GREEN INFRASTRUCTURE
Conceptual Plan for Catchment #4

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Introduction

Green Infrastructure is naturally-occurring vegetation and soils that mimic natural ecological processes to aid in water management and create healthier ecosystems. Precipitation hits impervious surfaces and "runs off" either into pervious surfaces like grass or, more likely, enters the existing combined sewer system carrying roadway pollutants and general litter. This will certainly dirty and contaminate the sewage water further.

Ecologically, the benefits of stormwater management are undeniable. By building a framework that directs stormwater runoff and collects it in retention cisterns for water reuse and detention greenways for temporary storage, we protect the environment from many perspectives. Firstly, finding a place for the stormwater to collect provides a safer place for this water to go instead of challenging the treatment system designed by the City to clean up toilet sewage from a combined sewer collection system.

Retention is important ecologically: it supports sustainability; retention creates a new supply source for millions of gallons of water that don't have to be pulled from the City's potable water distribution system. Retained water can be reused and will replace water that would otherwise need to be purchased. By doing this we recognize rainwater as the valued 21st century resource it is.

The health benefits of flood control in Catchment #4 include social benefits as well. Because physical health interacts with mental health, the social aspect of reduced flooding damage and frequency are valuable. Research reveals that running water releases negative ions into its

surroundings which mediate mood and improve creativity. In addition, other research says that walking in nature changes brain chemistry in a positive way, in such a way as to reduce violence and improve attitude. This is invaluable to our catchment area which floods low producing, low consuming, and generally disadvantaged communities plagued with crime. Its location is adjacent to the new Falcons Stadium which is attracting new businesses and a new resident population.

Financially, the benefits of green infrastructure are paramount. Usually, green infrastructure is cause for land use redesignation because stormwater greenways can do double duty as public play spaces as well as flood detention areas. (Our greenways are designed to take on rainwater only during major storms which exceed the 25 year rain event). Also, the kind of publicly visible stormwater system which we propose to include in Catchment #4 with recreational greenways and ephemeral streams always raises the appeal and property values for communities.

Background

Catchment #4 is of relatively high elevation in comparison to the nearby areas. This is of great significance when you think about the consequences of a nonexistent stormwater infrastructure in a city like Atlanta that has a combined sewer system: endangered health of residents who live downhill and downstream. When rain events occur, the local residents are victimized by flooding that comes from the surcharged and overflowing combined sewage systems which carry untreated poisonous toxins, bacteria and pathogens. Furthermore, the system is designed to release these combined sewage overflows into local tributaries and thus into Proctor Creek.

Much of Catchment #4 lies outside the boundaries of the Atlanta University Center, but much of the rainwater from these higher elevation areas will run downhill to flood the CAU campuses and the AHA property. Most of this land is controlled by public/private housing developers.

Developers are required to keep stormwater runoff separate from sewage until they can connect to the combined sewer system at the nearest street. We have assumed that is the case for all 3 of the apartment areas we're looking at in the Castleberry Hills neighborhood. Each of the apartment complexes in Catchment #4 is oriented such that those parts farthest from the entrance are at higher elevations making water flow down via stormwater pipes and parking lots toward the entrance of the complex. We place our stormwater catchment cisterns at the low point of each complex just before the stormwater drainage systems leave the complex where they will join the newly installed daylighted ephemeral stream stormwater drainage system we recommend.

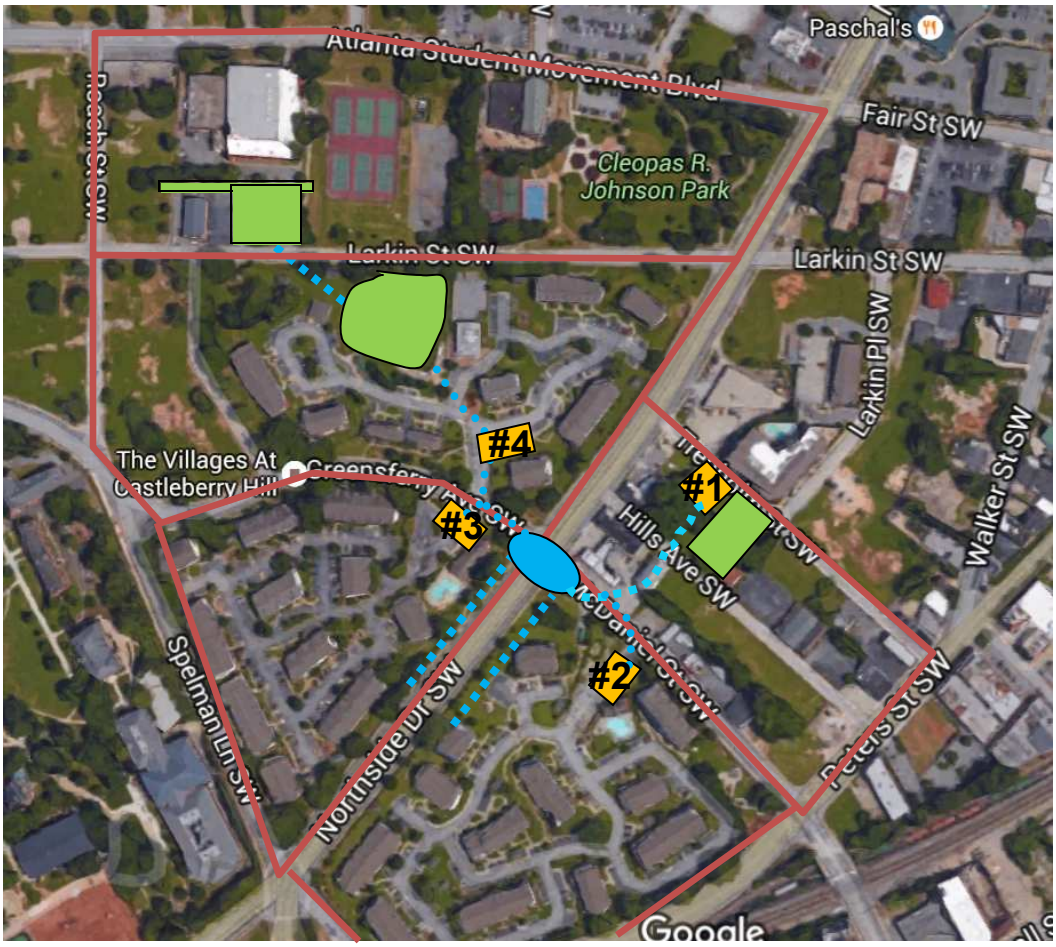
The first apartment Complex #1, The Villages at Castleberry Hills, 369 McDaniels Street, is bound by Peoples Street SW, McDaniels Street SW and Northside Drive SW. Complex #2, The Villages at Castleberry Hills, 600 Greensferry Avenue, is across Northside Drive SW and bounded by Spelman Lane SW, Greensferry Avenue SW and Northside Drive SW. Complex #3, The Villages at Castleberry Hills, 565 Greensferry Avenue, is directly across Greensferry Avenue from Complex #2 and is bound by Larkin Street SW, Northside Drive and Dora Street SW. The land under all of these properties is owned by the Atlanta Housing Authority (AHA) and the City of Atlanta. See map on page 6.

There are multiple types of green infrastructure like stormwater greenways, ephemeral streams, green roofs, rain gardens, and permeable pavements. To this natural green infrastructure pallet we have added stormwater retention cisterns. We use cisterns for water harvesting which can retain millions of gallons of water for reuse.

Implementation of this conceptual plan will require having someone to nurture collaboration and cooperation among the private and public stakeholders. Once they agree to consider moving forward, more complex hydrological analysis will be necessary along with cost/benefit analyses.

The Conceptual Plan

As shown on the map below and described in the following text, we propose making use of cisterns, green play space/floodplains, ephemeral streams, an ecological ford and an urban farm to manage the stormwater runoff of Catchment #4, by capturing the 100-year rain events.



Legend	
Greenspace	
Cistern	
Ephemeral Stream	
Ford	

Four cisterns will capture up to 25-year rain events. Larger rain events in excess of the 25-year event will overflow the cisterns and run through ephemeral streams to two stormwater management greenways located nearby at lower elevations. The ephemeral streams would usually be dry but have shallow wet flows only during rain events exceeding a typical 25-year rain event. Each one can be designed as an amenity for its neighborhood, one that celebrates the value of rainwater as a resource. Ephemeral streams can be paved with cobbles to mimic nature, excite the imagination, and uplift the spirit!

Capacities for Storing Stormwater in Cisterns and Greenways

Cistern #1	550,000 gallons	Baseball Field Greenway	1,160,000 gallons
Cistern #2	900,000 gallons	CAU Gym Greenway	730,000 gallons
Cistern #3	730,000 gallons	**Total**	**1,890,000 gallons**
Cistern #4	960,000 gallons	Cistern Total	3,140,000 gallons
Total	**3,140,000 gallons**	**GRAND TOTAL**	**5,030,000 gallons**

Cistern 1: A cistern will collect stormwater runoff from the Trenholm Street to Hills Avenue stretch perpendicular to contiguous Northside Drive. In addition, we propose an urban farm to serve this area, to provide aesthetic green infrastructure and produce healthy food, on an expanse of roughly 30,000 ft². The nearby churches can expect positive value outcomes from this garden as well as improvement in their property values, recognizing it as "creation care." We further propose that this urban farm would be engineered such that it is an improved tool for capturing stormwater runoff. The overflow from the Cistern No. 1 and urban farm will overflow into an ephemeral stream running towards McDaniels Street.

Cistern dimensions of 62ft x 100ft x 12 ft deep = 73,530 ft^3.

Capacity: 73,530 ft^3 x 7.48 gallons/ft^3 = 550,000 gallons.

Cistern 2: The 2nd cistern will be at the Villages at Castleberry Hills apartment complex #1, located at McDaniel Street and Northside Drive. There will be a cistern near the current pool – certainly not disturbing the pool area because the cistern will be underground. An ephemeral stream leaves this cistern, joins the ephemeral stream carrying overflow from Cistern 1 and heads down McDaniel Street to Northside Drive.

Cistern dimensions of 100ft x 100ft x 12 ft deep = 120,000 ft^3

Capacity: 120,000 ft^3 x 7.48 gallons/ft^3 = 900,000 gallons

The McDaniel Street/Greensferry Ford: The conventional method for transporting stormwater under Northside Drive is to install stormwater culverts under the highway. We encourage considering creation of a "ford" over and across Northside Drive for all the reasons discussed below. We recognize that for the ford concept, the issue of hydroplaning must be resolved.

Crossing Northside Drive at the McDaniel Street/Greensferry Avenue intersection, we propose a "ford". Northside slopes downhill from both the north and south directions to the ford, employing it for Northside's runoff as well as overflows from Cisterns 1 and 2 and streaming towards the baseball field greenway. See page 10.

The ford can be an attractive addition to the area that adds a sense of place especially when accompanied with signage that indicates the "ford".

<u>Cistern 3</u>: The 3rd cistern will be at the Villages at Castleberry Hills, 600 Greensferry Avenue, Complex #2, whose back end is at Spelman Lane and Northside Drive. There will be a cistern at the entrance near the present signage. Overflow from Cistern 3 serving Complex #2 will flow into the ephemeral stream after it has crossed Northside Drive at the "ford".

Cistern dimensions of 82ft x 100ft x 12ft deep = 98,000 ft^3

Capacity: 98,000 ft^3 x 9.48 gallons/ft^3 = 730,000 gallons

<u>Cistern 4</u>: Apartment Complex #3, the Villages at Castleberry Hills, 565 Greensferry Avenue, will have a cistern just inside the entrance and near the peanut shaped pond. The overflows from this cistern will similarly join the ephemeral stream coming through the apartment gates that then runs past the peanut shaped pond and on toward the baseball field. The ephemeral stream can be designed as an amenity for the complex, one that celebrates the value of stormwater as a resource. Ephemeral streams can be paved with cobbles to mimic nature, excite the imagination, and uplift the spirit. This one can add a sense of place to the complex and can be accompanied with signage that celebrates its ecological value. During less than 25 year rain events, this ephemeral stream will be dry. It will carry only small wet flows during major rain events.

Cistern dimensions of 100ft x 107ft x 12ft deep = 128,000 ft^3

Capacity: 128,000 ft^3 x 7.48 gallons/ft^3 = 960,000 gallons

<u>Baseball Field Play Space/Floodplain</u>: The baseball field in Complex #3 can readily be redesigned to both improve field drainage and serve as a floodplain during major rain events. Excavating 3 feet of soil from the playing field and utilizing that soil to construct a 5 foot high berm to enclose the field where adequate elevation change does not already exist. This will be necessary only on parts of the western and northern edges of the ball field near Larkin Street.

The field itself would then be reengineered with French drains buried 12 to 18 inches deep in porous soils with high quality soils and sod on top to improve current drainage and stop muddy conditions. We recommend construction of a notched concrete and stone clad overflow waterfall at the western end of the bermed field. The width or thickness of the 5 foot high berm will be determined by the amount of soil excavated from the ball field at the start of the project implementation process. From the berm, an ephemeral stream can run parallel to Larkin Street towards the CAU gym, collecting overflow from the redesigned and reengineered ballfield.

Baseball Field Greenway Dimensions of 184 ft x 96 ft x 4 ft deep = 153,056 ft^3

plus a curved western area measuring 196 ft x 26 ft x ½ x 4 ft deep = 2,197 ft^3

Capacity: a total capacity of 155,253 ft^3 x 7.48 gallons/ft^3 = 1,160,000 gallons

<u>CAU Gym Play Space/Floodplain Greenway</u>: The final item of stormwater infrastructure will be at the lowest elevation area in Catchment #4, in the City of 100 hills, north of Larkin Street at what currently serves as the CAU gym's parking lot – an area that regularly receives *treacherous* flooding during rain events as reported by gym staff, some walking to their floating vehicles in waist deep water. To prevent this danger we propose the redistribution of land use resources. We propose that gym staff and patrons instead use the WRFG-FM radio station parking lot that is adjacent to the gym. It has access from Atlanta Student Movement Boulevard. It is at a higher elevation, does not flood and is of sufficient size.

Much of the current lot will be re-engineered as a green play space/floodplain measuring 155 ft x 105 ft for a total of 16,275 ft². With its low elevation it is where the ephemeral stream will end. The higher elevation of this parking area near the loading dock will not be disturbed and will not flood. The play space/floodplain will be six feet below loading dock parking. Commercial vehicles and service vehicles that currently park at or near the loading dock can access this area via the Atlanta Student Movement Boulevard (Fair Street) entrance to the lot.

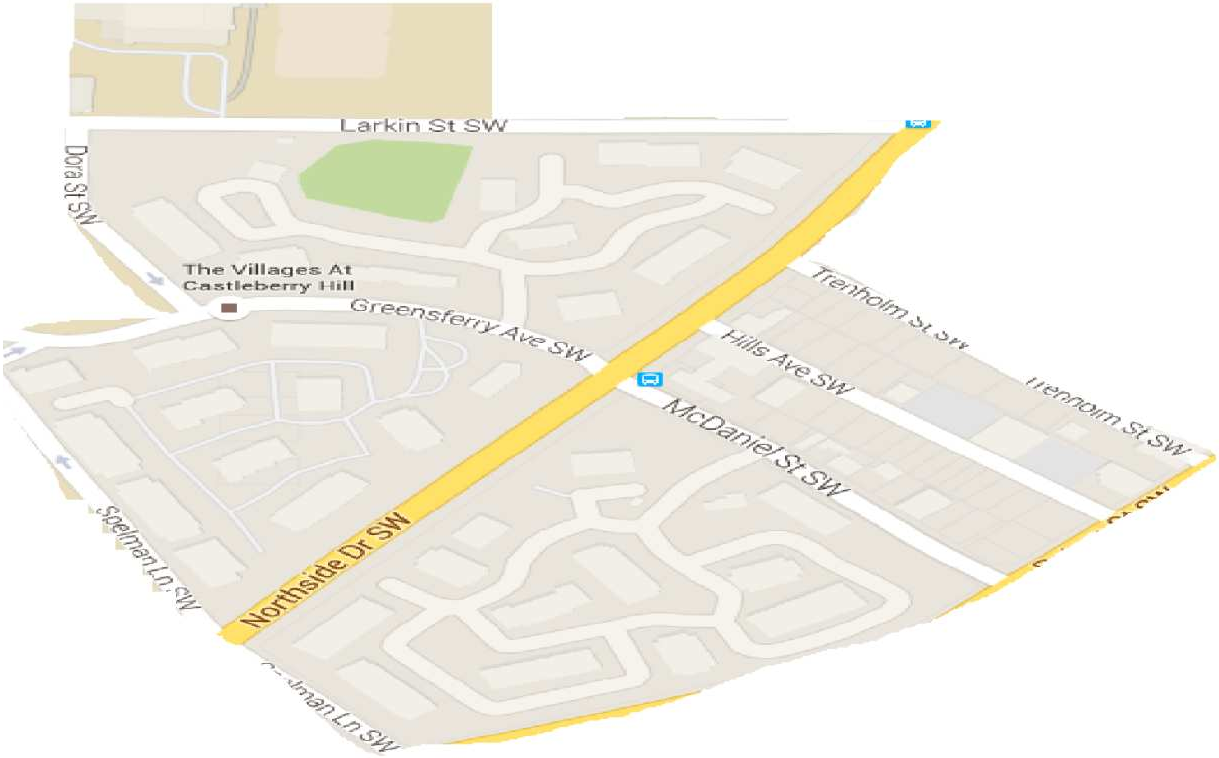
This greenway can be enlarged if the adjacent Vision Ministries Holiness Church is engaged to allow 20 to 30 ft of the lowest, most flood likely north end of their parking lot to become part of this flood control plan. The church commitment would also make it possible to connect this greenway to the major greenway proposed for the adjacent AHA property.

Gym Greenway dimensions of 155 ft x 105 ft x 6 ft deep = 97,650 ft^3

Capacity: 98,650 ft^3 x 7.48 gallons/ft^3 = 730,000 gallons

<u>Methodology</u>

The first step in this project was to outline the boundaries of our catchment followed by the first team walk-through to identify the boundaries of Catchment #4 and organize it into the designated zones related to the cistern sites that would capture the stormwater runoff from each zone. The boundaries of Catchment #4 and its zones are shown on the map below:



The methodology of this project was directed at capturing stormwater. To determine the amount of stormwater we wanted to capture, we calculated the surface area of each building and its contiguous roads and parking lots (impervious surfaces) and nearby pervious spaces. Using DaftLogic.com, we were able to pull up our spaces on Google Maps and place lines around the buildings to find the lengths and widths of each space. Then, we created a table for each zone, noting the dimensions, calculating the surface areas, and figuring the storage for each rain event -- for the 25-year rain event falling on impervious surfaces and a 100-year rain event falling on all surfaces, both pervious and impervious. For each zone served, we then subtracted the 25-year retention cistern values from the 100-year total to estimate overflows into ephemeral streams and needed greenway capacity.

Once we had surface area calculations and reviewed topography, we were able to identify the type of green infrastructure we wanted to implement at specific locations relative to the amount of water that needed to be captured. We tabulated the dimensions and area of each building along with the dimensions of some parking lots, and apartment complexes.

Cisterns

The major infrastructure for storing rainwater from the 25-year rain events is cisterns. Underground cisterns are widely used for the collection and storage of rainwater runoff to which can be added the storage of air conditioning condensate. This retained water can be used for irrigation, cooling tower make-up, fire protection reserves and manufacturing process water. The locations of the cisterns were determined based on the elevation of the area. All of the cisterns are located on areas of low elevation.

The proposed cisterns will also capture all of the smaller rain events (95% of all the rainwater that falls on an area is in 1.8 inch or smaller rain events). The large amount of water captured from these frequent rain events will provide a continuous supply for reuse. To also be effective for flood control, our major concern in this analysis, cisterns will have to be drained or otherwise dewatered before large 25-year rain events.

Calculations

Table 1: Dimensions of Buildings, Parking Spaces and Green Spaces in Area 4 Conceptual plan

Area 1	Dimensions	Total Dimensions
1 Building	327.2X42.3	13840.56
2 Building	168.1X64.6	10859.26
3 Building	82.5X83.8	6913.5
4 Building	184X74.4	13689.6
5 Building	162.5X114	18525
6 Building	287X88.6	25428.2
7 Building	94.6X152.6	14435.96
8 Building	168X122.3	20546.4
9 Building	281.1X95.1	26723.1
10 Building	133.7X110.5	147738.5
	Total	298700.08
Area 2		
Building bygreensferry4	91.3X202.4	18479.12
Building bygreensferry5	264X112.3	29647.2
Building bygreensferry6	147.4X109.9	16199.26
Building By Spelman Lane 1 &2	318.7X110.06	35076.122
Building 3	150.04X129.95	19497.7
Building 7	149.6X123.4	18460.64
Building 8	214.28X104.84	22,400.83
Building 9	218.09X87.03	18,980.37
Building 10	321.27X97.215	312,232.26

Area 1	Dimensions	Total Dimensions
Building 11	195.5X121.04	23,663.32
pool	156.4X131.6	20,582.24
Building 12	174.129X58.4	10,169.13
	Total	545388.192
Area 3		
Building 1 (with left of gate entrance on map)	55.7x87.6	4879.32
Building 2	52.2x67.3	3513.06
Building 3	57.6x95.4	5495.04
Building 4	60x160	9,600
Building 5	56x166	9296
Building 6	50x163.7	8185
Building 7	62x101.5	6293
Building 8	64.4x162.6	10471.44
Building 9	63x95	5985
Building 10	51.3x139.5	7156.35
Building 11	36.1x67.1	2422.31
Building 12	58.4x14.1	823.44
Building 13	61.2x138.02	8446.82
	Total	82566.78
Area 4: McDaniel to Trenholm		
Texaco Lot	186.04x158.2	29431.52
Lot adjacent	69.5x58.41	4059.49
Barber Shop	58.41x25.1	1466.09
Closed	16.6x27.3	453.18
Burger R Us	18.2x28.4	516.88
Auto Select Automotives	60x127.1	7626
UnNamed	50x92	4600
UnNamed Lot (Peters & Hill)	80x91	7280
Fulton Loan Lot+ Corner building	171.6x199.2	34182.72
Assembly of Truth Ministries + Lot	83.9x191	16024.9
Lot Trenholm & Northside	45.9x162.8	7472.52

Area 1	Dimensions	Total Dimensions
Area 5	Total	113113.3
Area 6	50.1x91.1	4555
Area 7	89x119	10,591
Area 8	107.7x233.4	25,137.18
Area 9	228.7x147.7	33,675
Area 10	285x147.7	42094.5
Area 11	222x285	63270
Area 12	96x147	14112
	Total	193434.68
Greensferry Avenue		27308.92
Dora Street		10843.42
Larkin Street	62390.93	26273.84
Roach Street		10277.24
Fair Street		42766.76
Trenholm Street		18518.91
Hills Avenue		24129.93
McDaniel Street		25345.25
Northside Drive		57541.28
	Total	243005.55
	Grand Total	604563.67
		Total Dimensions