.12. Monitoring and Adaptive Management

Section 2039 of the Water Resources Development Act (WRDA) 2007 requires that a recommended project include a monitoring plan to measure the success of the ecosystem restoration and to dictate the direction to which adaptive management, if needed, should proceed. At this stage in the planning process, it is assumed that pre- and post-construction monitoring will occur. For cost estimating purposes post construction monitoring was anticipated to occur at years 2, 5, and 10. A detailed monitoring and adaptive management plan will be developed prior to finalization and approval of this feasibility study.

5.13 Environmental Operating Principles

The general environmental criteria for projects of this nature are identified in Federal environmental statutes, executive orders, planning guidelines, and the Corps Environmental Operating Principles (EOP) originally established in 2002. The TSP strongly supports the USACE Environmental Operating Principles as outlined below:

1.) Environmental Sustainability. The project was designed for minimum OMRR&R.

2.) Consider Environmental Consequences. The project was designed to achieve a system that is more natural that will support riparian life.

3.) Seek Balance and Synergy. This project will provide improved connectivity and provides opportunity for recreational features to be included.

4.) Accept Corporate Responsibility. Project was designed for full compliance with National Environmental Policy and Endangered Species Acts.

5.) Mitigate Impacts. Project was designed to minimize impacts during construction. Long-term impacts are positive by restoring the environment.

6.) Understand the Environment. A multi-stakeholder, scientific and economic approach was used to obtain information for the study and develop the TSP.

7.) Respect Other Views. The study team solicited, listened to, and incorporated the views of others through public workshops, UWFP, and team meetings.

5.14 Optimization of the TSP

The TSP will be refined after release of this draft report to incorporate public and agency comments. Environmental, engineering and economic analyses will be revised as appropriate to reflect any revisions to the plan. The final version of this report will describe changes to the plan.

5.15. Risks Identified

1. Identification of potential brownfield sites. Based on existing information shared from the City of Atlanta and the EPA, the PDT feels that finding an

undocumented brownfield or industrial site (with HTRW issues) within the project footprint is low.

2. Identification of an unknown burial. There are two cemeteries located adjacent to the project footprint. There are no reported remains in the current project foot print. This is an implementation risk. This is a low risk. The current path forward is to prepare an inadvertent discover plan.

3. The risk of failure of one or more restoration measures may involve structural failure or failure of the element(s) to meet the goals and objectives of the project. This failure could result from failure to correctly implement the selected alternative or mischaracterization of the baseline conditions that would result in selection of restoration measures that do not sufficiently address the problems. To address this risk, mitigation actions could include post-construction monitoring and site inspections to identify problems and track the success of the project relative to the restoration goals and objectives, establishment of an annual maintenance budget to repair damages, and continued maintenance of the project. A monitoring and adaptive management plan will be developed to address this risk.

4. Cost risks were identified during the cost risk analysis and are discussed in the Cost Appendix.

6. Environmental Impacts

Because the purpose of the project is ecosystem restoration, in general, the adverse impacts associated with proposed action are expected to be minor both individually and cumulatively. Overall, addressing the problems outlined in Section 2.2 would result in a beneficial impact to the environment. However, as reach-specific actions described in Section 5 including in-channel structures, riparian planting, invasive species management, weir construction, bank reshaping, wetland plantings, rip-rap bank protection, construction of fish passage structures, and log vane channel structures could have site-specific impacts, impacts to individual resource areas are discussed in further detail in this section.

6.1. Topography, Geology, and Soils

No alternatives would be expected to have adverse impacts to the overall topography and geology of the watershed or to any specific reach. The possibility for localized impacts to soil stability exists. Heavy machinery used during the construction period would cause minor soil disturbances and there would be the potential for both soil compaction and erosion. With no controls erosion could be exacerbated in areas with erodible soils. However, the proposed action would be implemented with all appropriate BMPs and with soil and erosion controls in place.

Over the long term, the proposed action and other action alternatives would have beneficial impacts to soils. Individual measures taken at the various stream reaches would reduce erosion and soil loss through mass wasting. Wetland plantings and control of invasive species would also help to stabilize soils.

Alternative 1 (the No Action Alternative) would have no immediate negative impacts like those described, neither would it have any of the benefits. Over the long term, soils would be expected to continue to erode at a rate similar to the past.

6.2. Air quality and greenhouse gases

The project would have short-term effects on emissions into the air as a result of exhaust from internal combustion engines. Construction of the project would generate emissions from heavy equipment working on site. In addition, during construction, fugitive dust emissions from ground-disturbing activities would occur. Uncontrolled fugitive dust emissions, including particulate matter less than 10 microns in diameter, would be temporary and localized. Impacts of emissions and fugitive dust on air quality and the human environment should be short-term and minor. Contractors working on the project would be required to comply with all Federal, state and local regulations regarding air quality including emissions and dust control and implement any required controls. Because of the short-term nature of the project and generally small amount of emissions expected from on-site equipment, emissions would qualify as *de minimis* and therefore are exempt from the need to complete a General Conformity Determination. This is consistent with current the U.S. Environmental Protection Agency regulations (USEPA 2011).

There would be no new sources of greenhouse gases discharged to the atmosphere. Sea level potentially changes as a result of climate change and USACE projects can be impacted as a consequence. In accordance with the guidance provided in USACE' EC 1165-2-212 (USACE 2011), the first step in determining impacts is to decide whether the project would occur in a coastal/tidal/estuarine zone or in an area bordering such zones. The City of Atlanta is not located in such a zone.

Alternative 1 (the No Action Alternative) would not result in any emissions of engine exhaust or fugitive dust.

6.3. Land Use

No alternative would result in impacts to current land use. Project features would be constructed within Proctor Creek or in its riparian zone. Those areas are not currently used as developable areas. The current floodplain would continue in its current use for floodplain functions. Recreational facilities in the watershed would improve under the recommended plan as opportunities for trails and educational signage could be realized. Agricultural lands do not occur in the area. Land use ordinances would remain as at present.

6.4. Water Resources

6.4.1. Proctor Creek and Tributaries

For each alternative impacts to the waters of Proctor Creek would vary by the number of reaches proposed to be subject to engineering solutions to the previously stated problems affecting the watershed. For example, the proposed action would include the maximum number of reaches Alternative 32718 while Alternative 32453 would include all the reaches except PC13. Inclusion of a greater number of flow attenuation treatments, bank stabilization features, invasive species removal and stabilization of the stream channel would result in greater overall benefits to the stream relative to sedimentation, substrate embeddedness, riffle and pool complexes, and flashy flood events. Therefore the proposed action would result in the greatest benefit to the stream while the remaining action alternatives would result in less ecological lift. The No Action Alternative would result in maintaining the current stream condition and trend towards channel instability and habitat degradation.

6.4.2. Surface Water Quality

The proposed riparian restoration and bank stabilization activities will likely yield some improvement in water quality in the watershed. This is an indirect benefit to USACE restoration improvements. Projects currently underway as part of the City of Atlanta's Watershed Improvement Plan are directly addressing water quality improvements.

6.4.3. Groundwater

None of the alternatives would have impacts on groundwater. None of the proposed actions would change the volume or quality of groundwater infiltration within the watershed.

6.5. Biological Resources

6.5.1. Vegetation

Under the Proposed Action Alternative some of the existing vegetation could be disturbed during the construction phase of the project for any of the action alternatives. In the case of invasive vegetation, this would involve the intentional destruction and replacement with native vegetation. This replacement would constitute a beneficial impact. In other areas, native vegetation would be removed as a result of the need for access to sites or the installation of the treatments. These areas would be reestablished or planted upon project completion. By restoring the creek to a more natural flow and planting in the riparian areas, additional habitat would be provided.

The No Action Alternative would have no immediate beneficial or adverse impacts. Over the long term, erosion would continue to damage trees and other vegetation at the edge of the creek, invasive vegetation would continue and wildlife habitat would continue to be limited.

6.5.2. Wildlife

The species currently inhabiting the area use the riparian areas for food, water, shelter and breeding habitat. They are mostly tolerant of human activities. As such, there would be no significant impacts to those populations as a result of the proposed action. In the immediate vicinity of the work areas, small animals including mammals, birds, reptiles and amphibians would be temporarily displaced during the construction period. A few individuals incapable of escaping, such as nesting birds, or slow-moving amphibians could be killed. This mortality would be a minor impact, and any lost individuals would be replaced through natural recruitment following project completion. By letter dated July 7, 2017, the USFWS stated their support for the project and indicated that a Draft Fish and Wildlife Coordination Act Report would be provided during the summer of 2017. See Appendix F regarding comments submitted by the USFWS under the auspices of the Fish and Wildlife Coordination Act.

6.5.3. Fish

Because of the degraded nature of Proctor Creek and the absence of a diverse fish community, there would be little chance for negative impacts. Small pollution tolerant species such as sunfish occur in the creek and the proposed project would cause some localized impacts to those. The impact could result from construction work, either directly from crushing individuals or indirectly from the disturbance to their habitat. Likewise, changes in water quality, notably turbidity, could cause impacts. There would be an expected movement of fish from protected habitats to areas where predators such as other fish or birds could take them. This impact is not quantifiable but is expected to be minor and temporary. It would occur in the immediate vicinity of construction in the stream and be limited to the time construction was occurring. Fish would be expected to repopulate the area once construction is complete. Additionally, limiting the use of heavy machinery in the creek and the strict use of BMPs, including silt fences and rapid revegetation of disturbed areas will control entry of sediment into the system.

Long-term beneficial impacts would be expected from the project. A successful project would result in improved habitat for sensitive species and allow greater movement of fish within the watershed. This would cause a return to a fish community of greater diversity, more balance between predators and prey, a more complex food web including macroinvertebrates, and overall higher fish populations.

6.5.4. Waters of the U.S. including Wetlands

There would be no minor fill of waters of the United States. A small emergent wetland exists at site PC08 which is proposed to receive a bank stabilization treatment and removal of invasive species. In addition, placement of riprap for bank stabilization would occur below the ordinary high water mark in several sites. The bank stabilization actions in wetlands and placement of riprap constitutes a discharge of fill material into Waters of the United States requiring a Clean Water Act Section 404(b)(1) Guidelines determination. After final selection of a TSP, that determination will be made. A Section 404(b)(1) evaluation will be prepared for the study. In addition, a State of Georgia Water Quality Certification and Stream Buffer Variance will be required and will be obtained after final selection of the TSP.

6.5.5. Threatened and Endangered Species

As described in Section 3.6.5, one listed species potentially occurs in the watershed, a plant, Michaux's Sumac (Rhus michauxii) (endangered). The plant is described as occurring in sandy or rocky open woods. Although no formal survey has been conducted for this species, it is extremely unlikely that suitable habitat occurs in the urban environment. USACE has determined that the project and all alternatives would have “no effect” on any Federally listed Threatened or Endangered species. Further action under the Endangered Species Act is not required.

6.5.6. Wildlife Corridors

By restoring the channel design and vegetation of Proctor Creek as previously described there would be a corresponding improvement in the ability of aquatic organisms to move through the watershed. Likewise a healthy riparian corridor with reduced erosion and stable banks would provide improved habitat in the wildlife corridor throughout the watershed. This would be the case for all action alternatives. For the No Action Alternative there would be no change from the existing condition.

6.6. Cultural Resources

6.6.1. Cultural Resource Identification

During the study we documented numerous archaeological surveys and identified resources in and near the proposed work areas. These resources are summarized in Table 16. None of the buildings identified during the analysis are within the project footprint, Table 17. Further management consideration is not warranted for these resources, however at least one eligible archaeological site (9FU114) will have to be either avoided or assessed further for impacts.

Table 16. Previously Recorded Archaeological Sites within one mile of the project area

Site Number	**Survey**	**Component(s)**	**Eligibility**
9FU564	New South Associates, 2010	Historic House Site	Ineligible
9FU28	Georgia State University, 1973	Prehistoric Indian Scatter	Undetermined
9FU546	R.S. Webb and Associates, 2008	20th century house lots, bulldozed house remains	Ineligible
9FU95	Bowen, 1977	Historic Non-Indian; Redeposit of 9FU91 Fill (1890-1910)	Undetermined
9FU114	New South Associates, 1988	Late nineteenth/early twentieth century	Eligible
9FU587	Southern Research, 2013	Early to late 20th century razed residential neighborhood	Ineligible

Table17. Nationally Registered Historic Structures and Districts

Name	Resource Type	Construction Date	Date Surveyed	Eligibility
Donald Lee Hollowell Parkway at Proctor Creek	Bridge	1908	May 2013	Proposed Eligible
Resource 3/Bankhead Highway	Landscape Structure	1910s-1920s	2015	Eligible
Collier Heights	District	1915-1979	2009	Eligible
King Plow Company	District	1902-1946	1996	Eligible
Mozley Park	District	1907-1954	1995	Eligible
Whittier Hills	District	1895-1957	2001	Eligible
Howell Interlocking	District	1889-1955	2003	Eligible
Howell Station	District	1890-1947	1997	Eligible
Washington Park	District	1919-1958	2000	Eligible

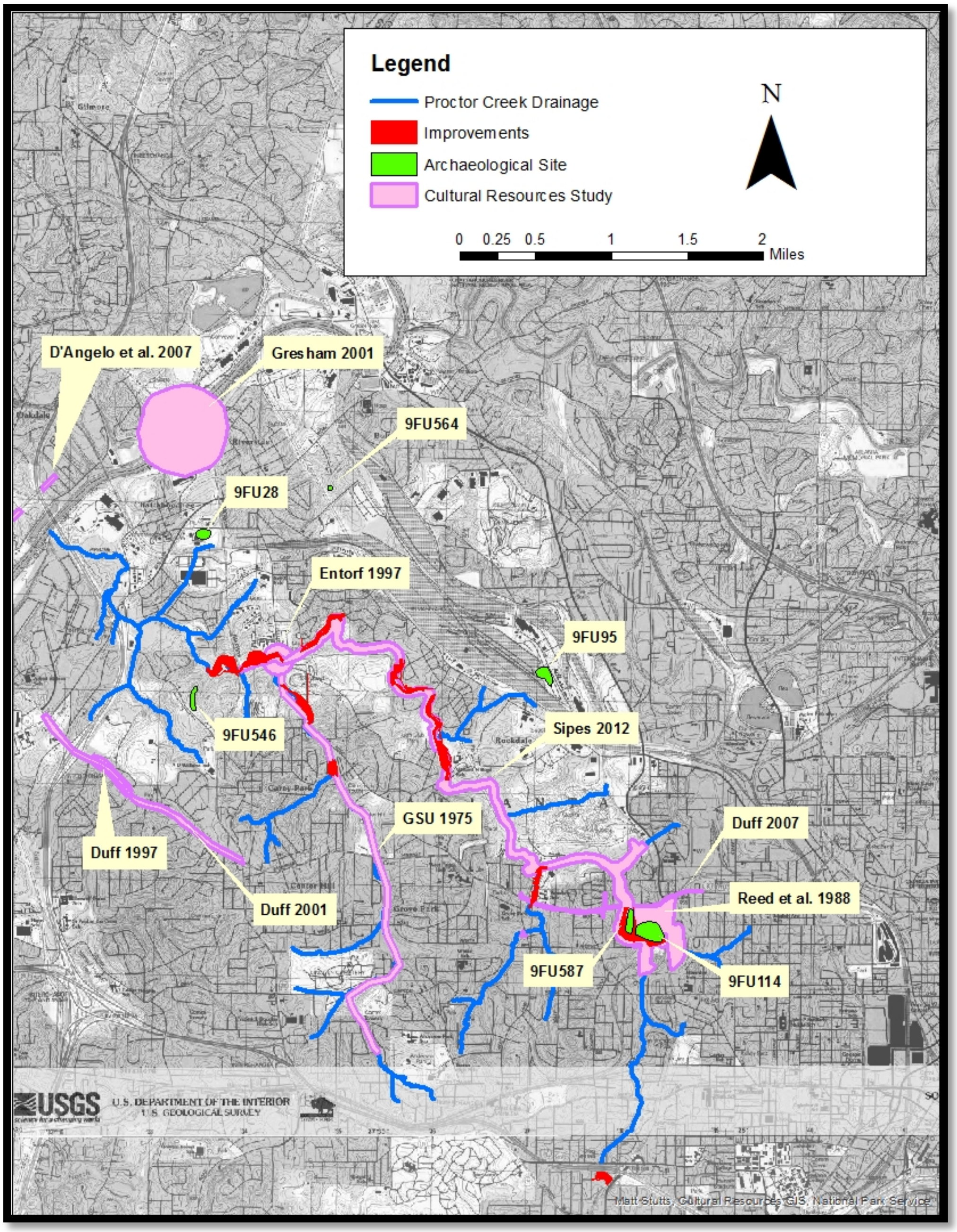


Figure 28: Recorded Archaeological sites and surveys in the Proctor Creek Project area

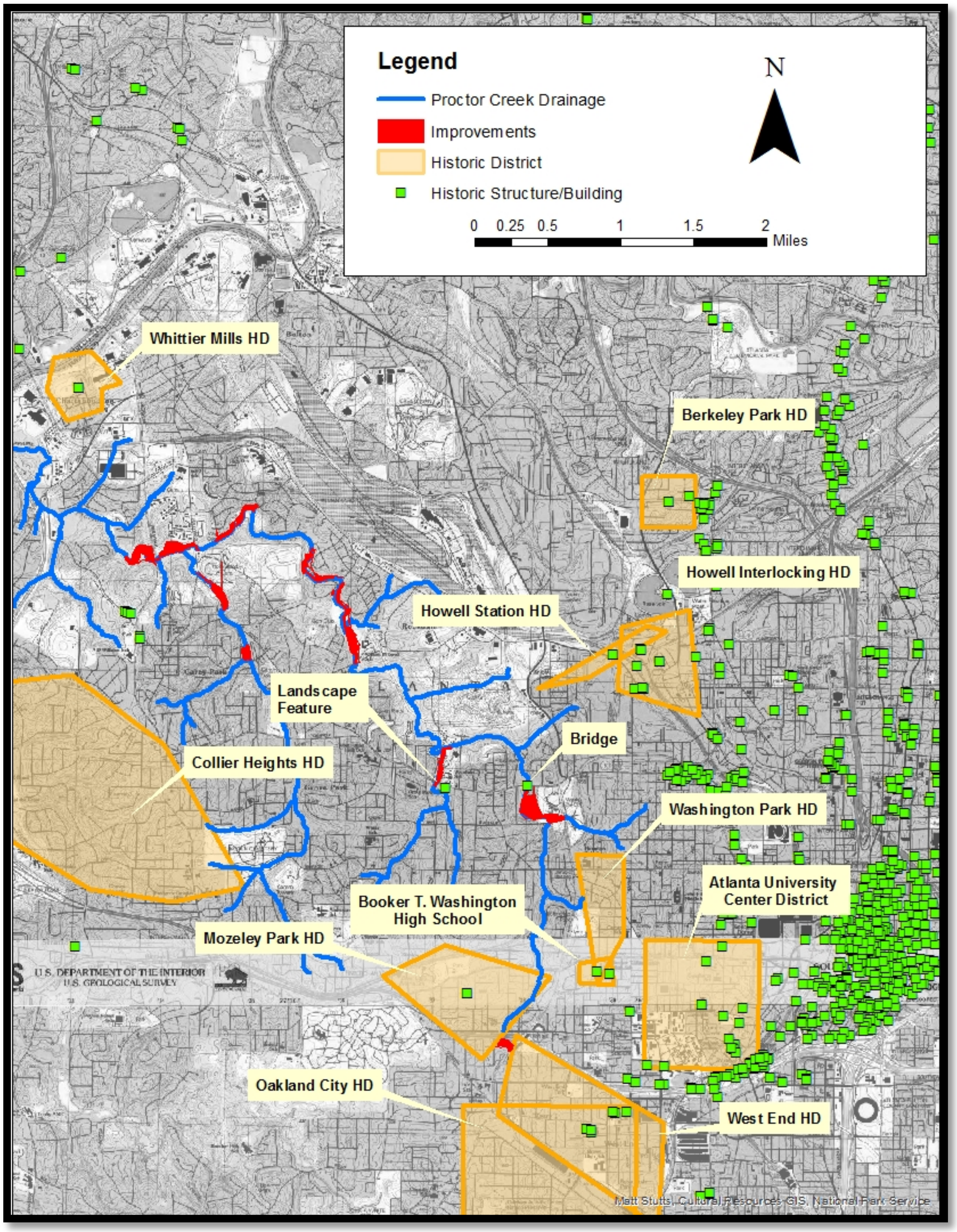


Figure 29: Recorded Historic Structures and Districts in the Proctor Creek Project area

6.6.2. Potentially Significant Resources in the Project Footprint

Only one potentially significant cultural resource has been identified in the proposed action alternative including the No Action Alternative. Site 9FU114, a late 19th century/early 20th century landfill has been identified as eligible for the National Register of Historic Places. The current strategy to fulfill Section 106 requirements of the National Historic Preservation Act is to draft a Memorandum of Agreement between

USACE, the Georgia State Historic Preservation Office, and the City of Atlanta in order to avoid, minimize, or mitigate potential impacts as determined by the final design of the project.

6.7. Traffic and Circulation

Although there may be local impacts to traffic in the areas of construction, there would be no impacts expected to major traffic corridors such as the interstate highways or other major traffic arteries in the Atlanta area. Construction of the project could result in local traffic delays, but these would be expected to be minor and small in number due to the limited scope of the project. No access would be required from state or Federal highways. Access to work sites would occur via local roads and streets. Residential areas where crews are entering and exiting may experience short delays. Most delays could be avoided by timing such construction movement to times other than peak traffic hours. Additionally, use of adequate signage and signalers would limit impacts. No long-term change in traffic volumes or patterns would be expected. No differences between alternatives would be expected in traffic patterns. The No Action Alternative would result in no impacts.

6.8. Noise

Noise would be generated by the proposed action from a number of construction-related sources. These include the vehicular traffic cited above, heavy equipment, workers talking at levels over the sound of equipment, walkie talkies, etc. Typical sources of construction-related noise is shown in Table 18, along with expected noise levels at 25 and 50 feet from the source. These exceed the ambient noise levels cited in the USACE study (USACE, 1998) of 58-72 dB for urban residential areas. However, it is expected that such noise levels from the proposed action would approximate the noise originating from a residential home construction project. Nearby residents would experience some interference and annoyance during outdoor activities. This would constitute a minor nuisance to those affected. Work will occur only during daylight hours assuring no sleep disturbance for most people. The impact would be short-term and minor.

The No Action Alternative would not result in any noise generation. All other alternatives would generate different degrees of noise of different duration and locations depending on the number of work sites included in the alternative, although none would generate a greater level of noise or from sources different than those of the proposed action.

Table 18. Typical Construction Noise Generating Sources in Typical Urban Environments

Construction Phase	Equipment	Noise Level at 25 feet (dBA)	Noise Level at 50 feet (dB)
Clearing and grubbing	Bulldozer, backhoe	95	89
Earthwork	Scraper, bulldozer	97	91
Foundation	Backhoe, loader	94	88
Superstructure	Crane, loader	95	89
Base preparation	Trucks, bulldozer	97	91
Paving	Paver, trucks	98	92
Source: U.S. Department of Transportation, 1977			

6.9. Recreation and Public Access

The existing parks and public access areas described in Section 3.10 would be unaffected by the proposed action and other alternatives including the No Action Alternative. Current facilities would continue to be available. For any action alternative, if there were a need to cause a temporary closure or limitation of use, those impacts would be temporary and minor. No such closures or limitations are planned at this time.

6.10. Aesthetics

The proposed work to restore Proctor Creek to a more natural state is a beneficial aesthetic impact. The work involving restoration of natural channel design, controlling erosion, improvement of the aquatic habitat, removal of invasive species, planting of vegetation and removal of existing debris in the area during construction would be considered by most people as enhancing the natural beauty of the area. All action alternatives would be expected to have similar aesthetic benefits, but to a lesser degree.

The No Action Alternative would result in no change to the existing degraded aesthetic condition.

6.11. Public Health and Safety including HTRW

The flashy nature of the creek would be slightly improved by the proposed work, as would the stability of the creek banks. Those improvements would lead to reduced hazards associated with flash flooding, although the effect would be expected to be minimal. During construction, implementation of standard safety procedures will maintain public and worker safety to the greatest extent possible. These procedures include the use of safety equipment where appropriate, safety zones around equipment, limitation of public access to the work areas, and appropriate training of all personnel. The current Proposed Action project footprint does not contain any known Brownfield sites. Additional evaluation of HTRW will be conducted once the TSP has been approved.

6.12. Climate Change

Under the Proposed Action Alternative, climate change is expected to have similar effects as compared to other alternatives. A more detailed climate change analysis will be evaluated prior to the final report.

6.13. Socio-Economics and Environmental Justice

Executive Order (EO) 12898 requires Federal agencies to consider and address the impacts of their activities on minority and low income populations. Ecosystem restoration alternatives were reviewed for environmental justice considerations.

The No Action Alternative would have no effect with respect to impacts to environmental justice considerations.

The proposed action alternative would not adversely impact any low income or minority population. The proposed action would likely have a slightly beneficial impact due to the overall improvement in ecosystem habitat as well as riparian zone improvements which will have some aesthetic improvement that residents will benefit from.

6.14. Cumulative Impacts

The Council for Environmental Quality (CEQ) regulations define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action." 40 C.F.R. § 1508.7. Actions considered in the cumulative impacts analysis include implementation of the action and no action alternatives and other Federal, State, Tribal, local, or private actions that impact the resources affected by the proposed action.

The continued growth and urbanization of the Atlanta Metropolitan area is the factor having the greatest overall cumulative impact to the environment in the Proctor Creek Watershed as well as the region around Atlanta. Much of the local area is almost completely developed with residential and commercial structures and their associated impervious surfaces, redevelopment is expected. Likewise, urbanization in the metropolitan area is expected to continue. Such growth will mean both increasing runoff to Proctor Creek as well as similar impacts to numerous other watersheds in the ACF Basin. This would lead to greater need for flood risk management in downstream areas, water quality declines, and continued degradation and fragmentation of aquatic and riparian ecosystems. Alternatively, the proposed action along with the implementation of similar projects in nearby watersheds, plus proactive stormwater and land use ordinances would combine to protect the habitats of various watersheds, while allowing continued economic and urban development.

7. Integrated Water Resource Management Comprehensive Plan Recommendations

7.1. Public involvement and outreach

USACE has engaged with multiple stakeholders throughout this planning process. Stakeholders involved include local residents, city partners, and other Federal agencies. As a designated Urban Waters Watershed many Federal agencies are engaged and working in the watershed in various capacities. Coordination with our agency partners as well as stakeholders has yielded a more complete understanding of problems and opportunities in the watershed from diverse perspectives.

Figure 30: Scoping Meeting at Proctor Creek Stewardship Council

7.2. Problems and Identified Needs by Issue Area

Below are the problems, concerns and issues that were gathered from approximately 500 stakeholders during roundtable listening sessions that were hosted by the EPA, City of Atlanta, and the Proctor Creek Stewardship Council.

Jobs and employment

- Training
- Economic Development
- No banks/lack of ATM access
- Training programs are limited and have a limitation of number of weeks they can be employed
- Limited opportunities
- Below average wages and no job security
- Need increased opportunities for jobs

Gentrification

- Lack of Youth in community
- Residents displaced from public housing youth hasn't returned
- Youth leave Proctor Creek after graduation
- Major gentrification practices in housing and transportation
- Increased tax base for properties
- Lack of knowledge about real estate practices illegal or legal
- Not receiving tax statements to pay real estate taxes
- Trying to acquire property from homeowners below market value – deceiving residents
- Increased higher priced home being built in the area that increase tax rates
- City code practices causes a disadvantage for underserved communities
- City is major property owner
- 80 percent of residents are renters
- Serious disadvantage regarding day care, senior citizens and public healthcare, prevent gentrification at all costs
- Drugs/prostitution safety concerns
- Limited greenspace
- Significant impact on churches from predatory loans
- No loans available for residents to purchase homes

Communication

- Lack of Communication
- Community Outreach and Education
- Lack of understanding about issues/concerns

Flooding/Stormwater

- Combined Sewer Overflow & Sanitary Sewer Overflow
- Permitting MS-4
- Perception that nothing is being done to address concerns in the community
- Need increased monitoring
- Is drinking water safe to drink?

Housing

- Limited Greenspace
- Significant impact on churches from predatory loans
- Need Tax Breaks
- Fear of being displaced
- Mold

Transportation

- No access to grocery stores
- Lack of accessibility for handicapped
- No sidewalks and the ones that are there are in disrepair

- Safety poor lighting
- Walkability
- Access to job opportunities outside watershed

Agriculture

- Food Desert
- Lack of grocery stores
- Limited spaces for gardening and access to affordable, healthy food options (aka fresh fruits and veggies) is limited or nonexistent because grocery stores are too far away access to affordable, healthy food options (aka fresh fruits and veggies) is limited or nonexistent
- Residents have a hard time finding foods that are culturally relevant that meet their dietary restrictions
- Food insecurity has health risk with increased diabetes rates

7.3. Objectives

USACE developed the objectives shown below based on the problems identified from various engagements with stakeholders during the Proctor Creek Feasibility Study as well as earlier engagements that were conducted by the EPA. The objectives are grouped into eight general issue areas (Table 19).

Table 19. IWRM Objectives

Objectives
Employment
Provide an environment that encourages employers to locate in the Proctor Creek community
Increase opportunities for personal growth through productive and satisfying employment for Proctor Creek residents
Increase access to financial institutions
Social Equity of Outcomes
Protect historic and cultural resources within the Proctor Creek community
Environment
Increase access to greenspace within the Proctor Creek watershed
Reduce health risks to neighboring communities
Reconnect residents to aquatic and historic landscapes
Make the creek a living laboratory for learning about local waters
Restore the aquatic ecosystem to the best attainable condition in an altered urban environment
Make Proctor Creek a swimmable, fishable stream

Table 19 (cont'd). IWRM Objectives

Communication
Improve communication between all stakeholders within the Proctor Creek watershed
Improve efficiency of contact with residents
Increase access to decision makers
Flooding/Storm water
Reduce combined sewer overflow in Proctor Creek watershed
Reduce sanitary sewer overflow in Proctor Creek watershed
Reduce flooding risks to property and structures
Housing
Make Proctor Creek a safe place to live and play
Provide an adequate supply of housing across income ranges for Proctor Creek residents
Transportation
Increase access to public transportation for all residents including those with disabilities within the Proctor Creek watershed
Increase walkability of Proctor Creek community
Provide access to transportation for employment opportunities outside the Proctor Creek watershed
Agriculture
Reduce health risks attributable to food insecurity to Proctor Creek residents
Provide access to affordable, healthy, fresh foods in the Proctor Creek community

USACE asked stakeholders to weight these objectives during several community roundtable sessions. The stakeholders could allocate 100 points amongst these objectives. The weights were used to inform the rankings of IWRM identified projects and programs. Eighty-eight stakeholders provided input into the objective ranking. Figure 31 is a visual depiction of raw stakeholder input received during the community engagements. Stakeholders tended to place more points (weight) on objectives related to the environment and employment. Stakeholder weights are summarized by objective and averaged (Table 20).

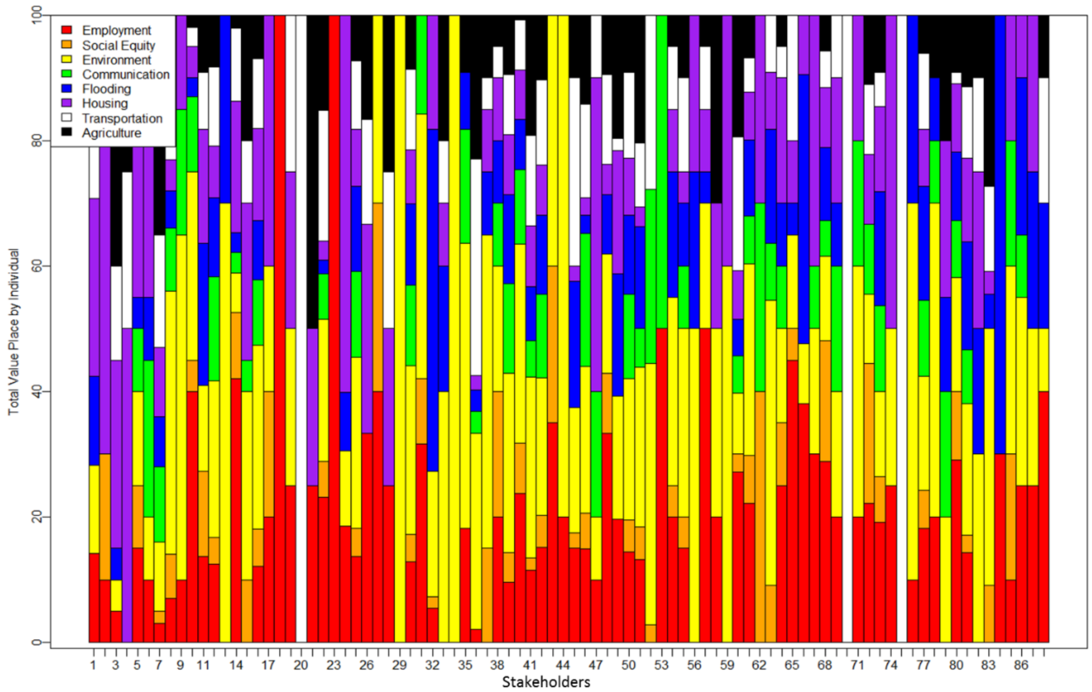


Figure 31: IWRM Stakeholder Objective Weighting

Table 20. Summary of Objective Weights

	S_EMP	S_SOC	S_ENV	S_COM	S_FLO	S_HOU	S_TRA	S_AGR
Resident Average	21.69	5.08	21.41	7.34	7.49	18.87	8.07	10.06
Stakeholder Average	18.96	5.15	26.64	7.45	10.08	14.74	8.52	8.46
Equal weights	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5

7.4. Multi-criteria Decision Analysis (MCDA)

Multi-criteria decision analysis (MCDA) is a structured decision making tool. It provides flexibility when comparing different variables across an array of alternatives. MCDA provides decision makers the ability to evaluate trade-offs between alternatives for both quantitative and qualitative data.

The first step in beginning MCDA for Proctor Creek was to determine weights for the evaluation objectives. These weights are displayed in Table 20. The second step was to identify potential solutions that could satisfy one or more of these objectives. The Urban Waters Federal Partnership identified projects and programs that could meet one or more of these objectives. USACE PDT scored the solutions (projects and programs) against their ability to satisfy each objective. A qualitative scale of 1-10 was used to score the solutions. A score of “1” equates to a project not contributing to the objective compared to a score of “10” which equates to a project substantially meeting that objective. The final step was to then run the “Rankings Analysis” based on an objective weighting scheme in IWR Planning Suite.

7.5. IWRM Alternatives

A description of IWRM alternatives is contained in Appendix D.

7.6. Ranking of Alternatives

The IWRM alternative ranking is displayed below in Table 21. Three different weighting scenarios were evaluated including: all stakeholder priorities, residential stakeholder priorities, and equally weighted objectives. Several of the projects and programs rank high across all three scenarios including Boone Park West, AUERC, Green Infrastructure/ Water Efficiency Team, Citizen Science Initiatives, Trash Free Waters, DWM watershed improvement projects and USACE Ecosystem Restoration Project. These projects ranking reflect the ability to meet stakeholder priorities.

Table 21. IWRM Alternative Ranking

Plan Name	Alternative Rank		
Weighting Scenario	Residents Only	Equal Weights	All Stakeholders
Atlanta Urban Ecology Resource Center (AUERC)	2	2	2
Boone to Beltline Greenway	13	8	13
Ecological Framework Habitat Implementation for Healthy Habitat and Healthy Communities	25	26	18
Urban Ecology Study (NAME PENDING)	9	7	12
Mosquito and Vermin Identification and Warning; Emergency Management Plan for Mosquito/Pandemic Fine Hazard	23	20	24
Urban Forest Inventory (UFiA)	32	38	29
Boone Park West	1	1	1
Riverwalk	15	19	15
Conservation Fund Parks with Purpose	6	8	8
Health Impact Assessment (watershed level); Green infrastructure incentives for economic development	11	8	9
Atlanta Watershed Learning Network	13	8	13
Greenspace and State Hazard Mitigation Office	18	18	25
Creation of CDFI (Community Development Finance Institution)	22	6	27
Hazard Mitigation Planning	36	34	35
PC Heritage Trail	37	34	37
Cultural Resource and Historic Landscape Protections	37	34	37
FEMA Employment Opportunities	24	26	31

Table 21 (cont'd). IWRM Alternative Ranking

Educational Environmental Signage	35	39	33
Pollinator Gardens	25	26	18
Green Infrastructure/ Water Efficiency Team	3	4	3
Citizen/Community Science Initiative	4	8	4
Trash Free Waters	4	8	4
Composting Education in Schools	10	8	11
Proctor Creek Pollinators (see also Urban Pollinators - Environmental)	17	21	16
Develop Monitoring Plan for Proctor Creek	25	26	18
EDA - The Russell Center for Innovation and Entrepreneurship	16	8	26
HUD Housing Counseling Agencies	19	17	30
Environmental Health	33	24	34
Legal Services - GA Heirs Property Center	37	34	37
Community Gardens at Schools to Market	34	33	36
Stormwater Management Implementation Plan	11	8	9
Migratory Bird Corridor FWS	25	26	18
Atlanta Conservation Partnership R8 Initiative	25	26	18
Update Biotics (T & E) Study FWS	25	26	18
UCF Program	21	21	17
EDA - Economic Development Intergration (EDI)	31	24	32
EDA - grant opportunities	20	21	28
USACE Ecosystem Restoration	7	3	7
Watershed Improvement Plan Projects	8	4	6

7.7. Recommendations

Recommendations will be developed following review and comment of this draft report.

7.8. Alternative Financing

The Federal Highway Administration and USACE are developing a potential mitigation bank that could be used to cost share in proposed projects. This effort is still in the early stages of development and additional detail will be included in the final report as it becomes available.

8. Summary of Environmental Compliance

Federal laws and Executive Orders applicable to all USACE recommended plans, their applicability to the proposed project, and, if applicable, their status is presented below:

N/A Non-applicable

C In compliance

P Compliance pending

STATUS PUBLIC LAW (US CODE)/EXECUTIVE ORDER

N/A Abandoned Shipwreck Act of 1987 (43 U.S.C. 2101)

N/A American Indian Religious Freedom Act (42 U.S.C. 1996)

N/A Agriculture and Food Act (Farmland Protection Policy Act) of 1981 (7 U.S.C. 4201)

N/A American Folklife Preservation Act of 1976, As Amended (20 U.S.C. 2101)

N/A Anadromous Fish Conservation Act of 1965, As Amended (16 U.S.C. 757a et seq)

N/A Antiquities Act of 1906, As Amended (16 U.S.C. 431)

C Archeological and Historic Preservation Act of 1974, As Amended (16 U.S.C. 469)

N/A Archeological Resources Protection Act of 1979, As Amended (16 U.S.C. 470)

N/A Bald Eagle Act of 1972 (16U.S.C. 668)

N/A Buy American Act (41 U.S.C. 102)

N/A Civil Rights Act of 1964 (Public Law 88-352) (6 U.S.C. 601)

C Clean Air Act of 1972, As Amended (42 U.S.C. 7401 et seq)

C Clean Water Act of 1972, As Amended (33 U.S.C. 1251 et seq)

N/A Barrier Resources Act of 1982 (16 U.S.C. 3501-3510)

N/A Coastal Zone Management Act of 1972, As Amended (16 U.S.C. 1451 et seq)

N/A CERCLA of 1980 (42 U.S.C. 9601)

N/A Conservation of Forest Lands Act of 1960 (16 U.S.C. 580 mn)

N/A Contract Work Hours (40 U.S.C. 327)

N/A Convict Labor (18 U.S.C. 4082)

N/A Copeland Anti-Kickback (40 U.S.C. 276c)

N/A Davis-Bacon Act (40 U.S.C. 276)

N/A	Deepwater Port Act of 1974, As Amended (33 U.S.C. 1501)
N/A	Emergency Flood Control Funds Act of 1955, As Amended (33 U.S.C. 701m)
N/A	Emergency Wetlands Resources Act (16 U.S.C. 3901-3932)
C	Endangered Species Act of 1972 (16 U.S.C. 1531)
C	EO 11988, Floodplain Management
C	EO 11990, Protection of Wetlands
C	EO 12898, Environmental Justice
N/A	Estuary Protection Act of 1968 (16 U.S.C. 1221 et seq)
N/A	Equal Opportunity (42 U.S.C. 2000d)
N/A	Farmland Protection Policy Act (7 U.S.C. 4201 et seq)
N/A	Federal Environmental Pesticide Act of 1972 (7 U.S.C. 136 et seq)
N/A	Federal Water Project Recreation Act of 1965, As Amended (16 U.S.C. 4601)
P	Fish and Wildlife Coordination Act of 1958, As Amended (16 U.S.C. 661)
N/A	Flood Control Act of 1944, As Amended, Section 4 (16 U.S.C. 460b)
N/A	Food Security Act of 1985 (Swampbuster) (16 U.S.C. 3811 et seq)
N/A	Hazardous Substance Response Review Act of 1980, As Amended (26 U.S.C. 4611)
N/A	Historic and Archeological Data Preservation (16 U.S.C. 469)
C	Historic Sites Act of 1935 (16 U.S.C. 461) Note: Superseded by NHPA, Section 106
N/A	Jones Act (46 U.S.C. 292)
N/A	Land and Water Conservation Fund Act of 1965 (16 U.S.C. 4601)
N/A	Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801)
N/A	Marine Mammal Protection Act of 1972, As Amended (16 U.S.C. 1361)
N/A	Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1401)
N/A	Migratory Bird Conservation Act of 1928, As Amended (16 U.S.C. 715)
C	Migratory Bird Treaty Act of 1918, As Amended (16 U.S.C. 703)
C	NEPA of 1969, As Amended (42 U.S.C. 4321 et seq)
C	National Historic Preservation Act of 1966, As Amended (16 U.S.C. 470)
C	National Historic Preservation Act Amendments of 1980 (16 U.S.C. 469a)

N/A Native American Religious Freedom Act of 1978 (42 U.S.C. 1996)

N/A Native American Graves Protection and Repatriation Act (25 U.S.C. 3001)

N/A National Trails System Act (16 U.S.C. 1241)

N/A Noise Control Act of 1972, As Amended (42 U.S.C. 4901 et seq)

N/A Rehabilitation Act of 1973 (29 U.S.C. 794)

N/A Reservoir Salvage Act of 1960, As Amended (16 U.S.C. 469)

N/A Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901-6987)

N/A River and Harbor Act of 1888, Section 11 (33 U.S.C. 608)

N/A River and Harbor Act of 1899, Sections 9, 10, 13 (33 U.S.C. 401-413)

N/A River and Harbor and Flood Control Act of 1962, Section 207 (16 U.S.C. 460)

N/A River and Harbor and FC Act of 1970, Sects 122, 209 and 216 (33 U.S.C. 426 et seq)

N/A Safe Drinking Water Act of 1974, As Amended (42 U.S.C. 300f)

N/A Shipping Act (46 U.S.C. 883)

N/A Submerged Lands Act of 1953 (43 U.S.C. 1301 et seq)

N/A Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601)

N/A Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201-1328)

N/A Toxic Substances Control Act of 1976 (15 U.S.C. 2601)

N/A Policy Act of 1970, As Amended (43 U.S.C. 4601)

N/A Utilization of Small Business (15 U.S.C. 631, 644)

N/A Wild and Scenic River Act of 1968 (16 U.S.C. 1271 et seq)

Assuming that the proposed project does not expand beyond the scope described in this draft report, the TSP is in compliance with NEPA.

9. Plan Implementation

The City of Atlanta is the Non-Federal Sponsor for this project. After the Feasibility Report is approved and if the non-Federal sponsor decides to proceed with the project, USACE will ask the non-Federal sponsor to sign a Project Partnership Agreement (PPA) which defines the Federal and non-Federal responsibilities for designing, implementing, operating, and maintaining the project. The costs of the feasibility phase will be included in the total project costs in the PPA and will be cost shared 65 percent Federal and 35 percent non-Federal. The cost apportionment shown below (Table 22) does not include O&M which is a non-Federal responsibility. The current cost apportionment shown assumes the Tentatively Selected Plan is endorsed as the NER plan. A different cost apportionment will apply if the TSP is a locally preferred plan.

Table 22. Cost Apportionment

Item	Apportionment		
	Federal	Non-Federal	Total
Construction*	$5,691,000	$2,641,000	$8,332,000
LERRD's*	$0	$424,000	$424,000
Total First Cost	**$5,691,000**	**$3,065,000**	**$8,756,000**

10. References

Channel Evolution Model, Simon 1989

Engineer Circular (EC) 1165-2-212 (USACE 2011)

Environmental Conservation Online System (USFWS 2017b)

Global Water Partnership Technical Committee (GWP), 2004; USACE, 2010

U.S. Army Corps of Engineers. (1992). Section 205 Proctor Creek Feasibility Study. Mobile: U.S. Army Corps of Engineers, Mobile District

U.S. Army Corps of Engineers.. (2000). ER 1105-2-100: Planning Guidance Notebook.