City Council Meeting
DECEMBER 3, 2018

ALPHARETTA CITY HALL
COUNCIL CHAMBERS
2 PARK PLAZA
6:30 PM

I. CALL TO ORDER

II. ROLL CALL

III. PLEDGE TO THE FLAG

IV. OLD BUSINESS

A. Approval of Conceptual Master Plan for the Wills Park Equestrian Center

V. NEW BUSINESS

A. Rucker Road - Roswell Project Limits

VI. WORKSHOP

A. Stormwater and Tree Coverage Findings - David Shostak, City Arborist

VII. PUBLIC COMMENT

VIII. REPORTS

IX. ADJOURNMENT TO EXECUTIVE SESSION

City Council Meeting
STAFF REPORT

Submitting Department: Recreation and Parks
Submitted By:
Meeting Date: December 3, 2018

I. AGENDA ITEM TITLE: APPROVAL OF CONCEPTUAL MASTER PLAN FOR THE WILLS PARK EQUESTRIAN CENTER

II. RECOMMENDATION:

Staff is requesting approval of the Conceptual Master Plan for the Wills Park Equestrian Center.

III. BUDGET IMPLICATIONS:

BUDGETED ITEM: NO
FISCAL IMPACT: NO
INCLUDED IN CURRENT FY CPTL BUDGET: NO
INCLUDED IN CURRENT FY OPRT. BUDGET: NO
TOTAL PROJECT COST:
APPROPRIATIONS:

ACCOUNT TITLE/NUMBER	DOLLAR AMOUNT

EXTERNAL FUNDING SOURCES:

ACCOUNT TITLE/NUMBER	DOLLAR AMOUNT

IV. REPORT IN BRIEF:

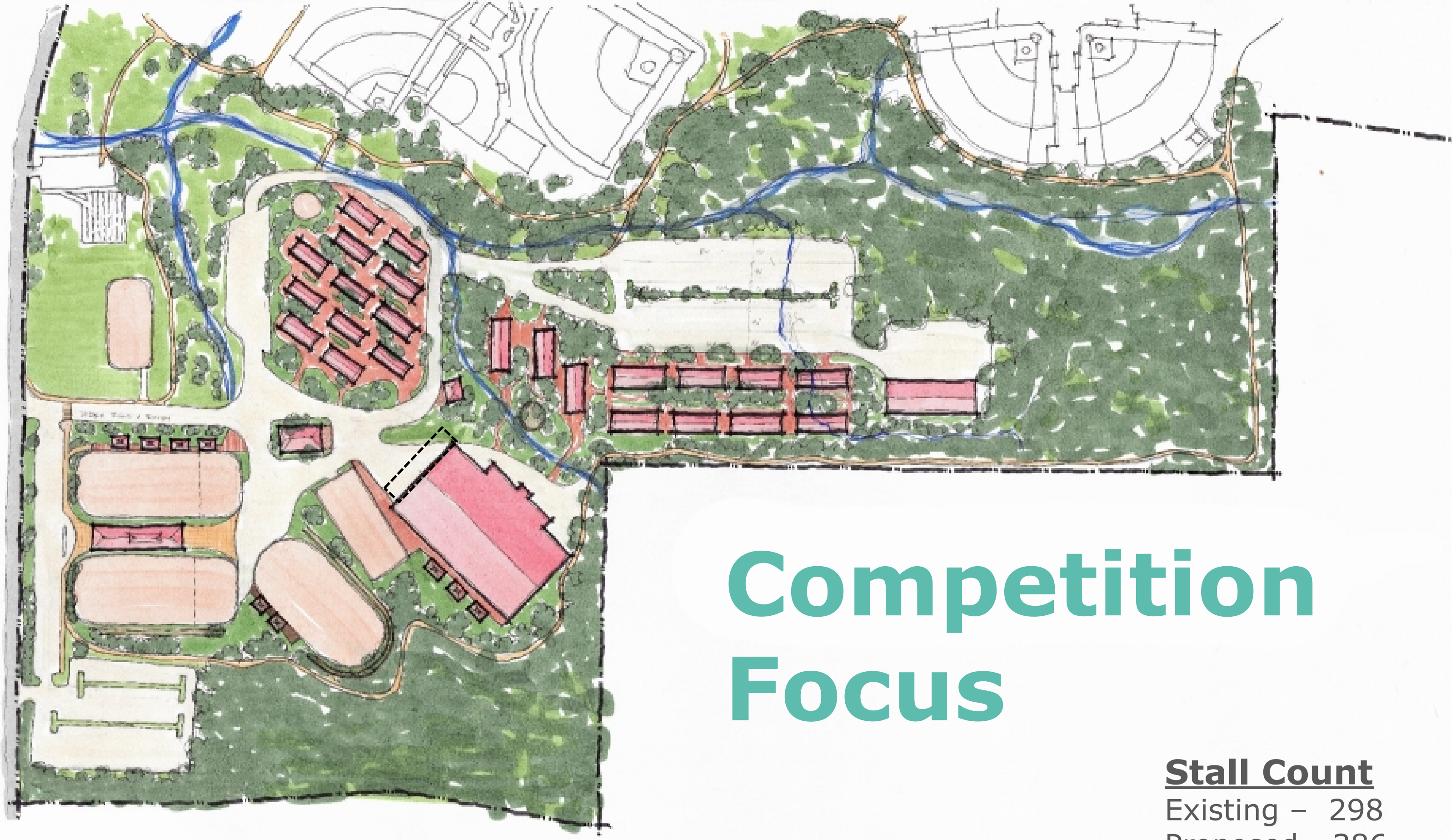
Staff is requesting approval of the Conceptual Master Plan for the Wills Park Equestrian Center. This plan was developed by Jacobs Engineering and is the result of public input through public meetings, on-site interviews, focus groups and on-line surveys. This plan was approved by the Equestrian Advisory Group and the Alpharetta Recreation Commission.

V. ALTERNATIVES:

VI. ATTACHMENTS:

Equestrian Center Concept Presentation 11-19

Concept A



Competition Focus

Stall Count
Existing – 298
Proposed - 386

Concept A
Gateway North

Car/Truck Parking

Community Garden

Stormwater Showcase

Warm-up Arena

Widened Entry

Show Office / Renovated Restroom


Entrance/Gateway


Stormwater


Show Office - Concessions

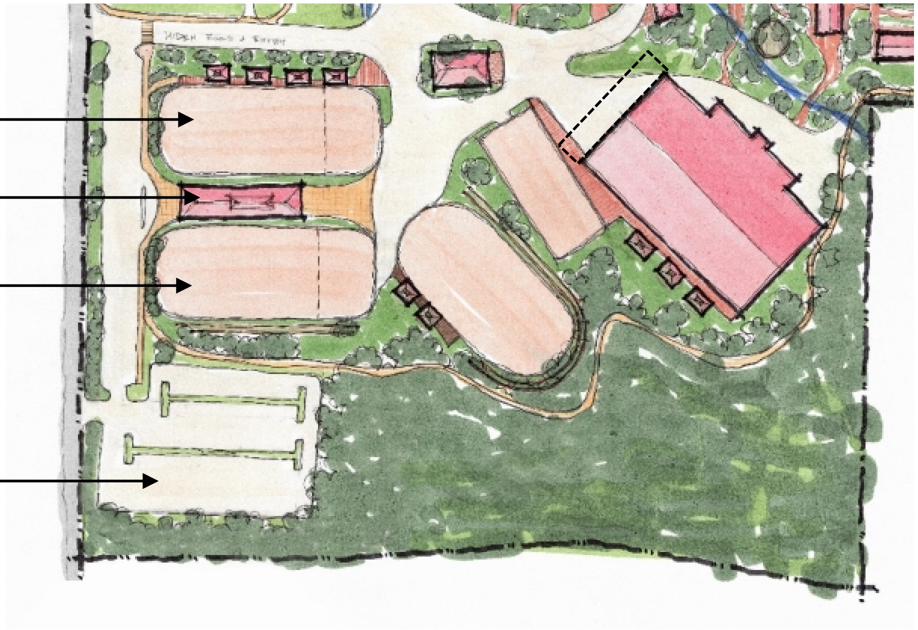
Concept A
Gateway South

New Arena 150’x 340’

Covered Seating, Toilets

Expand Existing Arena

Public Parking



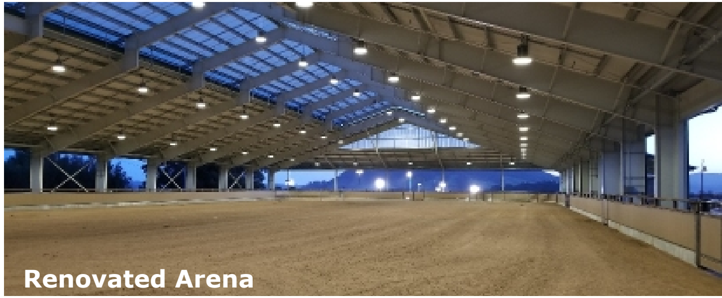

Covered Seating


Outdoor Arena

Concept A
Covered Arena


Terraced Seating


Shade Pavilion


Renovated Arena

Concept A
Central Barns

Lunging Pen

Barn Expansion
(48 Stalls)

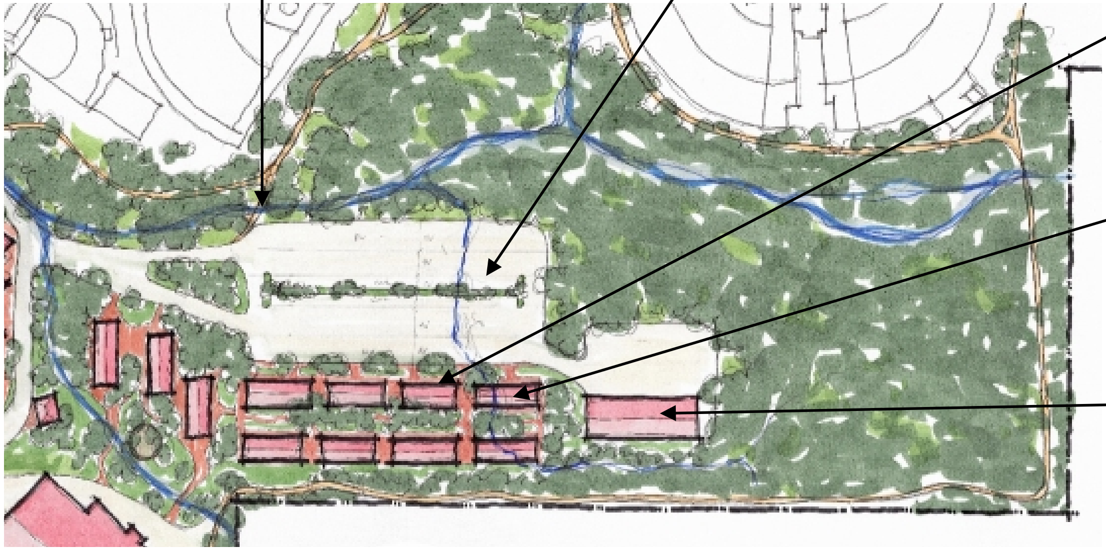
Replace Barns


Barns


Barns


Lunging Pens

Concept A
Back Barns




Bridge


Trailer Parking


New Barns


Maintenance Facility

Concept B

Community Focus

Stall Count
Existing – 298
Proposed – 350

Concept B
Gateway North

Community Space

Community Garden

Stormwater Showcase

Warm-up Arena

Expanded Car/Truck Parking

Replace Barns/Add New

Community Space

Stormwater

New Barns

Concept B
Gateway South

Show Office /
Renovated Restrooms

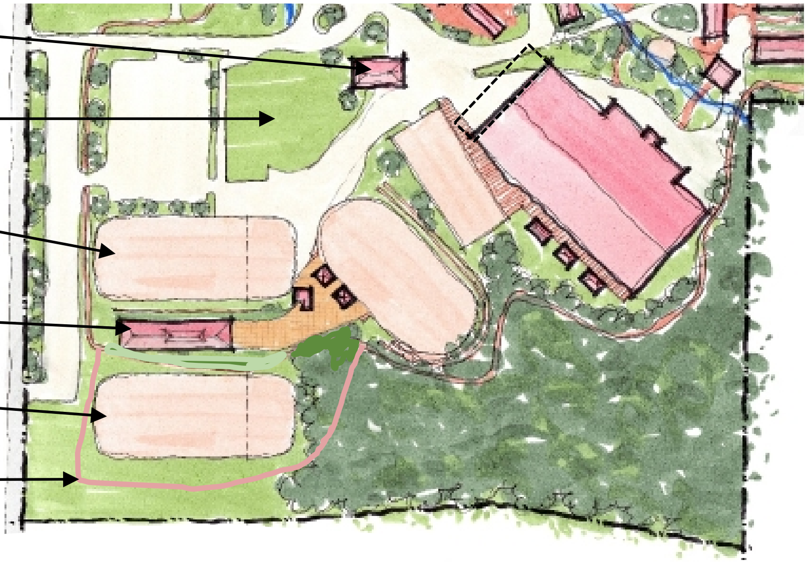
Green Space

Expand Existing Arena

Future Grandstand

New Arena 150’x340

Expand Existing Trail

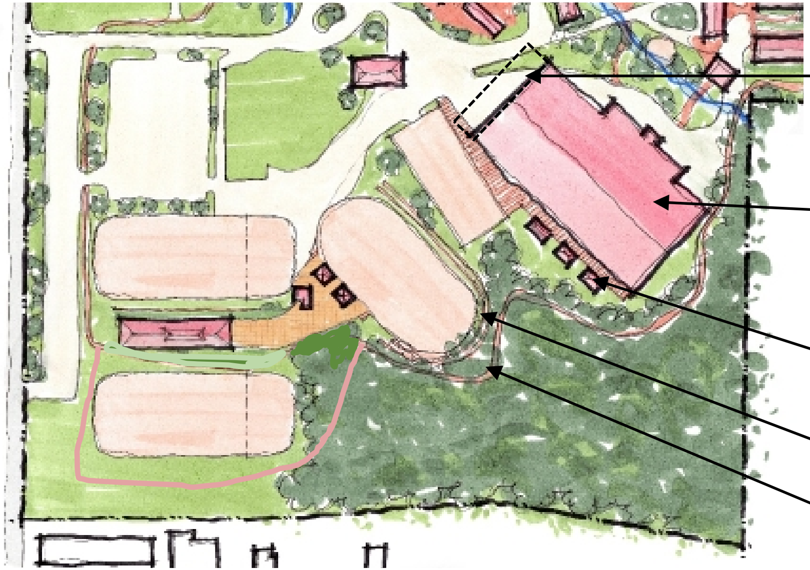



Covered Seating


Green Space

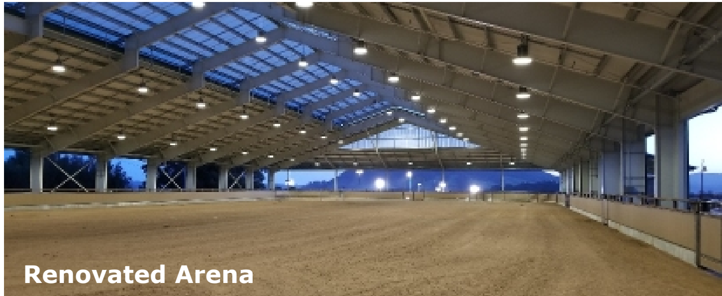

Outdoor Arena

Concept B
Covered Arena

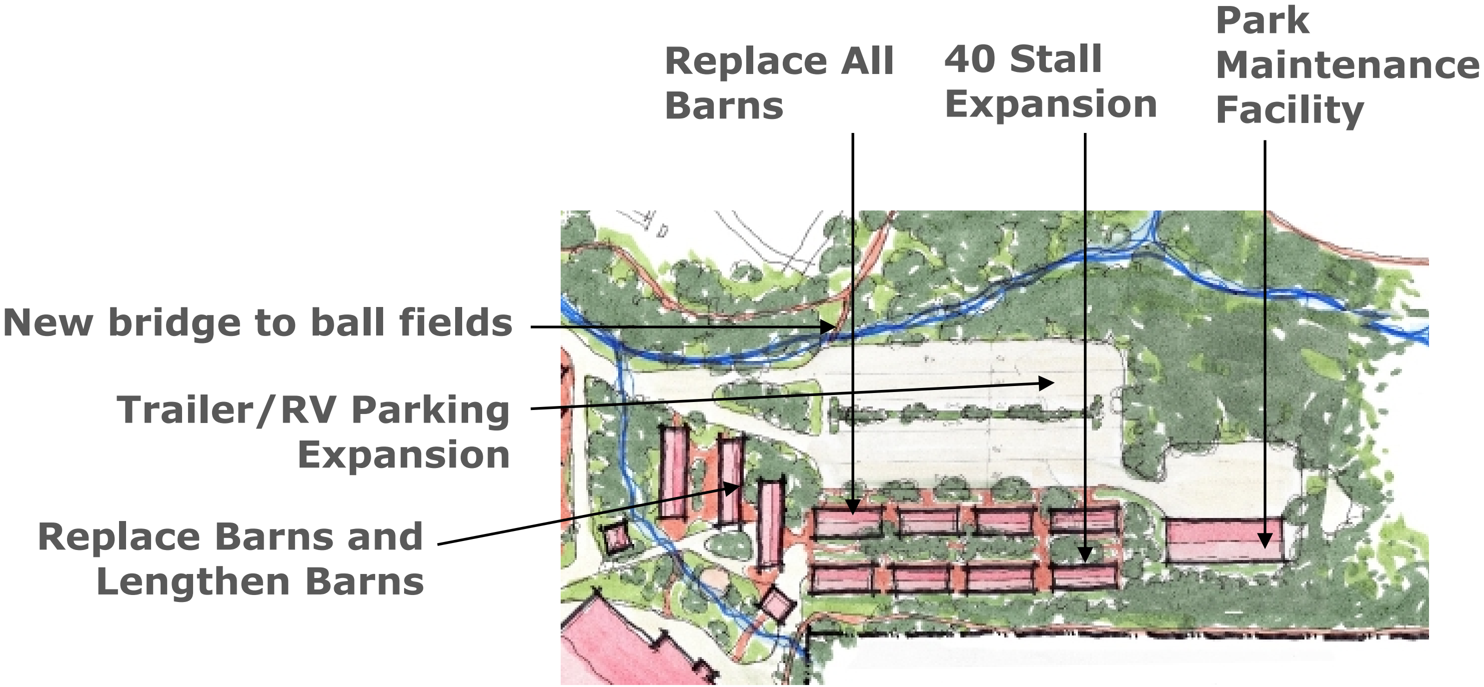



Terraced Seating


Shade Pavilion


Renovated Arena

Concept B
Back Barns




Bridge


Trailer Parking


Barns


Barns

Alternative for Back Barns

City Council Meeting
STAFF REPORT

Submitting Department: Public Works
Submitted By:
Meeting Date: December 3, 2018

I. AGENDA ITEM TITLE: RUCKER ROAD - ROSWELL PROJECT LIMITS

II. RECOMMENDATION:

Please approve Change Order Number 1 for work associated with the Rucker Road Corridor to CW Matthews in the amount not to exceed $2,905,157.50 and authorize the Mayor to execute all necessary documents.

III. BUDGET IMPLICATIONS:

BUDGETED ITEM: YES

FISCAL IMPACT: YES

INCLUDED IN CURRENT FY CPTL BUDGET: YES

INCLUDED IN CURRENT FY OPRT. BUDGET: NO

TOTAL PROJECT COST: $2,905,157.50 (TO BE FULLY FUNDED BY THE CITY OF ROSWELL)

APPROPRIATIONS:

ACCOUNT TITLE/NUMBER	DOLLAR AMOUNT

EXTERNAL FUNDING SOURCES:

ACCOUNT TITLE/NUMBER	DOLLAR AMOUNT

IV. REPORT IN BRIEF:

Rucker Road was one of the 2016 Bond Projects and earlier this year the City executed a contract with CW Matthews in the amount of $15,030,195.75 to construct the Rucker Road Corridor improvements. The City of Roswell included Rucker Road as one of their TSPLOST Tier 1 projects, and while Alpharetta was in the construction phase, Roswell was preparing plans and obtaining the necessary right of way for construction for the improvements within Roswell.

Earlier this year, Roswell and Alpharetta executed an Intergovernmental Agreement (IGA) that stated Alpharetta would obtain a change order price from our contractor to complete the improvements along Rucker Road within the City Limits of Roswell. In return, Roswell would reimburse Alpharetta 100% for all work within the City Limits of Roswell.

Collectively the two cities have worked together with the design and construction teams to obtain a price for the work within Roswell. The total price to complete the work within the City Limits of Roswell is $2,905,175.50. Over $770k of the total cost is associated with Fulton County's Water Main work.

Upon execution of the proposed change order, the contractor will start work immediately and all inspections, project management, and citizen coordination associated with the section within Roswell is the responsibility of the City of Roswell. Awarding the change order to CW will minimize the time it will take to complete the section in Roswell and overall disruption to the citizens who live along the corridor. The anticipated completion date of the section within Roswell is late Summer 2019.

V. ALTERNATIVES:

VI. ATTACHMENTS:

INTERGOVERNMENTAL AGREEMENT
BETWEEN
THE CITY OF ROSWELL, GEORGIA
AND
THE CITY OF ALPHARETTA, GEORGIA

FOR CONSTRUCTION OF A PROJECT ON RUCKER ROAD

This INTERGOVERNMENTAL AGREEMENT (the "Agreement"), made and entered into this 27th day of Nov 2017, by and between THE CITY OF ROSWELL, GEORGIA AND THE CITY OF ALPHARETTA, GEORGIA;

RECITALS

WHEREAS, Roswell and Alpharetta are both municipalities of the State of Georgia which are receiving TSPLOST funding from Fulton County as a result of the referendum passed by voters in November 2016; and

WHEREAS, Alpharetta is beginning the construction of a project along Rucker Road within their city limits, and

WHEREAS, Roswell is finishing design work and starting right of way acquisition of a project along Rucker Road within their city limits, and

WHEREAS, Roswell has included Rucker Road Improvements as a Tier 1 TSPLOST project, and

WHEREAS, The Mayors and City Councils of Roswell and Alpharetta find that it is in the best interest of residents of both cities that travel disruption along the corridor is minimized to the highest extent possible, and

WHEREAS, the Cities wish to work together to provide efficient and cost effective services to their respective citizens and for the mutual benefit of both Cities.

THEREFORE:

In order thereby to carry out the public purposes as set forth above, the Cities hereby agree as follows:

1. Roswell Obligations. Roswell shall use TSPLOST funding to pay the total construction cost for the portion of Rucker Road inside Roswell city limits. Roswell shall provide the final construction plans to Alpharetta Public Works staff. Roswell shall be responsible for providing construction inspection services for the portion of Rucker Road inside Roswell city limits. Roswell shall be responsible for all additional utility relocation costs required by the project in Roswell.

2. Alpharetta's Obligations. Alpharetta shall obtain a change order fee from the contractor based on the construction plans provided by Roswell. Alpharetta shall modify the total contract amount to their contractor once the fee has been reviewed by Roswell staff. Alpharetta shall invoice Roswell 100% of the construction costs inside Roswell city limits. The limits of both projects are included as Exhibit "A"

3. Method of Payment. Alpharetta will invoice monthly for any incurred expenses by the contractor, which shall be paid within 30 days.

4. Cooperation. The parties will cooperate with each other in good faith in pursuing the completion of the undertakings of the parties hereunder.

5. Governing Law. This Agreement and the rights and obligations of the parties hereto (including third party beneficiaries) shall be governed, construed, and interpreted according to the laws of the State of Georgia.

6. Entire Agreement. This Agreement expresses the entire understanding and agreement between the parties hereto.

7. Severability. The invalidity of any one or more phrases, sentences, clauses, or sections contained in this Agreement shall not affect the remaining portions of this Agreement or any part thereof.

8. Counterparts. This Agreement may be executed in several counterparts, each of which shall be an original, and all of which shall constitute but one and the same instrument.

9. Amendments in Writing. No waiver, amendment, release, or modification of this Agreement shall be established by conduct, custom, or course of dealing, but solely by an instrument in writing executed by the parties hereto.

10. Notices. Except as otherwise specifically provided herein, any notices, demands, approvals, consents, requests, and other communications hereunder shall be in writing.

11. Limitation of Rights. Nothing in this Agreement express or implied, shall give to any person, other than the parties hereto and their successors and assigns hereunder, any benefit or any legal or equitable right, remedy, or claim under this Agreement.

[SIGNATURES ON FOLLOWING PAGE]

CITY OF ROSWELL, GEORGIA

Date Signed: 1-10-2018

By______________________
Lori Henry, Mayor

Attest______________________
Gary Palmer, City Administrator

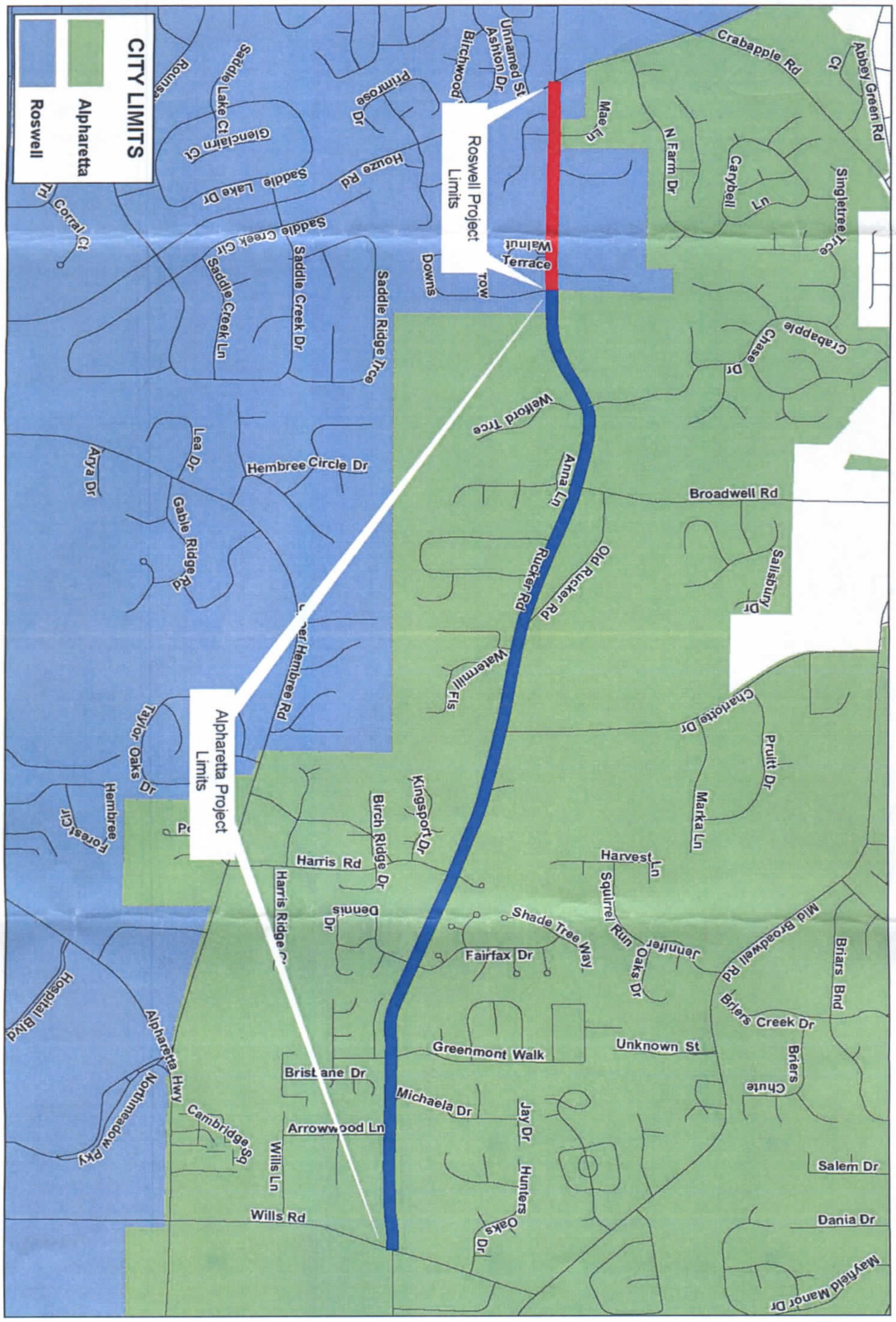
CITY OF ALPHARETTA, GEORGIA

Date Signed: 1-23-18

By______________________
David Belle Isle, Mayor

Attest______________________
Bob Regus, City Administrator

EXHIBIT "A"



CITY LIMITS
Alpharetta
Roswell
Roswell Project Limits
Alpharetta Project Limits
Crabapple Rd
Abbey Green Rd
Singletree Trce
Carybell Ln
N Farm Dr
Mae Ln
Unnamed St
Ashton Dr
Birchwood
Primrose Dr
Glenclairn Ct
Saddle Lake Ct
Saddle Lake Dr
Houze Rd
Saddle Creek Cir
Saddle Creek Dr
Saddle Creek Ln
Saddle Ridge Trce
Downs
Walnut Terrace
Corral Ct
Crabapple Chase Dr
Welford Trce
Anna Ln
Broadwell Rd
Hembree Circle Dr
Lea Dr
Arya Dr
Gable Ridge Rd
Old Rucker Rd
Rucker Rd
Salisbury Dr
Watermill Fls
Charlotte Dr
Pruitt Dr
Taylor Oaks Dr
Hembree Forest Cir
Kingsport Dr
Birch Ridge Dr
Harris Rd
Harris Ridge Ct
Markal Ln
Harvest Ln
Squirrel Run
Shade Tree Way
Dennis Dr
Fairfax Dr
Oaks Dr
Mid Broadwell Rd
Briars Bnd
Hospital Blvd
Alpharetta Hwy
Greenmont Walk
Unknown St
Briers Creek Dr
Briers Chute
Northmeadow Pky
Cambridge Sq
Michaela Dr
Jay Dr
Arrowwood Ln
Wills Ln
Hunters Oaks Dr
Salem Dr
Wills Rd
Dania Dr
Mayfield Manor Dr

BID TOTALS

Biditem	Description	Quantity	Units	Unit Price	Bid Total
10	TRAFFIC CONTROL - 16-006	1.000	LS	84,571.41	84,571.41
20	GRADING COMPLETE - 16-006	1.000	LS	815,212.27	815,212.27
30	RECYL AC 12.5MM SP,GP2,BM&HL	1,553.000	TN	104.92	162,940.76
40	RECYL AC 19 MM SP,GP 1 OR 2 ,INC BM&	254.000	TN	95.87	24,350.98
50	RECYL AC 25MM SP,GP1/2,BM&HL	457.000	TN	97.16	44,402.12
60	GR AGGR BASE CRS, INCL MATL	1,857.000	TN	41.35	76,786.95
70	AGGR SURF CRS	100.000	TN	40.02	4,002.00
80	RECYL AC LEVELING,INC BM&HL	500.000	TN	109.41	54,705.00
90	TACK COAT	1,026.000	GL	2.66	2,729.16
100	MILL ASPH CONC PVMT,VARB DEPTH	6,490.000	SY	7.78	50,492.20
110	CONC SIDEWALK, 6 IN	4,497.000	SY	35.92	161,532.24
120	CONC SIDEWALK, 8 IN	229.000	SY	69.51	15,917.79
130	CONC MEDIAN, 6 IN	106.000	SY	64.08	6,792.48
140	CONC VALLEY GUTTER, 6 IN	39.000	SY	60.32	2,352.48
150	CONC HEADER CURB, 6, TP 2	4,144.000	LF	14.57	60,378.08
160	CONC CURB & GUTTER/ 6X24TP2	61.000	LF	31.42	1,916.62
170	CONC CURB & GUTTER, 6X30TP2	64.000	LF	31.61	2,023.04
180	PVMT REF FAB STRIPS, TP2,18 INCH WIDTH	3,098.000	LF	9.07	28,098.86
190	CL B CONC,BASE OR PVMT WIDEN	55.000	CY	263.95	14,517.25
200	CL B CONC, INCL REINF STEEL	24.000	CY	861.69	20,680.56
210	GALV STEEL PIPE HDRAIL,2,ROUD	280.000	LF	44.00	12,320.00
220	MORTAR RUBBLE MASONRY	51.000	CY	857.00	43,707.00
230	RIGHT OF WAY MARKERS	16.000	EA	138.82	2,221.12
240	GUARDRAIL, TP W	248.000	LF	48.58	12,047.84
250	GUARDRAIL ANCHORAGE, TP 1	1.000	EA	1,553.00	1,553.00
260	GRAIL ANCH, TP 12A, 31 IN TANG, STDR PIPE	1.000	EACH	2,882.00	2,882.00
270	STM DR PIPE 18,H 1-10	1,496.000	LF	73.08	109,327.68
280	STM DR PIPE 24,H 1-10	136.000	LF	92.02	12,514.72
290	FLARED END SECT 18 IN, ST DR	1.000	EA	784.13	784.13
300	STN DUMPED RIP RAP, TP 3, 18	9.000	SY	66.24	596.16
310	PLASTIC FILTER FABRIC	9.000	SY	22.45	202.05
320	REC STORM SEW MANHOLE, TYPE 1	1.000	EA	2,700.00	2,700.00
330	ADJUST CATCH BASIN TO GRADE	5.000	EA	3,800.00	19,000.00
340	ADJUST DROP INLET TO GRADE	4.000	EA	3,300.00	13,200.00
350	ADJUST MANHOLE TO GRADE	11.000	EA	2,700.00	29,700.00
360	CATCH BASIN, GP 1	16.000	EA	3,800.00	60,800.00
370	CATCH BASIN, GP 1, ADDL DEPTH	10.000	LF	425.00	4,250.00
380	DROP INLET, GP 1	3.000	EA	3,300.00	9,900.00
390	DROP INLET, GP 1, ADDL DEPTH	1.000	LF	425.00	425.00
400	STORM SEW MANHOLE, TP 1	2.000	EA	3,300.00	6,600.00
410	JUNCTION BOX	2.000	EA	2,700.00	5,400.00
420	REM SIGN	8.000	EA	500.00	4,000.00
430	RESET SIGN	8.000	EA	500.00	4,000.00
440	HWY SIGNS, TP1MAT,REFL SH TP 9	132.000	SF	22.00	2,904.00
450	HWY SGN,TP1MAT,REFL SH TP 11	102.000	SF	22.00	2,244.00
460	GALV STEEL POSTS, TP 7	532.000	LF	12.00	6,384.00
470	PULL BOX, PB-2	1.000	EA	485.00	485.00
480	LOOP DETECTOR, 6 FT X 40 FT, QUADRUPO	3.000	EA	670.00	2,010.00
490	THERM PVMT MARK, ARROW, TP 2	40.000	EA	85.00	3,400.00
500	THERMO SOLID TRAF ST 5 IN, WHI	7,597.000	LF	0.50	3,798.50
510	THERMO SOLID TRAF ST, 5 IN YEL	5,990.000	LF	0.50	2,995.00
520	THERM SOLID TRAF STRIPE, 8,WH	2,839.000	LF	2.75	7,807.25
530	THERM SOLID TRAF STRIPE,24,WH	211.000	LF	8.50	1,793.50

BID TOTALS

Biditem	Description	Quantity	Units	Unit Price	Bid Total
540	THERMO SKIP TRAF ST, 5 IN, WHI	2,483.000	GLF	0.40	993.20
550	THERMO SKIP TRAF ST, 5 IN, YEL	2,823.000	GLF	0.40	1,129.20
560	THERM TRAF STRIPING, WHITE	73.000	SY	5.00	365.00
570	THERM TRAF STRIPING, YELLOW	372.000	SY	5.00	1,860.00
580	RAISED PVMT MARKERS TP 1	172.000	EA	5.00	860.00
590	RAISED PVMT MARKERS TP 3	110.000	EA	5.00	550.00
600	CONDUIT, NONMETL, TP 2, 2 IN	508.000	LF	24.00	12,192.00
610	MAINT OF INLET SEDIMENT TRAP	15.000	EA	65.00	975.00
620	CONS & REM INLET SEDIMENT TRAP	30.000	EA	165.00	4,950.00
630	MAINT OF TEMP SILT FENCE, TP C	1,247.000	LF	0.50	623.50
640	TEMPORARY SILT FENCE, TYPE C	2,495.000	LF	3.00	7,485.00
650	WATER QUALITY MONITORING AND SAMPLI	4.000	EA	500.00	2,000.00
660	WATER QUALITY INSPECTIONS	12.000	MO	500.00	6,000.00
670	BARRIER FENCE (ORANGE), 4 FT	4,800.000	LF	0.90	4,320.00
680	TRAF SIGNAL INSTALLATION NO - 1	1.000	LS	2,725.00	2,725.00
690	TEMPORARY GRASSING	2.900	AC	350.00	1,015.00
700	MULCH	60.000	TN	300.00	18,000.00
710	PERMANENT GRASSING	0.500	AC	1,550.00	775.00
720	AGRICULTURAL LIME	2.000	TN	250.00	500.00
730	FERTILIZER MIXED GRADE	1.000	TN	550.00	550.00
740	FERTILIZER NITROGEN CONTENT	41.000	LB	10.00	410.00
750	SOD	2,150.000	SY	6.95	14,942.50
760	EROSION CONTROL MATS, SLOPES	5,002.000	SY	0.95	4,751.90
1010	TEMPORARY SILT FENCE, TYPE C	3,000.000	LF	3.75	11,250.00
1020	CLASS A CONCRETE	40.000	CY	575.00	23,000.00
1030	ADJUST WATER METER BX TO GRADE	5.000	EA	297.00	1,485.00
1040	ADJUST WATER VALVE BX TO GRADE	5.000	EA	355.00	1,775.00
1050	FLOWABLE FILL	60.000	CY	297.50	17,850.00
1060	WATER MAIN, 6 IN DIP	20.000	LF	85.50	1,710.00
1070	WATER MAIN, 8 IN DIP	480.000	LF	92.50	44,400.00
1080	WATER MAIN, 10 IN DIP	40.000	LF	97.50	3,900.00
1090	WATER MAIN, 12 IN DIP	2,400.000	LF	89.75	215,400.00
1100	CUT & PLUG EXIST WATER MAIN	11.000	EA	4,255.00	46,805.00
1110	INSERTION VALVE - 8-12 IN DIA	2.000	EA	18,000.00	36,000.00
1120	GATE VALVE, 6 IN	4.000	EA	2,515.00	10,060.00
1130	GATE VALVE, 8 IN	5.000	EA	3,355.00	16,775.00
1140	GATE VALVE, 10 IN	1.000	EA	3,975.00	3,975.00
1150	GATE VALVE, 12 IN	6.000	EA	5,175.00	31,050.00
1160	VALVE MARKER	70.000	EA	255.00	17,850.00
1170	STEEL CASING - 18 IN	330.000	LF	95.00	31,350.00
1180	JACK OR BORE PIPE - 18" STEEL CASING	330.000	LF	295.00	97,350.00
1190	TAP SLEEVE/VAL ASSY, 6" X 6"	1.000	EA	4,975.00	4,975.00
1200	TAP SLEEVE/VAL ASSY, 8" X 8"	11.000	EA	6,895.00	75,845.00
1210	TAP SLEEVE/VAL ASSY,10" X 10"	1.000	EA	8,895.00	8,895.00
1220	TAP SLEEVE/VAL ASSY,12" X 12"	1.000	EA	10,750.00	10,750.00
1230	FIRE HYDRANT	4.000	EA	6,550.00	26,200.00
1240	WATER SERVICE LINE, 1 IN	100.000	LF	37.00	3,700.00
1250	WATER SERVICE LINE, 2 IN	100.000	LF	41.00	4,100.00
1260	WATER SERVICE LINE, 3/4 IN	100.000	LF	36.25	3,625.00
1270	WATER SERVICE LINE - 1 1/2 INCH	100.000	LF	41.55	4,155.00
1280	RELOCATE EXIST FIRE HYDRANT	1.000	EA	3,575.00	3,575.00
1290	RELOCATE X WATER VAL,INCL BOX	6.000	EA	1.00	6.00
1300	RELOCATE X WATER METER,INC BOX	6.000	EA	775.00	4,650.00

BID TOTALS

Biditem	Description	Quantity	Units	Unit Price	Bid Total
1310	RELOC EX WTR MTR INCL BP & VLT -	1.000	EA	12,750.00	12,750.00
1320	REMOVE EXIST FIRE HYDRANT	1.000	EA	795.00	795.00
1330	ADJUST MANHOLE TO GRADE	1.000	EA	4,825.00	4,825.00
1340	RLC EXT WT MT, INC BP&VLT, 4"GT	1.000	EA	10,000.00	10,000.00

Bid Total ========> $2,905,157.50

Alpharetta

TREES TO OFFSET STORMWATER

Case Study 07: City of Alpharetta, GA

Green Infrastructure Center

GEORGIA FORESTRY COMMISSION

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

THE CITY OF ALPHARETTA GEORGIA

October 2018

The Green Infrastructure Center Inc. is the technical services consultant for this project and the case study author. Illustrations in the report are by the Green Infrastructure Center Inc. (GIC). Several of the photos were provided by the City of Alpharetta.

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Publication Date: October 2018

Alpharetta

Case Study 07: Alpharetta, GA

October 2018

CONTENTS

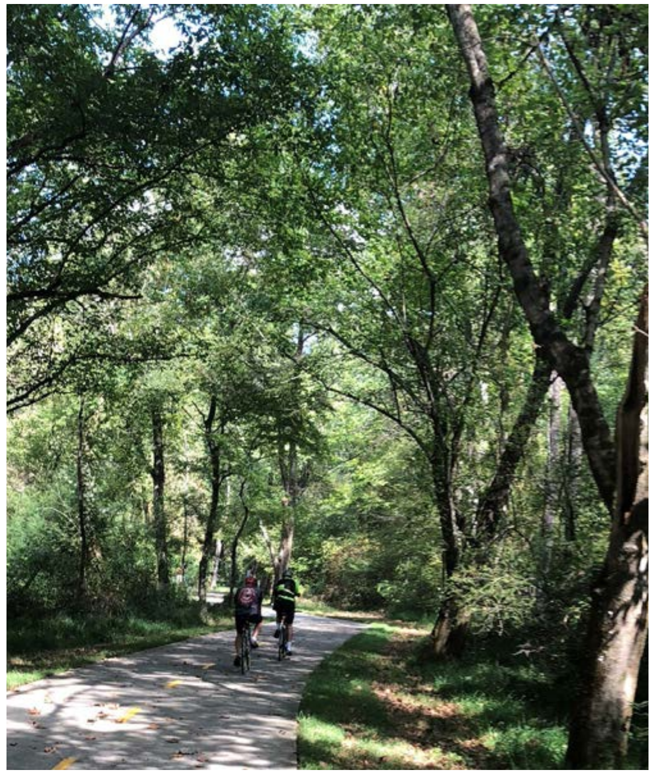
PROJECT OVERVIEW

This project Trees to Offset Stormwater is a study of Alpharetta's tree canopy and its role in taking up, storing and releasing water. This study was undertaken to assist Alpharetta in evaluating how to better integrate trees into their stormwater management programs. More specifically, the study covers the role that trees play in stormwater management and shows how the city can benefit from tree conservation and replanting. It also evaluates ways for the city to improve forest management as the city develops.

PROJECT FUNDERS AND PARTNERS

The project was developed by the nonprofit Green Infrastructure Center Inc. (GIC) in partnership with the states of Georgia, Alabama, Florida, South Carolina, North Carolina and Virginia. The GIC created the data and analysis for the project and published this report. This study is one of 12 pilot projects evaluating a new approach to estimate the role of trees in stormwater uptake. The USDA Forest Service provided the funding for Georgia to determine how trees can be utilized to meet municipal goals for stormwater management. The Georgia Forestry Commission (GFC) administered the pilot studies in Georgia and selected Alpharetta to be one of the two test cases. The City of Norcross is the other Georgia municipality selected for study.

The project was spurred by the on-going decline in forest cover throughout the southern United States. Causes for this decline arise from multiple sources including land conversion for development, storm damages, lack of tree replacement as older trees die, and for coastal cities, inundation from Sea Level Rise. Many localities have not evaluated their current tree canopy, which makes it difficult to track trends, assess losses or set goals to retain or restore canopy. As a result of this project, Alpharetta now has baseline data against which to monitor canopy protection progress, measures for the stormwater and water quality benefits provided by its urban forest, and locations for prioritizing canopy replanting.



Residents enjoy the canopy.

OUTCOMES

This report includes those findings and recommendations that are based on tree canopy cover mapping and analysis, the modeling of stormwater uptake by trees, a review of relevant city codes and ordinances, and citizen input and recommendations for the future of Alpharetta. More specifically, the following deliverables were included in the pilot study:

- Analysis of the current extent of the urban forest through high resolution tree canopy mapping,
- Possible Planting Area analysis to determine where additional trees could be planted,
- A method to calculate stormwater uptake by the city's tree canopy,
- A review of existing codes, ordinances, guidance documents, programs and staff capabilities related to trees and stormwater management, and recommendations for improvement,
- Two community meetings to provide outreach and education,
- Presentation about the pilot studies as a case study at regional and national conferences, and
- A case book and presentation detailing the study methods, lessons learned and best practices.

The project began in May 2017 and Alpharetta staff members have participated in project review, analysis and evaluation. The following city divisions were involved in the project planning and review as the Technical Review Committee (TRC): Stormwater Engineering, Zoning Administration, Transportation Development Services, GIS/Planning in Community Development, Urban Forestry Program Management in Public Works, and Parks and Recreation.

COMMUNITY ENGAGEMENT

Two community meetings were held. The first meeting held in January 2018 provided an overview of the project. The second meeting held in October 2018 provided recommendations (listed below) for the city and elicited feedback. All individual comments from both meetings were provided to the city.

The community forums invited public comments on the mapping that had been done for the project, and solicited public comment on the health and needs of the urban forest. Residents identified specific tree planting opportunities based on the possible planting area analysis. They also noted the issue of invasive species, such as Emerald Ash Borer that has been seen along the Big Creek Greenway and which will affect the city's ash trees. They also suggested parks where more trees could be planted for shade and beauty.

At the final meeting, results of the codes analysis were presented, as well as findings from the stormwater calculator. Community members were shown six specific code/ordinance or practice changes recommended to the City of Alpharetta. Meeting attendees were asked to choose the top three changes they felt would most benefit the urban forest. The policy or code changes are listed below in priority order (most to least popular).

Objectives in Priority Order:

- Use the stormwater calculator tool and increase urban canopy.
- Develop an Urban Forest Management Plan for the city.
- Collect urban forest data to monitor the health of the urban forest.
- Conduct a land cover assessment every four years to compare data and progress.
- Set parking requirements for both minimums and maximums.
- Adopt a complete green streets policy.

The city was congratulated for already having moved into implementations for several recommendations including more detailed specifications for tree planting in parking lots. They also noted that as North Point Mall is redeveloped it can become greener with more infiltation and tree cover.. The city is constantly increasing standards for urban tree planting to ensure that tree survival rates are higher than a typical urban tree. The City Arborist David Shostak noted that "We make sure that trees stay alive and thrive, not just live."

Residents and stakeholders also suggested conducting a city-wide green infrastructure study to identify and plan for landscape connectivity. This could be accomplished with additional funding (but it is beyond the scope of the current project, which is limited to trees and stormwater evaluation).

City Arborist David Shostak (center) explains city planting standards.

Stakeholders study canopy locations.

Alpharetta can use this report and its associated products to:

- *Set goals and develop a management plan for retaining or expanding its tree canopy by watershed.*
- *Improve management practices so trees will be well-planted and well-managed.*
- *Educate developers about the importance of tree retention and replacement.*
- *Motivate private landowners (residential, commercial, and institutional) to plant and protect their trees.*
- *Support grant applications for tree conservation projects.*

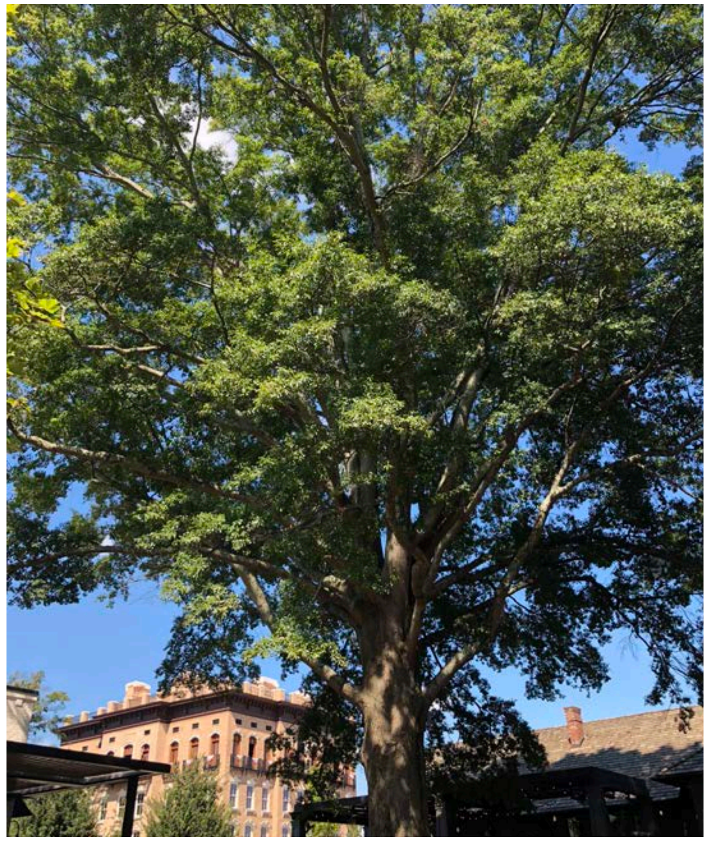
SUMMARY OF FINDINGS

Satellite imagery was used to classify the types of land cover in Alpharetta (for more on methods see page 15). This shows the city those areas where vegetative cover helps to uptake water and those areas where impervious land cover is more likely to result in stormwater runoff. High-resolution tree canopy mapping provides a baseline that is used to assess current tree cover and to evaluate future progress in tree preservation and planting. An ArcGIS geodatabase with all GIS shape files from the study was provided to Alpharetta.

The goal of this study was to identify ways in which water entering the city's municipal separate storm sewer system (MS4) could be reduced by using trees to intercept and soak up runoff. Tree canopy serves as 'green infrastructure' that can provide more capacity for the city's grey infrastructure (i.e. stormwater drainage systems) by absorbing or evaporating excess water before it runs off. The model created shows how the city can reduce potential pollution of its surface waters, which can impact Total Maximum Daily Load (TMDL) outcomes and watershed and island plans.

The detailed land cover analysis created for the project was used to model how much water is taken up by the city's trees in various scenarios. This new approach allows for more detailed assessment of stormwater uptake based on the landscape conditions of the city's forests. It distinguishes whether the trees are growing in a more natural setting (e.g. a cluster of trees in an urban forest), a lawn setting, or over pavement, such as streets or sidewalks. The amount of open space and the condition of surface soils affect the infiltration of water.

As city trees are evaluated, it's important to remember that trees within a cluster provide more value than individual trees alone because they also tend to have a more natural ground cover, more leaf litter (as they are not managed or mowed under) and less compacted soils. Thus, there is more stormwater retention for trees found in a natural setting than a tree over a lawn or over pavement. Trees also shelter one another from wind damages and are less likely to fall. As cities develop and lose forest, trees planted in isolation do not provide equivalent value as the same number of trees found clustered together. Therefore, when counting total trees in a city, managers should also consider the setting in which those trees are found and they should protect intact forested clusters of trees as often as possible.



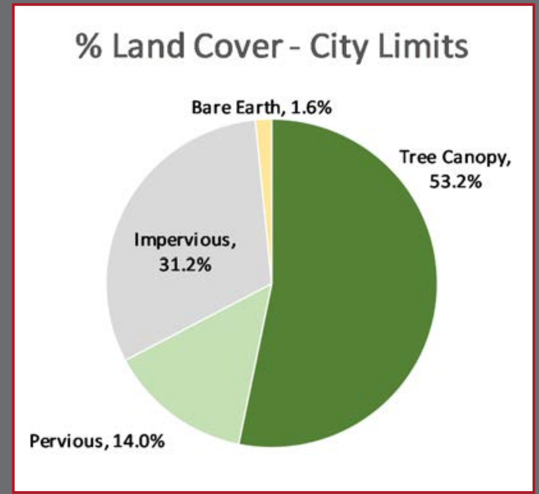
One mature tree can absorb thousands of gallons of water per year.

During an average high volume rainfall event in Alpharetta (a 10-year storm), over 24 hours the town's trees take up an average of 30 million gallons of water.

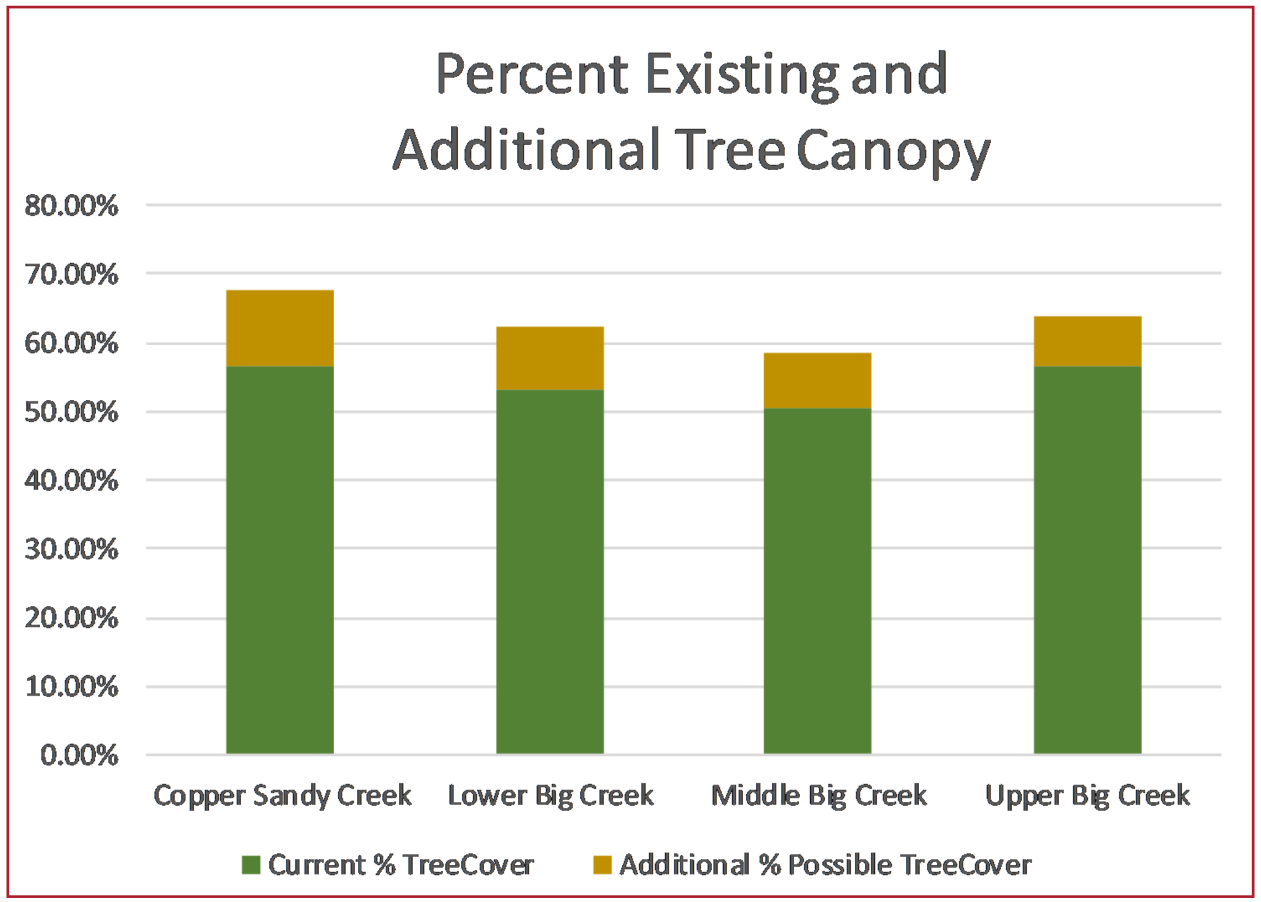
That's 45 Olympic swimming pools of water!

Alpharetta: Fast Facts & Key Stats

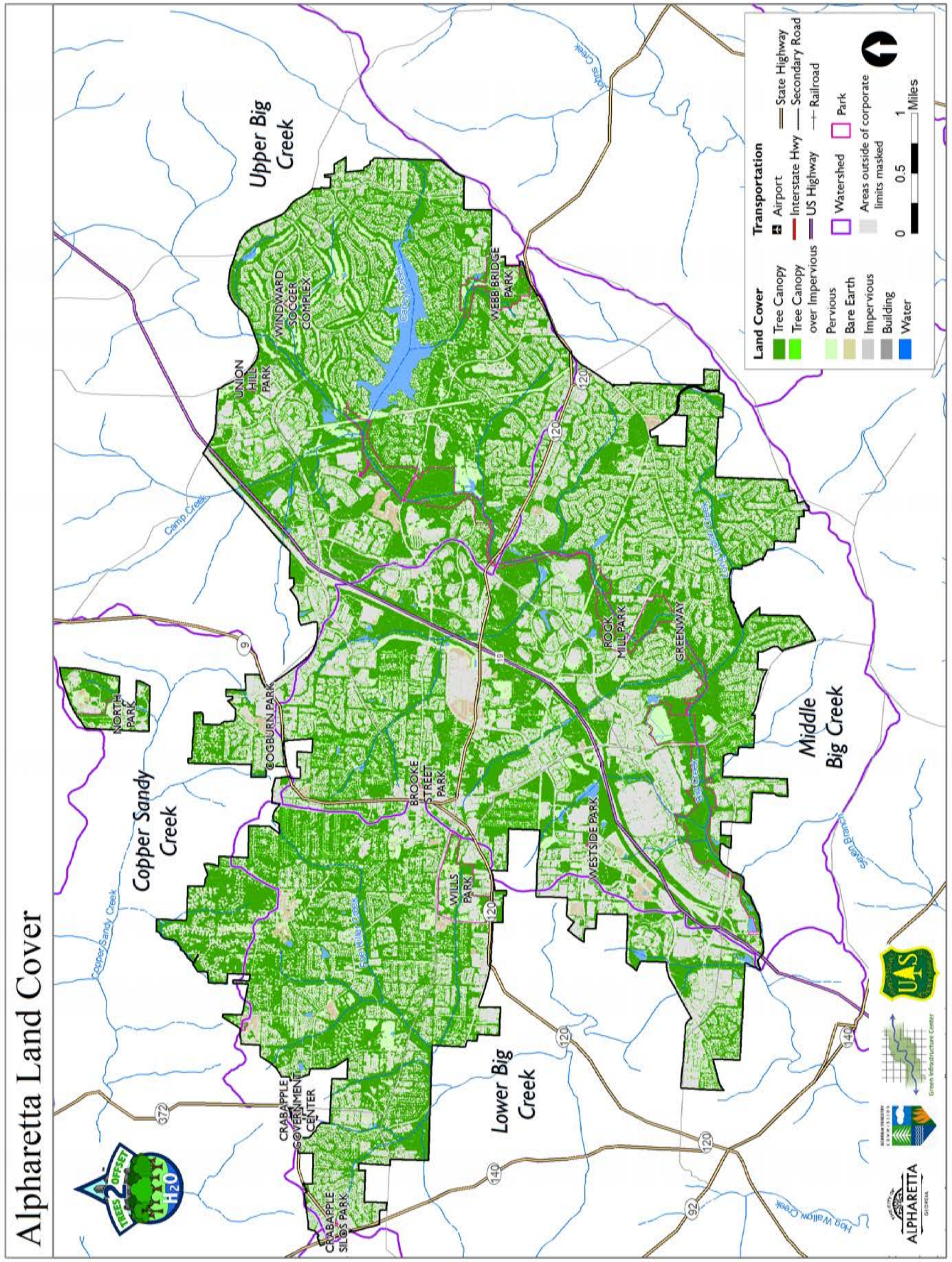
- Piedmont community in North Central Georgia.
- County: .... Fulton
- 2017 U.S. Census Population Estimate: ...... 65,799 people
- City Area
  - Total area: .... 27.3 sq. mi.
  - Land: .... 26.4 sq. mi.
  - Water: .... 0.4 sq. mi.
  - Streams: .... 42.2 miles
  - Tree Canopy: .... 9,121 acres (53%)



Citywide tree canopy is 53 percent.



Percent Tree Cover and Possible Planting Area by Watershed



This map shows the tree canopy of the city which covers 53 percent of the area.

WHY PROTECT OUR URBAN FORESTS?

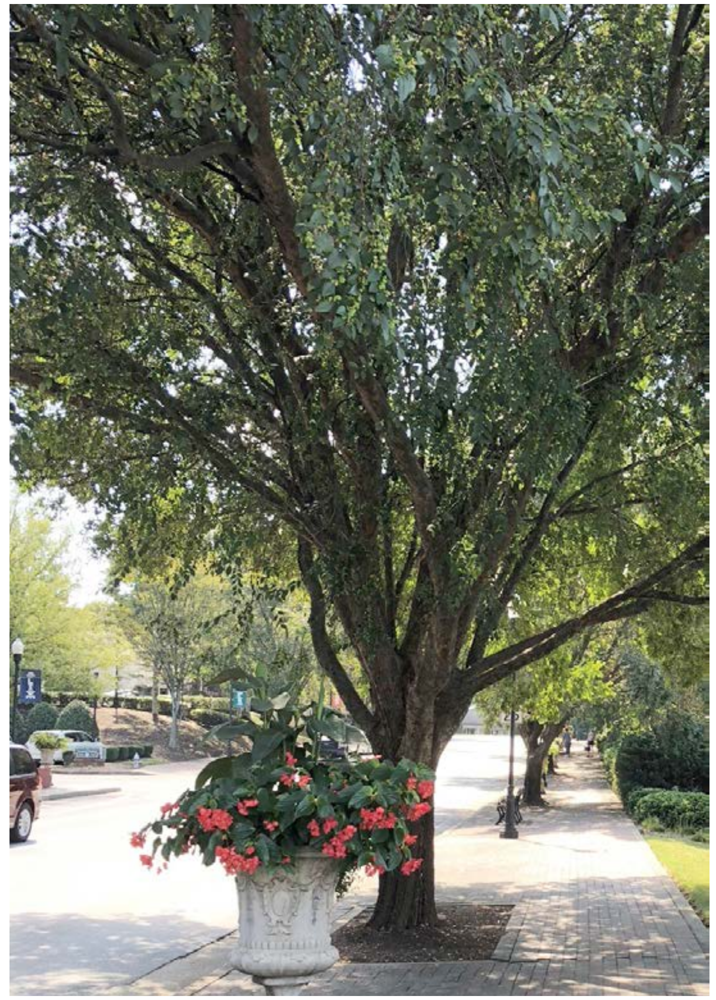
Today, municipalities are losing their trees at an alarming rate, estimated at four million trees annually nationwide (Nowak 2010). This is due, in large part, to population growth. This growth has brought pressures for land conversion to accommodate both commercial and residential development. Cities are also losing older, established trees from the cumulative impacts of land development, storms, diseases, old age and other factors (Nowak and Greenfield 2012). At 53 percent canopy, Alpharetta has good coverage by the urban forest.

However, many cities such as Alpharetta have lost their natural forest cover as the city has grown. While the canopy is very good today, the city may see losses unless replanting does not keep pace with tree losses. As older trees die (or before they die), younger trees need to be planted to restore the canopy. Alpharetta has a robust urban forestry program, but like all cities, improvements can be made. For recommendations on how the city can better protect and manage its urban forests, see the Codes and Ordinances section of this report.

The purpose of this report is not to seek a limit on the city's development, but to help the city better utilize its tree canopy to manage its stormwater. Additional benefits of improved canopy include:

- cleaner air,
- aesthetic values,
- reduced heating and cooling costs,
- decreased urban heat island effects,
- buffering structures from wind damage.
- increased bird habitat;
- fostering walkability and multimodal transportation; and,
- increased revenue from tourism and retail sales.

Assessment and inventory of trees is key to ensuring a healthy forest.

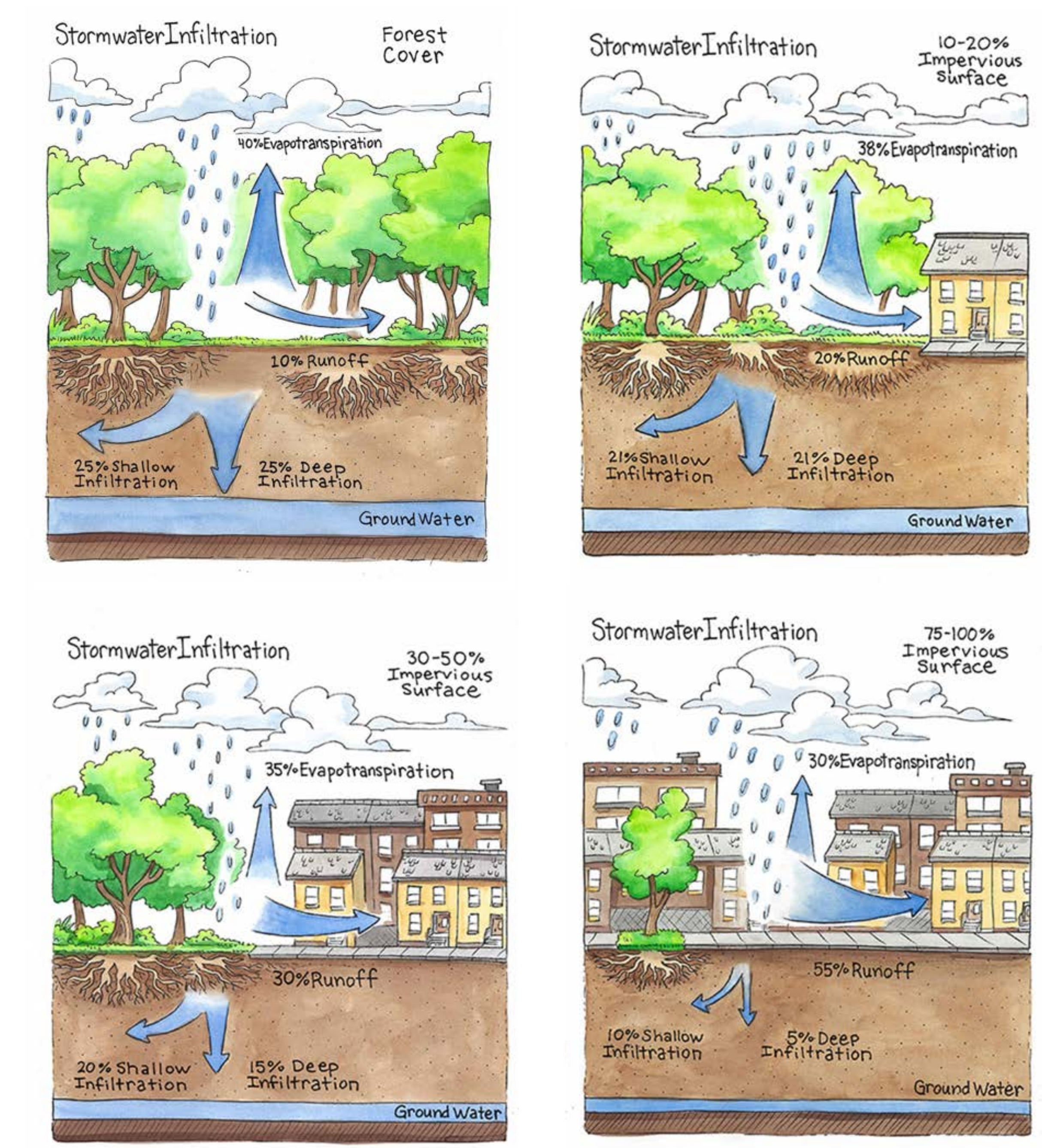


Neighborhood trees

According to the U.S. Environmental Protection Agency (EPA), excessive stormwater runoff accounts for more than half of the pollution in the nation's surface waters and causes increased flooding and property damages, as well as public safety hazards from standing water. The EPA recommends a number of ways to use trees to manage stormwater in the book Stormwater to Street Trees.

In considering runoff, the amount of imperviousness is one consideration; the other is the degree and type of forested land cover, since vegetation helps absorb stormwater and reduces the harmful effects of runoff. As their urban forest canopies have declined across the south, municipalities have seen increased stormwater runoff. Unfortunately, many cities do not have a baseline analysis of their urban forests or strategies to replace lost trees.

When forested land is converted to impervious surfaces, stormwater runoff increases. This increase in stormwater causes temperature spikes in receiving waters, increased potential for pollution of surface and ground waters and greater potential for flooding. When underground aquifers are not replenished, land subsides.



Runoff increases as land is developed. Information source: U.S. EPA

Another cause of canopy decline is the many recent powerful storms that have affected the Southeastern United States. This study was funded to address canopy decline by helping municipalities monitor, manage and replant their urban forests and to encourage cities to enact better policies and practices to reduce stormwater runoff and improve water quality.

It is not just development and storms that contribute to tree loss. Millions of trees are also lost as they reach the end of their life cycle through natural causes. For every 100 street trees planted, only 50 will survive 13-20 years (Roman et al 2014).

Even in older developed areas with a well-established tree canopy, redevelopment projects may remove trees. Choosing the wrong tree for a site or climate, planting it incorrectly, or caring for it poorly can all lead to tree canopy loss. It is also important to realize that an older, well-treed neighborhood of today may not have good coverage in the future unless young trees – the next generation – are planted.

Urbanizing counties and cities are beginning to recognize the importance of their urban trees because trees provide tremendous dividends. For example, urban canopy can reduce

Excess impervious areas cause hot temperatures and runoff. Some older paved areas predate regulations requiring stormwater management.

stormwater runoff anywhere from two to seven percent (Fazio 2010). According to Penn State Extension, during a one-inch rainfall event, one acre of forest will release 750 gallons of runoff, while a parking lot will release 27,000 gallons! This could mean an impact of millions of gallons during a major precipitation event. While stormwater ponds and other management features are designed to attenuate these events, they cannot fully replicate the pre-development hydrologic regime. In addition, as an older city, parts of Alpharetta may lack stormwater management practices that are now required for new developments.

Trees filter stormwater and reduce overall flows. So planting and managing trees is a natural way to mitigate stormwater. Estimates from Dayton, Ohio study found a seven percent reduction in stormwater runoff due to existing tree canopy coverage and a potential increase to 12 percent runoff reduction as a result of a modest increase in tree canopy coverage (Dwyer et al 1992). Conserving forested landscapes, urban forests, and individual trees allows localities to spend less money treating water through the municipal storm systems and also reduces flooding.

Tree planting is key to maintaining canopy.

Trees in residential yards also help to soak up rainfall.

Each tree plays an important role in stormwater management. For example, based on the GIC's review of multiple studies of canopy rainfall interception, a typical street tree's crown can intercept between 760 gallons to 3000 gallons per tree per year, depending on the species and age. If a community were to plant an additional 5,000 such trees, the total reduced runoff per year could amount to millions of gallons of reduced runoff. This means less flooded neighborhoods and reduced stress on storm drainage pipes and decreased runoff into the city's creeks.

Another compelling fiscal reason for planning to conserve trees and forests as a part of a green infrastructure strategy is minimizing the impacts and costs of natural disasters. Not only do trees reduce the likelihood of extensive flooding, they also serve as a buffer against storm damages from wind.

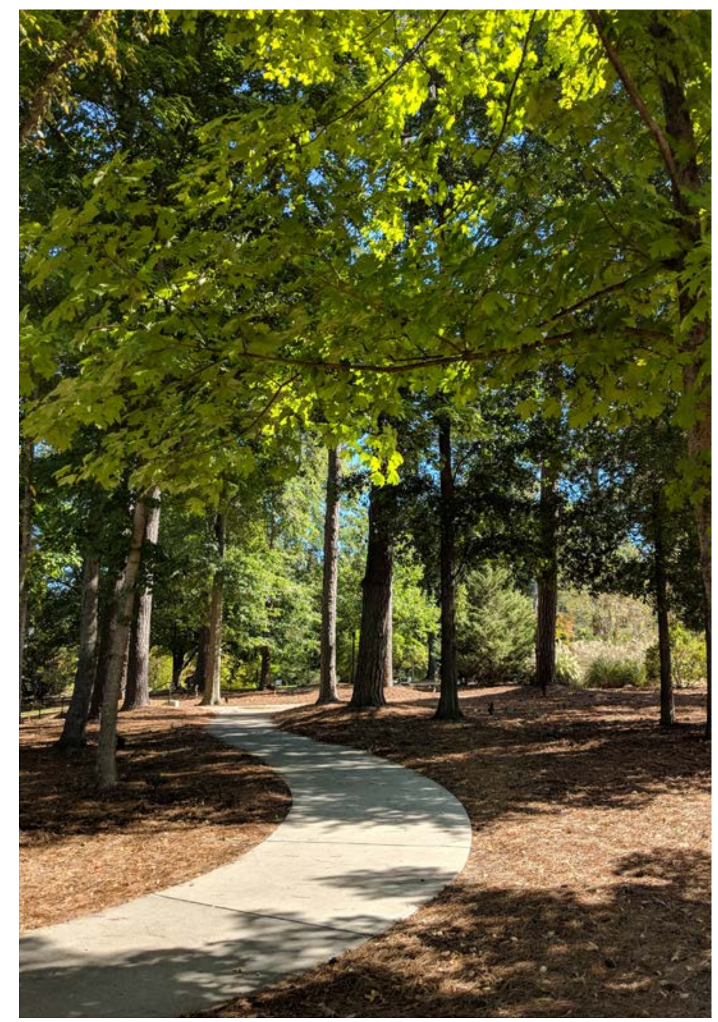
In urban areas, Geographic Information Systems (GIS) software is used to map the extent of the current canopy as well as to estimate how many new trees might be fitted into an urban landscape. A Possible Planting Area (PPA) map estimates areas that may be feasible to plant trees. A PPA map helps communities set realistic goals for what they could plant (this is discussed further on in the Methods Appendix).

ADDITIONAL URBAN FOREST BENEFITS

Quality of Life Benefits

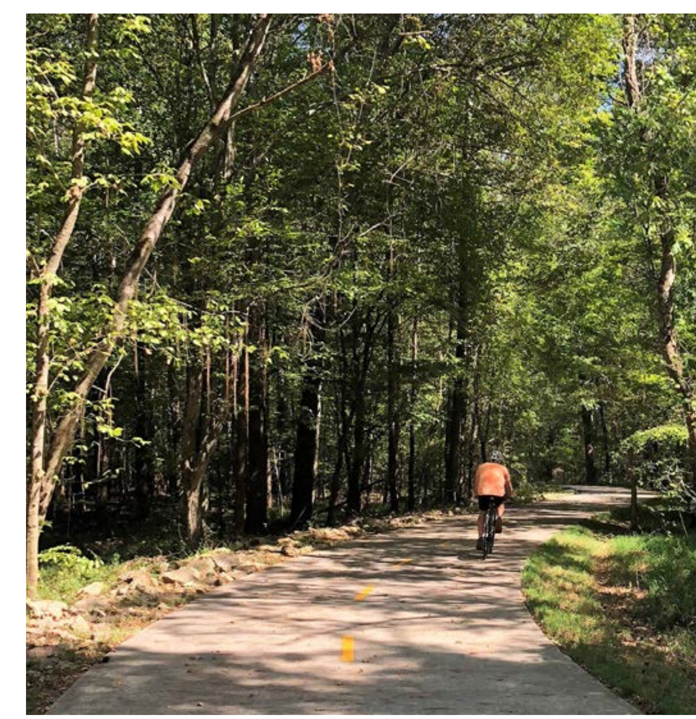
During Georgia's hot summers, more shade is always appreciated. Tree cover shades streets, sidewalks, parking lots, and homes, making southern urban locations cooler, and more pleasant for walking or biking. Trees absorb volatile organic compounds and particulate matter from the air, improving air quality, and thereby reducing asthma rates. Shaded pavement has a longer lifespan thereby reducing maintenance costs associated with repairing or replacing roadways and sidewalks (McPherson and Muchnick 2005).

Communities with greener landscapes benefit children by reducing both asthma and ADHD symptoms.



Trees provide substantial shade and beauty

Children who suffer from Attention Deficit Hyperactivity Disorder (ADHD) benefit from living near forests and other natural areas. One study showed that children who moved closer to green areas have the highest level of improved cognitive function after the move, regardless of level of affluence (Wells 2000). Thus, communities with greener landscapes benefit children and reduce ADHD symptoms. Trees also cause people to walk more and walk farther. This is because when trees are not present, distances are perceived to be longer and destinations farther away, making people less inclined to walk than if streets and walkways are well treed (Tilt, Unfried and Roca 2007).



Well treed areas encourage people to walk and bike.

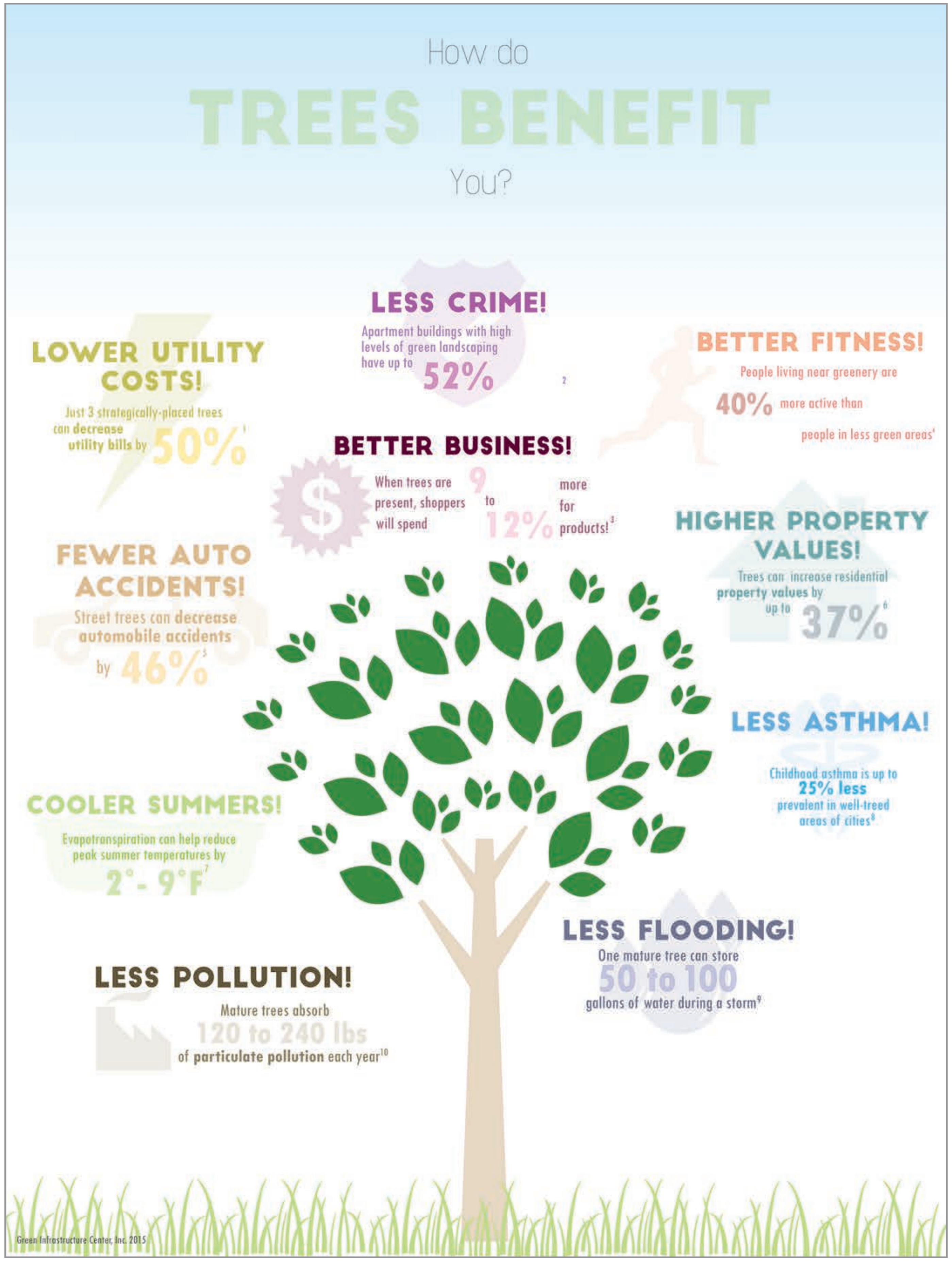
Economic Benefits

Developments that include green space or natural areas in their plans sell homes faster and for higher profits than those that take the more traditional approach of building over an entire area without providing for community green space (Benedict and McMahon 2006). This desire for green space is supported by a National Association of Realtors study which found that 57 percent of voters surveyed were more likely to purchase a home near green space and 50 percent were more willing to pay 10 percent more for a home located near a park or other protected area. A similar study found that homes adjacent to a greenbelt were valued 32 percent higher than those 3,200 feet away (Correll et al. 1978).

Meeting Regulatory Requirements

Trees also help meet the requirements of the Clean Water Act. The Clean Water Act requires Georgia to have standards for water quality. When waters are impaired they may require establishment of a Total Maximum Daily Load (TMDL) standard and a clean-up plan (i.e., Best Management Action Plan) to meet water quality standards. Since a forested landscape produces higher water quality by cleaning stormwater runoff (Booth et al 2002), increasing forest cover results in less pollutants reaching the city's surface and ground waters.

There are many places where trees can be added for shade and beauty.



NATURAL ECOLOGY IN URBAN CONDITIONS – CHANGING LANDSCAPES

Natural history, even of an urbanized location, informs planting and other land-management decisions. Alpharetta is located in the Piedmont Region of Georgia, characterized by gently rolling, well-rounded hills and long, low ridges with a few hundred feet of elevation difference between the hills and valleys. It generally has high-grade metamorphic rocks and scattered igneous intrusions. Its vegetation consists of early succession and scrub-shrub habitat with low, woody vegetation and herbaceous plants with periodic disturbances that result in dense understory vegetation. While the urban landscape of Alpharetta is highly altered, the urban forest still supports birds, bees and other pollinators while providing shade and cooling for the city.

Planting understory shrubs and other vegetation will help soak up rainwater and are better than lawns for reducing runoff.

HISTORIC LAND COVER

Alterations to the landscape began with its original inhabitants and accelerated most dramatically with urbanization in the latter half of the 20th century. Originally occupied by the Cherokee, whom the federal government removed to Oklahoma, settlers took over the lands in the 1830s that now form Alpharetta. Development began with a Methodist camp, set up along a spring in what is now downtown. The camp eventually became a trading post. Following the camp, the Town of Milton formed at this location and, as the area grew, it was eventually chartered as the City of Alpharetta on December 11, 1858. After the 1980s, the city saw a large building boom, due to its proximity to Atlanta and its evolution as a technology hub for major businesses, transforming Alpharetta from a small, rural city to the state's 12th largest city.

The city is developing rapidly with new areas for work and play.

GROWTH AND DEVELOPMENT CHALLENGES

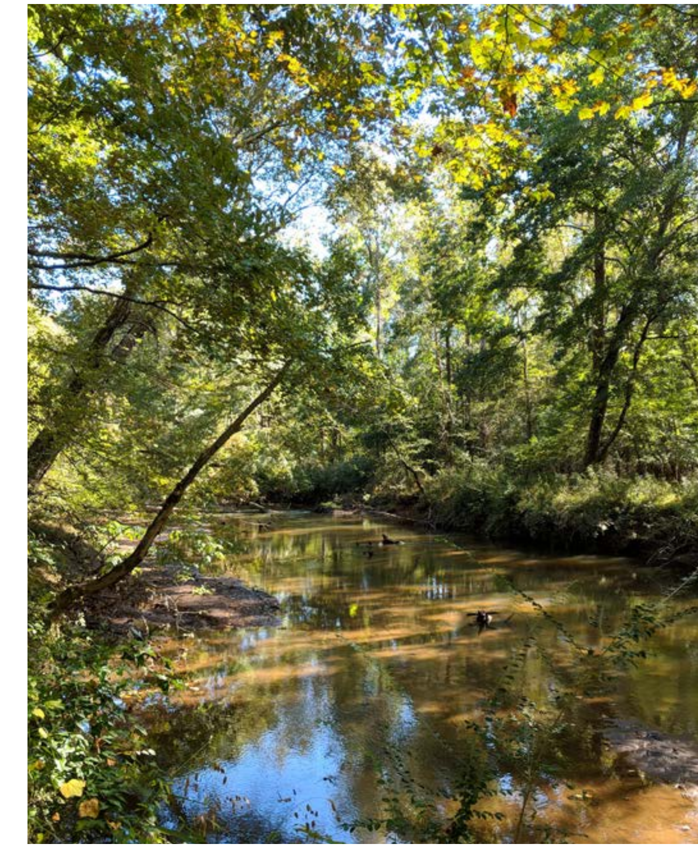
Demands for space to meet the needs for housing, commercial, business, and transportation uses put strains on both the city's grey and green infrastructure. Its close proximity to the burgeoning Atlanta Metro Region and its smaller city charm, mean that land for development and re-development is in high demand. The population has increased 14.7 percent since the 2010 census (U.S. Census Bureau) and in 2017, Alpharetta was the fastest growing city in Georgia.

Today, Alpharetta's downtown is charming with its restaurants, sidewalks and shops. 'Area Vibes' ranked Alpharetta the seventh best place to live in Georgia and 'Niche' ranks the city fourth best. While these rankings are not necessarily scientific, the city's abundant parks and excellent tree cover add to these positive scores.

An unofficial goal is to have a park or other fun destination within a 10-minute walk of every resident (about 1/2 mile).

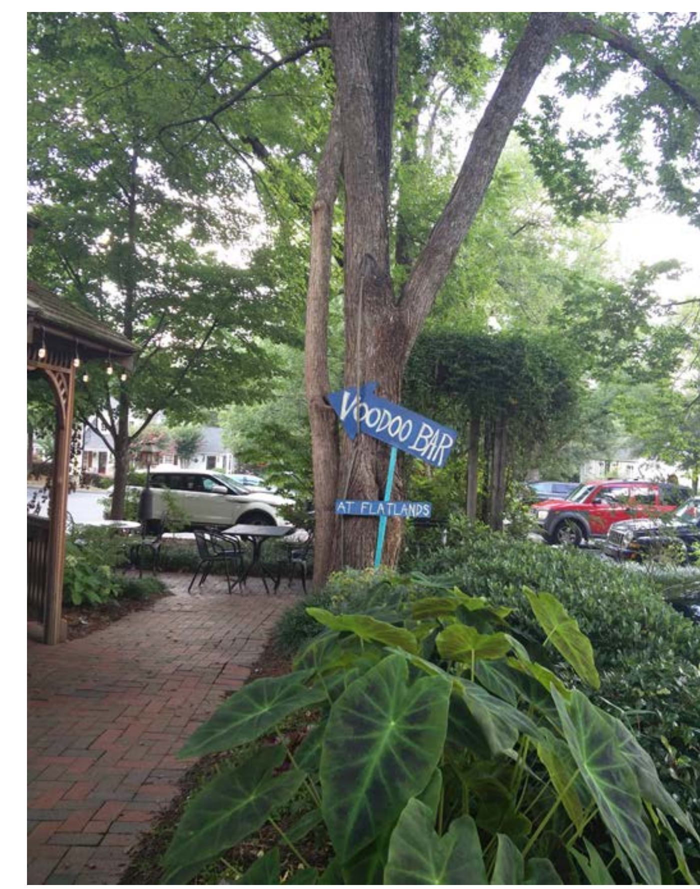
As Alpharetta grows, demands for green space increase. According to the city's 2018 Recreation and Parks Master Plan, the city has 339 acres of parks, and another 459 acres within the Big Creek Greenway. The plan notes that an unofficial goal is to have a park or other fun destination within a 10-minute walk of every resident (about ½ mile).

The city is also determining how to complete the Big Creek Greenway's final segment. The Parks Master Plan suggests that maintaining the current level of service as the population grows will require the city to acquire at least another 52 acres for parks by 2030. The city can use these acquisitions of current and future park sites to help ensure tree cover is maintained and to plant more trees in city parks as existing canopy ages.



Parks, such as the Big Creek Greenway, enhance the city's livability and soak up rainfall.

Trees enhance the character of new development too.



Trees add to the character of small businesses.

DEVELOPMENT AND STORMWATER

As an older city, established in 1858, there are areas that pre-date the 1987 Clean Water Act Amendments which requires the treatment of stormwater runoff. Adding stormwater treatment for older areas is achieved by either retrofitting stormwater best management practices into the landscape, or adding them as properties are re-developed. Adding more trees is a best management practice that provides other benefits beyond stormwater uptake, such as shade, air cleansing and aesthetic values. Recommendations for improvements to better utilize trees to manage stormwater and to reduce imperviousness are found in the Codes, Policies and Practices section of this report.

Reducing imperviousness and increasing vegetation are one way to ease the frequency of flooding because this limits the amount of water that needs to be drained by the storm drainage system. Vegetation reduces water entering the system by intercepting, capturing and transpiring that water.

The requirements set forth by the Clean Water Act of 1972 for the Environmental Protection Agency's National Pollution Discharge Elimination System (NPDES) permitting program, and subsequent amendments in 1987 regulating nonpoint source pollution, form the foundation for the city's stormwater management program.

New developments require stormwater management such as ponds to hold and filter runoff.

Kids learn the importance of soil for Arbor Day.

Residents can make a difference in runoff by planting trees and other vegetation to soak up runoff.

ANALYSIS PERFORMED

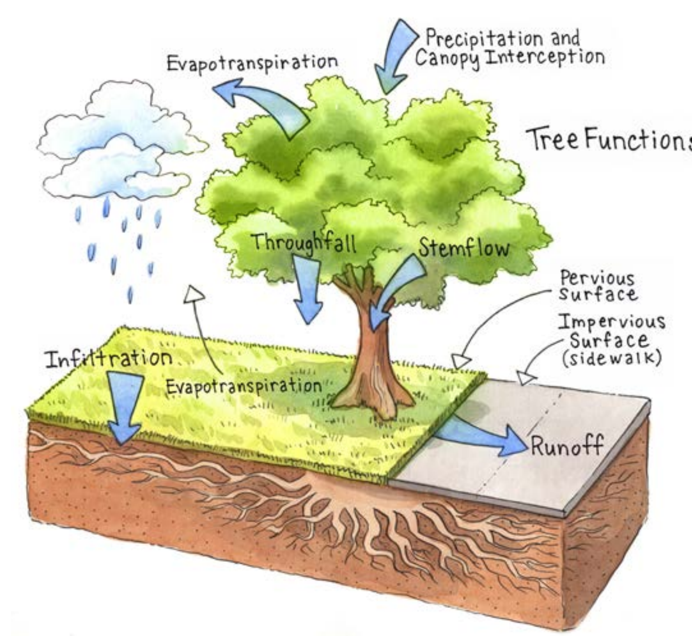
This project evaluated options for how to best model stormwater runoff and uptake by the city's tree canopy. Its original intended use was for planning at the watershed scale for tree conservation. An example is provided on page 17. However, new tools created for the project allow the stormwater benefits of tree conservation or additions as to be calculated at the site scale as well.

As noted, trees intercept, take up and slow the rate of stormwater runoff. Canopy interception varies from 100 percent at the beginning of a rainfall event to about three percent at the maximum rain intensity. Trees take up more water early on during storm events and less water as storm events proceed and the ground becomes saturated (Xiao et al. 2000). Many forestry scientists, as well as civil engineers, have recognized that trees have important stormwater benefits (Kuehler 2017, 2016). See diagram of tree water flow below.

METHOD TO DETERMINE WATER INTERCEPTION, UPTAKE AND INFILTRATION

Currently, most cities use TR-55 curve numbers developed by the Natural Resources Conservation Service (NRCS) to model expected runoff amounts. The city can use the modified TR55 curve numbers (CN) from this study that include a factor for canopy interception. This project is also a tool for setting goals at the watershed scale for planting trees and for evaluating consequences of tree loss as it pertains to stormwater runoff.

The chart shows the canopy breakdown by watersheds. Six watersheds intersect the city limits, however two have the vast majority of their area outside of the city limits. They are Rocky Creek-Little River in the Northwest with about 5 acres and Crooked Creek-Chattahoochee River to the south with less than 0.5 acres. Their area is included in citywide calculations and captured in the spreadsheet tool provided to the city, but they are not discussed individually for this report.



Trees and the Water Cycle

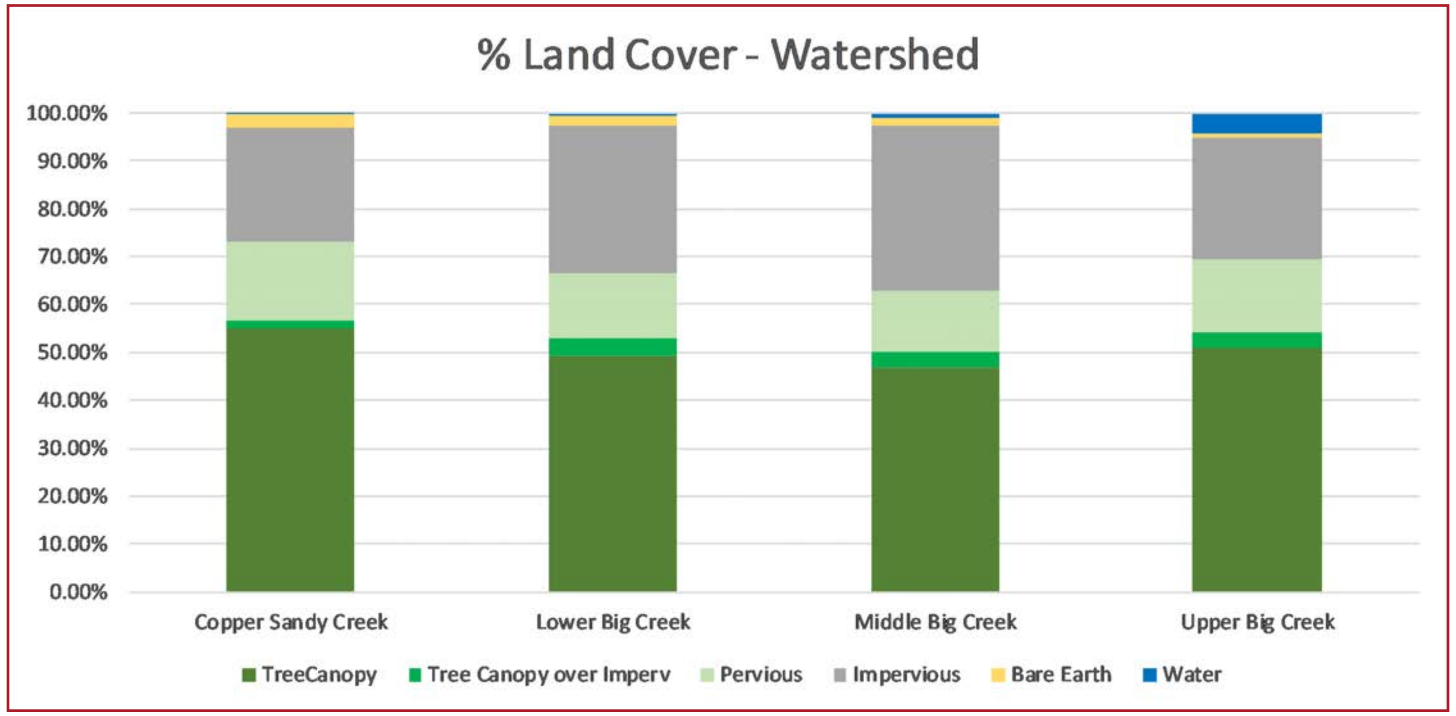
Unit of Analysis	Percent Tree Canopy
Cooper Sandy Creek	56.8%
Crooked Creek – Chattahoochee River	71.4%
Lower Big Creek	53%
Middle Big Creek	50.2%
Rocky Creek – Little River	21.6%
Upper Big Creek	54.4%
Citywide	53.2%

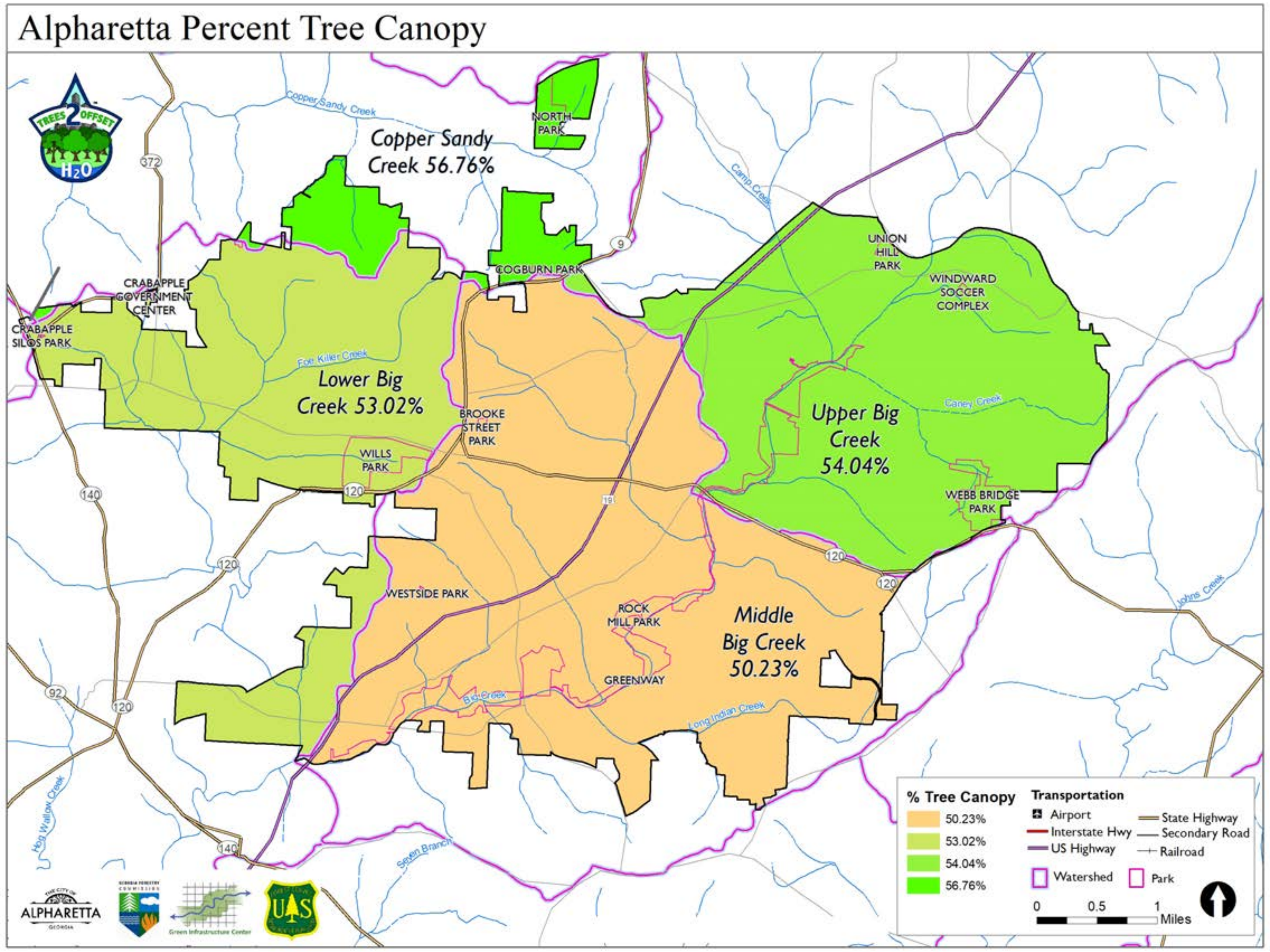
This study used modified TR-55 curve numbers to calculate stormwater uptake for different land covers, since they are widely recognized and understood by stormwater engineers. Curve numbers produced by this study can be utilized in the city's modeling and design reviews. The project's spreadsheet calculator tool makes it very easy for the city to change the curve numbers if they so choose. A canopy interception factor is added to account for the role trees play in interception of rainfall based on location and planting condition (e.g. trees over pavement versus trees over a lawn or in a forest).

Tree canopy reduces the proportion of precipitation that becomes stream and surface flow, also known as water yield. In a study, Hynicka and Divers (2016) modified the water yield equation of the NRCS model by adding a canopy interception term (Ci) to account for the role that canopy plays in capturing stormwater, resulting in:

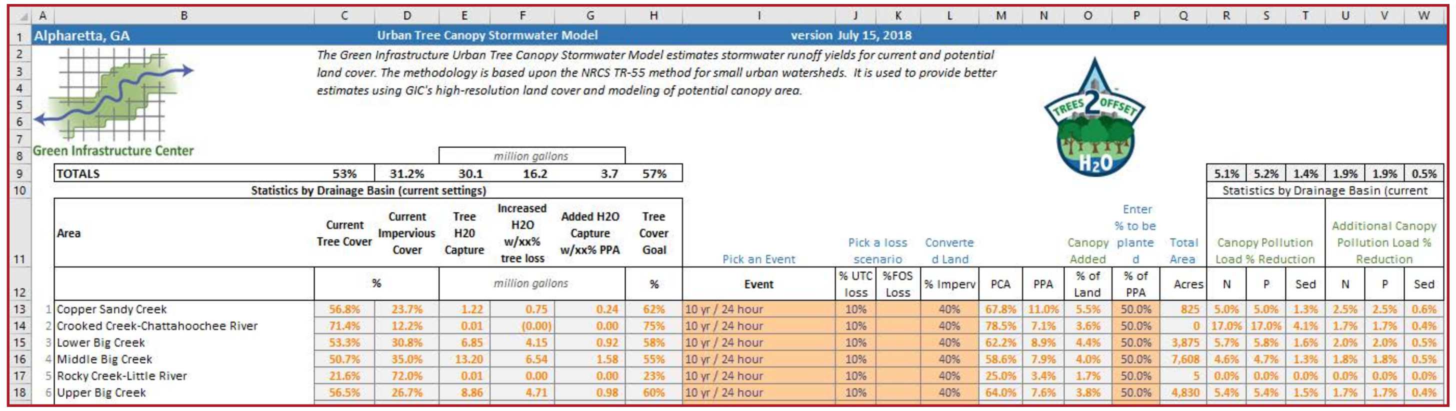
$$R = \frac{(P - C_i - I_a)^2}{(P - C_i - I_a) + S}$$

Where R is runoff, P is precipitation, Ia is the initial abstraction for captured water, which is the fraction of the storm depth after which runoff begins, and S is the potential maximum retention after runoff begins for the subject land cover (S = 1000/CN – 10).





This map shows the tree canopy percentage for each watershed.



Alpharetta, GA — **Urban Tree Canopy Stormwater Model** — **version July 15, 2018**

The Green Infrastructure Urban Tree Canopy Stormwater Model estimates stormwater runoff yields for current and potential land cover. The methodology is based upon the NRCS TR-55 method for small urban watersheds. It is used to provide better estimates using GIC's high-resolution land cover and modeling of potential canopy area.

Green Infrastructure Center

Statistics by Drainage Basin (current settings)

	Area	Current Tree Cover (%)	Current Impervious Cover (%)	Tree H20 Capture (million gallons)	Increased H2O w/xx% tree loss (million gallons)	Added H2O Capture w/xx% PPA (million gallons)	Tree Cover Goal (%)	Pick an Event: Event	Pick a loss scenario: % UTC loss	%FOS Loss	Converted Land: % Imperv	PCA	PPA	Canopy Added: % of Land	Enter % to be planted: % of PPA	Total Area: Acres	Canopy Pollution Load % Reduction: N	P	Sed	Additional Canopy Pollution Load % Reduction: N	P	Sed
	TOTALS	53%	31.2%	30.1	16.2	3.7	57%										5.1%	5.2%	1.4%	1.9%	1.9%	0.5%
1	Copper Sandy Creek	56.8%	23.7%	1.22	0.75	0.24	62%	10 yr / 24 hour	10%		40%	67.8%	11.0%	5.5%	50.0%	825	5.0%	5.0%	1.3%	2.5%	2.5%	0.6%
2	Crooked Creek-Chattahoochee River	71.4%	12.2%	0.01	(0.00)	0.00	75%	10 yr / 24 hour	10%		40%	78.5%	7.1%	3.6%	50.0%	0	17.0%	17.0%	4.1%	1.7%	1.7%	0.4%
3	Lower Big Creek	53.3%	30.8%	6.85	4.15	0.92	58%	10 yr / 24 hour	10%		40%	62.2%	8.9%	4.4%	50.0%	3,875	5.7%	5.8%	1.6%	2.0%	2.0%	0.5%
4	Middle Big Creek	50.7%	35.0%	13.20	6.54	1.58	55%	10 yr / 24 hour	10%		40%	58.6%	7.9%	4.0%	50.0%	7,608	4.6%	4.7%	1.3%	1.8%	1.8%	0.5%
5	Rocky Creek-Little River	21.6%	72.0%	0.01	0.00	0.00	23%	10 yr / 24 hour	10%		40%	25.0%	3.4%	1.7%	50.0%	5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	Upper Big Creek	56.5%	26.7%	8.86	4.71	0.98	60%	10 yr / 24 hour	10%		40%	64.0%	7.6%	3.8%	50.0%	4,830	5.4%	5.4%	1.5%	1.7%	1.7%	0.4%

The calculator tool developed for this project allows the city to see the water uptake by existing canopy and model impacts from changes, whether positive (adding trees) or negative (removing trees).

Major factors determining CN are:

- The hydrologic soil group (defined by surface infiltration rates and transmission rates of water through the soil profile, when thoroughly wetted)
- Land cover types
- Hydrologic condition – density of vegetative cover, surface texture, seasonal variations
- Treatment – design or management practices that affect runoff

What is new about the calculator tool is that the curve numbers relate to the real land cover conditions in which the trees are found. In order to use the equation and model scenarios for future tree canopy and water uptake, the GIC first developed a highly detailed land cover analysis and an estimation of potential future planting areas, as described following. These new land cover analyses can be used for many other projects, such as looking at urban cooling, walkability (see map of street tree coverage on following pages), trail planning and for updating the comprehensive plan.

An example of how this modeling tool can be used for watershed-scale forest planning is indicated following. The actual model spreadsheet was provided to Alpharetta. It links to the land cover statistics for each type of planting area. It also allows the city to hypothetically add or reduce tree canopy to see what are the effects for stormwater capture or runoff. The key finding from this work is that removal of mature trees generates the greatest impacts for stormwater runoff. As more land is re-developed in Alpharetta, the city should maximize tree conservation for maintenance of surface water quality and groundwater recharge. This will also benefit the city's quality of life by fostering clean air, walkability, and attractive residential and commercial districts. Several studies have shown that higher tree canopy percentage is associated with lower overall hospitalization numbers and also with lower hospital visits from asthma.

The stormwater runoff model provides estimates of precipitation capture by tree canopy and the resulting reductions in runoff yield. It takes into account the interaction of land cover and soil hydrologic conditions. It can also be used to run 'what-if' scenarios, specifically losses of tree canopy from development and increases in tree canopy from tree planting programs.

The trees and stormwater model can be used to estimate the impact of the current canopy, possible losses to that canopy, and potential for increasing that canopy. As shown below, for a 10-year,* 24-hour storm a loss of 10% of the urban tree canopy would increase runoff by 16.2 million gallons, while increasing canopy coverage from the current 53 to 57 percent would decrease runoff by almost 3.7 million gallons.

This new approach allows for more detailed assessments of stormwater uptake based on the landscape conditions of the city's forests. It distinguishes whether the trees are within a tree cluster, a lawn setting, a forested wetland or over pavement, such as streets or sidewalks. Tree setting is considered because the conditions in which the tree is living affect the amount of water the tree can intercept. The amount of open space and the condition of surface soils affect the infiltration of water. In order to determine these conditions, a detailed land cover assessment was performed as described following. The analysis can be used to create plans for where adding trees or better protecting them can reduce stormwater runoff impacts and improve water quality.

*A 10-year storm refers to the average recurrence interval, or a 10 percent change of that level of rainfall occurring.

LAND COVER, POSSIBLE PLANTING AREA, POSSIBLE CANOPY AREA ANALYSIS

The land cover data were created using 2015 leaf-on imagery from the National Agriculture Imagery Program (NAIP) distributed by the USDA Farm Service Agency. Ancillary data for roads (from Alpharetta government), and hydrology (from National Wetlands Inventory and National Hydrography Dataset) were used to determine:

1) Tree cover over impervious surfaces, which otherwise could not be seen due to these features being covered by tree canopy; and

2) Wetlands not distinguishable using spectral/feature-based image classification tools.

In cities studied for this project, forested open space was identified as areas of compact, continuous tree canopy greater than one acre, not intersected by buildings or paved surfaces.

The final classification of land cover consists of six classes listed below. The Potential Planting Area (PPA) is created by selecting the land cover features that have space available for planting trees. (i.e., areas were the growth of a tree will not affect or be affected by existing infrastructure.) Of the seven land cover classes, only pervious (grass and scrub vegetation) is considered for PPA.

- Tree Canopy
- Tree Canopy over Impervious
- Pervious
- Impervious
- Bare earth
- Water

Next, these eligible planting areas are limited based on their proximity to features that might either interfere with a tree's natural growth (such as buildings) or places a tree might affect the feature itself such as power lines, sidewalks or roads.

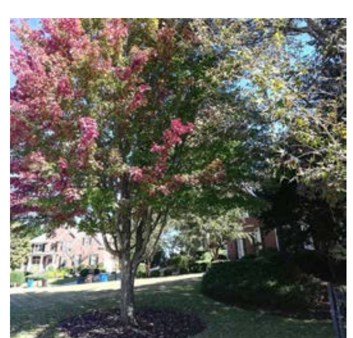
Adding more canopy can help alleviate flooding.

This shows what is currently treed (green) and areas where trees could be added (orange).

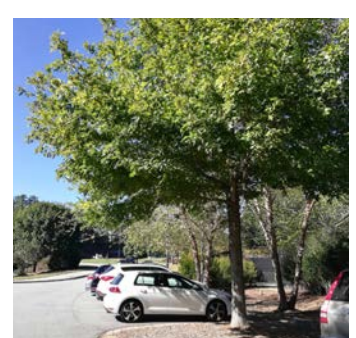
Playing fields and other known land uses that would not be appropriate for tree cover are also avoided. However, there may be some existing land uses (e.g., soccer fields or golf courses) that are unlikely to be used for tree planting areas but that may not have been excluded from the PPA. In addition, the analysis did not take into account proposed future developments (e.g., planned developments) that would not likely be fully planted with trees. Therefore, the resulting PPAs represent the maximum potential places trees can be planted and grow to full size. A good rule is to assume about half the available space could be planted with trees.

Tree over street

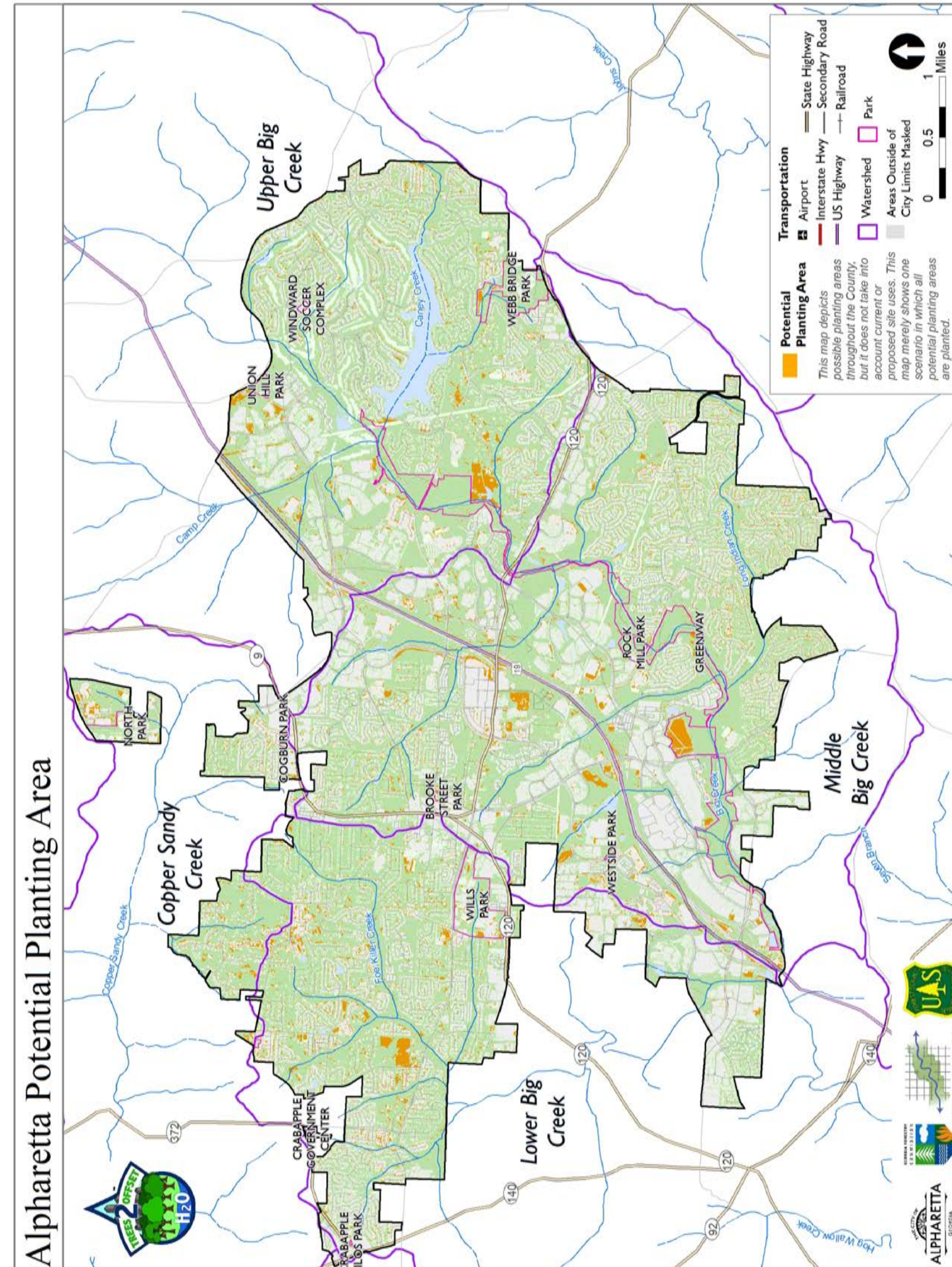
Trees over forest



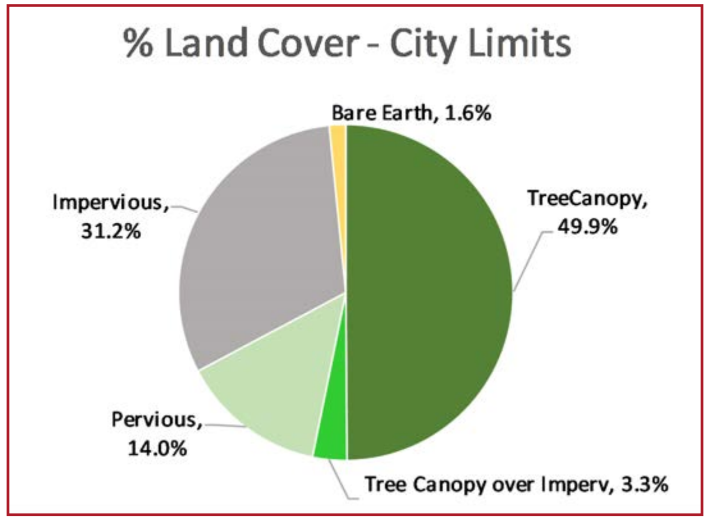
Tree over lawn

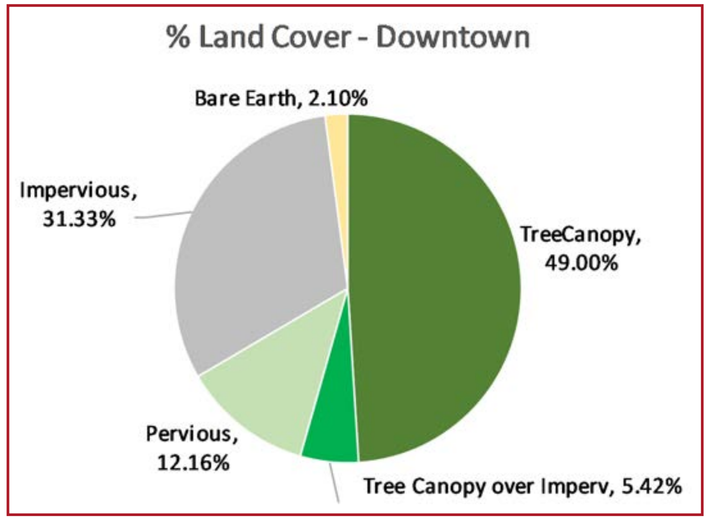


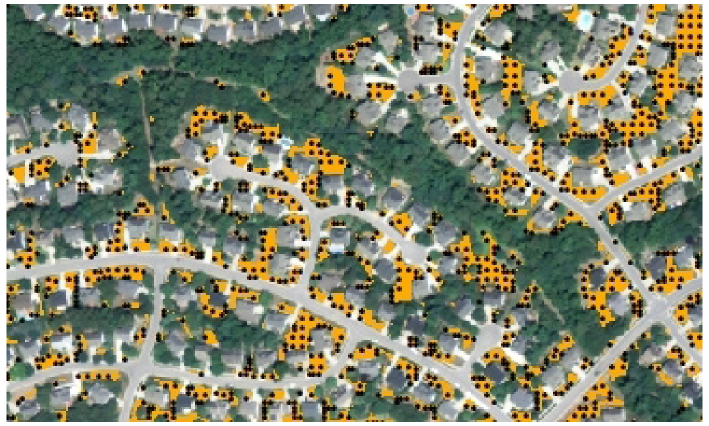
Tree over parking lot



Potential Planting Area (PPA) shown in orange depicts areas where it may be possible to plant trees. All sites would need to be confirmed in the field and may be on private or public lands.







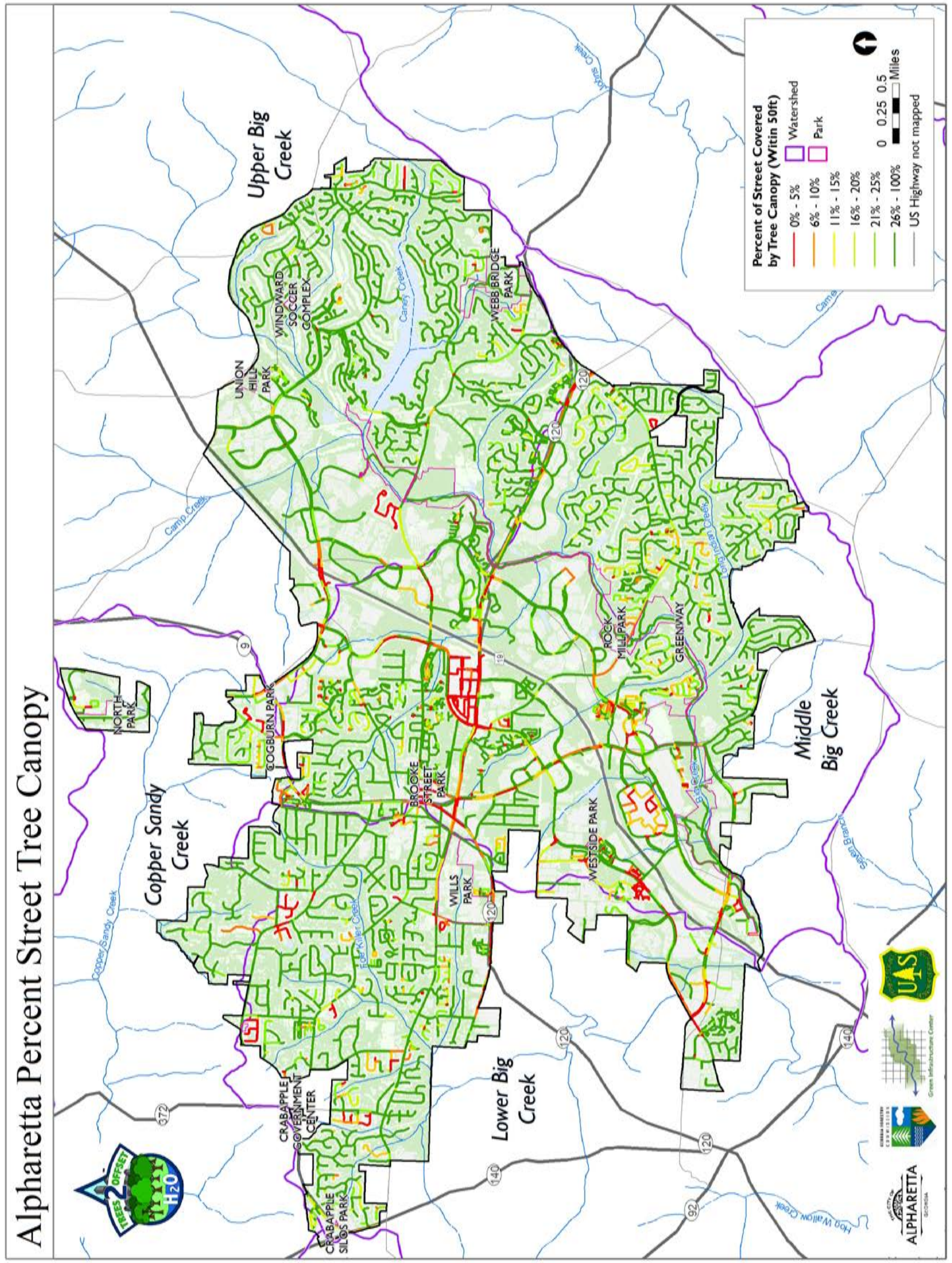
Potential Planting Spots (PPS)

Potential Canopy Area (PCA)

The Potential Planting Spots (PPS) are created from the PPA. The PPA is run through a GIS model that selects those spots where a tree can be planted depending on the size of trees desired. For this analysis, expected sizes of both 20 ft. and 40 ft. diameter of individual mature tree canopy were used with priority given to 40 ft. diameter trees (larger trees have more benefits). It is expected that 30 percent overlap will occur as these trees reach maturity. The result demonstrates a scenario where, if planted today, once the trees are mature, their full canopy will cover the potential planting area and overlap adjacent features, such as roads and sidewalks.

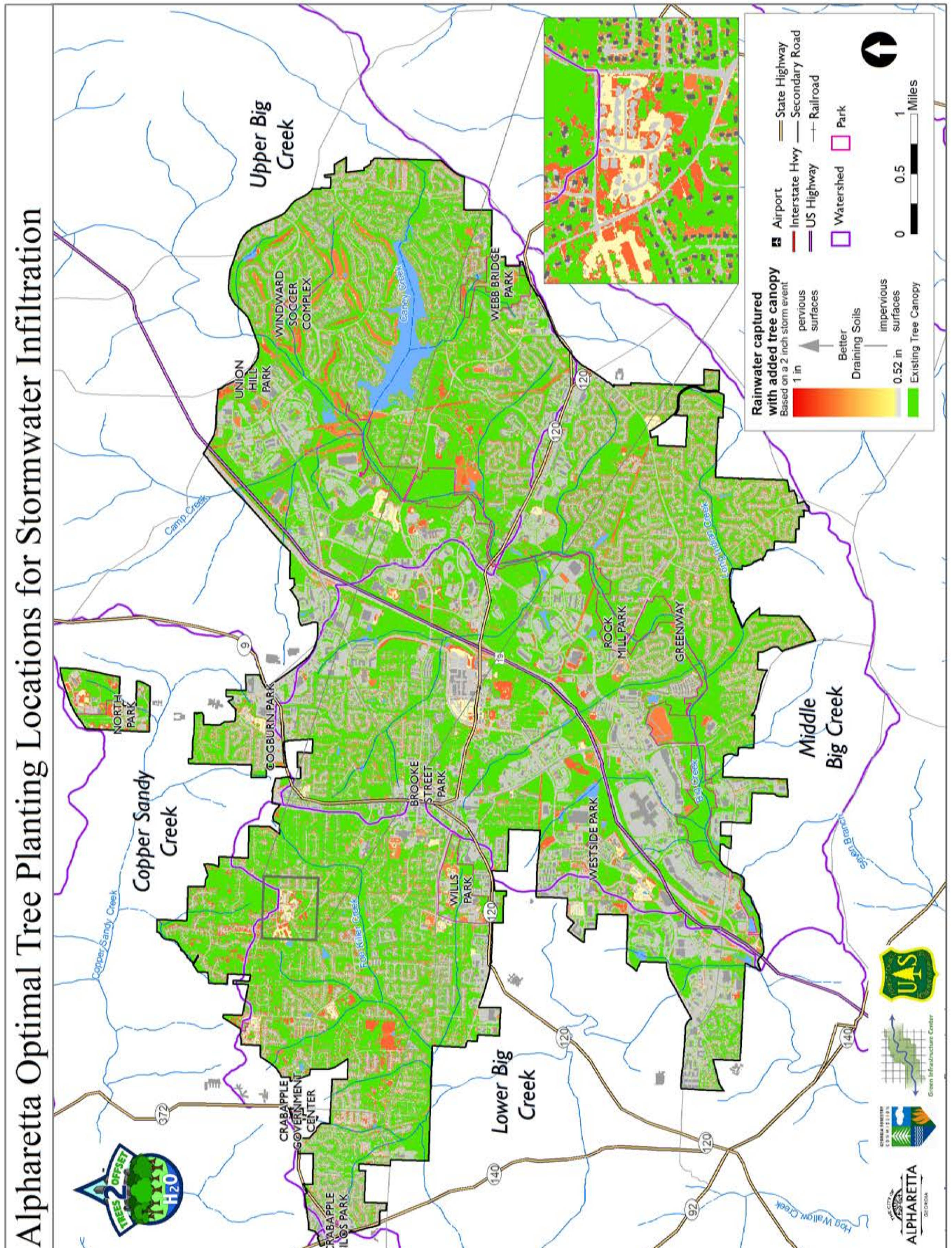
The Potential Canopy Area (PCA) is created from the PPS. Once the possible planting spots are selected, a buffer around each point that represents a tree's mature canopy is created. Similarly, the tree buffer radius is 20 ft. or 40 ft. diameter canopy for each tree. These individual tree canopies are then dissolved together to form the potential overall canopy area.

Percent Street Trees (see map on following page) is calculated using the Land Cover Tree Canopy and road centerlines, which are buffered to 50 ft. from each road segment's centerline. The percent value represented is the percentage of tree cover within that 50 ft. buffer.



The street trees map shows which streets have the most canopy (dark green) and which have the least (red). Streets lacking good coverage can be targeted for planting to facilitate uses, such as safe routes to school or beautifying a shopping district.

See Methods Appendix for more details on mapping methodology.



This map shows which plantable areas are the most permeable and will provide the greatest stormwater infiltration benefits.

CODES, ORDINANCES AND PRACTICES REVIEW

This review is designed to determine which practices make the city more impervious (e.g. too much parking required) and which make it more pervious (e.g. conserving trees or requiring open spaces). Documents reviewed during the codes, ordinances and practices analysis for the project include relevant sections of the city's current code that influence runoff or infiltration. Data were gathered through analysis of city codes and policies, as well as interviews with city staff, whose input was incorporated directly on the spreadsheet summary prepared by the GIC. The spreadsheet provided to the city lists all the codes reviewed, interviews held and relevant findings. A more detailed memo submitted to the city by GIC provides more ideas for improvement.

EVALUATION AND RECOMMENDATIONS

Points were assigned to indicate what percentage of urban forestry and planning best practices have been adopted to date by the city. The spreadsheet tool created for city codes can also serve as a tracking tool and to determine other practices or policies the city may want to adopt in the future to strengthen the urban forestry program or to reduce impervious land cover. A final report comparing all studied localities will be issued by GIC in 2019.

Alpharetta invests staff time and funds to manage its urban forest. The city just celebrated its 29th year of being recognized as a 'Tree City USA' by the Arbor Day Foundation, which means that it spends adequate funds per capita on tree care, it has a tree ordinance, and it practices tree management. The City has two arborists on staff, one in Public Works and one in Community Development. The Community Development Arborist reviews tree removal permit applications on private property and completes plan reviews on all private developments.

Most impressive of all cities studied to date for this project is the city's mandatory checklist, which requires extensive tracking of trees throughout the development process.

Most impressive of all cities studied to date for this project is the city's mandatory checklist, which requires extensive tracking of trees throughout the development process: https://www.alpharetta.ga.us/docs/default-source/planning-zoning/arborist-checklist.pdf?sfvrsn=c3def5ab_20

The recommendations provided in this report are a way to increase the protections for, and size of, the forest in Alpharetta. As noted earlier, although the city's canopy is about 53 percent, it is not distributed equally citywide and will require new plantings to maintain this level of coverage. Alpharetta is one of 12 localities in a six-state area of the Southeastern U.S. to be studied and the seventh to be completed. As other places are studied, they will be compared to the city, and vice versa.

Planting trees for Arbor Day.

Arbor Day, celebrated annually, includes tree planting and community education.

Top recommendations to improve forest care in Alpharetta listed in priority order include the following:

1. **Use the GIC's stormwater uptake calculator to determine the benefits of maintaining or increasing tree canopy goals by watershed.** The calculator provided to Alpharetta allows the city to determine the stormwater benefits or detriments (changes in runoff) from adding or losing trees and to calculate the pollution loading reductions for nitrogen, phosphorus, and sediment.

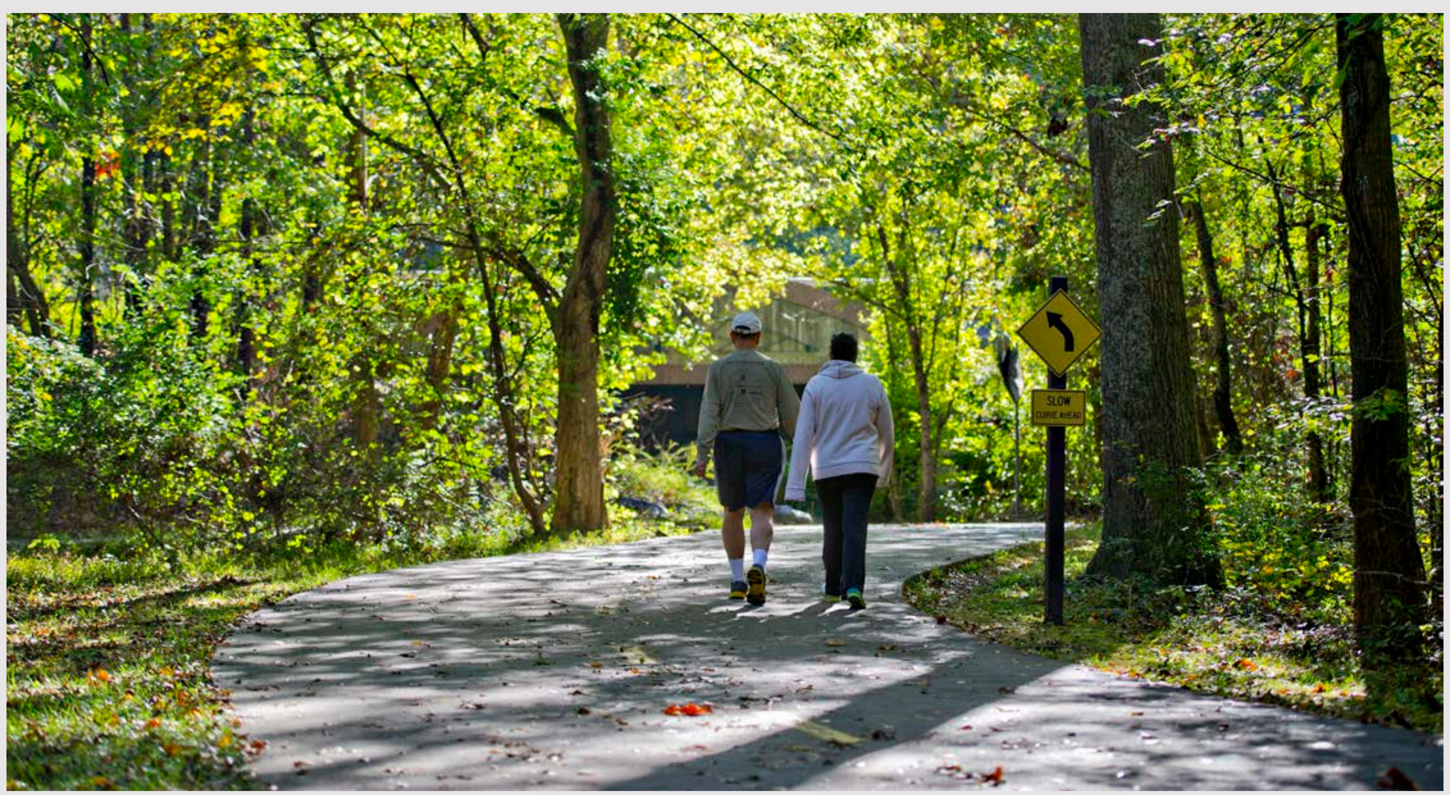
2. **Develop an Urban Forest Management Plan (UMFP).** A UFMP meshes local government and community interests to proactively manage the urban canopy and provide long term benefits. A management plan includes the current condition of the urban forest maintenance costs, urban tree canopy coverage goals and steps to achieve them.

3. **Determine urban forestry data needs and which software will best collect the needed urban forestry data.** The city should implement a data collection process as part of its urban forestry program. Monitoring urban forest composition and health is necessary for maintaining a thriving urban forest that serves both people and wildlife. Current urban forest survey technology makes data collection far less arduous than it was in the past. Use of these software systems allows urban forest managers to make more strategic and cost-effective decisions for managing the urban forest.

4. **Conduct a land cover assessment every four years to determine and allow for comparison of tree canopy coverage change over time.** Keeping tree canopy coverages at levels that promote public health, walkability, and groundwater recharge for watershed health is vital for livability and meeting state water quality standards. Regular updates to land cover maps allow for this analysis and tree planning to occur.

5. **Use the urban forestry funding calculator to develop an urban tree canopy coverage goal and determine the cost of achieving that goal.** Request funding from city council to achieve the desired goal. Planting and maintaining more trees costs money but is well worth the outcome as trees pay the city back in improved property values, sales tax revenues and energy savings.

6. **Develop a contingency budget for the urban forest to allow critical urban forestry maintenance items to continue through economic downturns.** During economic downturns, urban forestry is one of the first programs to be cut from a municipal budget. The city should set a contingency budget which funds maintenance for critical tree care activities, such as watering and risk management, to be carried out while less critical items, such as sucker pruning, are allowed to be completed at a later date.



7. **Develop a forestry emergency response plan.** The city does not have a plan for replacing trees lost to natural disasters such as hurricanes or other storms. This means that canopy will decrease over time. Given the many benefits that trees provide (increased groundwater infiltration, soil stability, and reduced runoff and flooding, shade and better air quality), the city should plan for funding and replacement tree plantings following natural disasters.

8. **Develop a community engagement guide for Alpharetta.** Effective community engagement is a challenge for many municipalities. A community engagement guide can be used to plan for successful community engagement activities. It should include tips for advertising events, identifying stakeholders, and retaining community engagement after the event.

9. **Develop/expand the city's tree care guidance documents.** The city should modify its tree care ordinance for city owned trees to require maintenance activities by year and by season. This ensures that maintenance occurs at the right time in the tree's life cycle and before storm seasons.

10. **Adopt a complete green streets policy.** Complete green streets allow for integration of stormwater management and aesthetic goals. By incorporating vegetation as an integral part of the design, they create and connect habitat, reduce urban heat island effect, help remove air pollutants, and promote walking and biking. The city should develop a policy that includes the following elements: green infrastructure (trees and other vegetation), pedestrian space, bicycle lanes, and stormwater management.

11. **Require and enforce 600, 1,000 and 1,500 cubic feet soil volume planting requirements for small, medium, and large trees respectively for all city trees.** At a minimum, canopy trees require 1,000 cubic feet of soil volume to thrive as recommended by the Environmental Protection Agency (Stormwater to Street Trees, 2013). The city urban forester should be consulted to recommend soil volumes based on species.

12. **Set minimum and maximum parking requirements.** Excessive parking standards have exponential negative effects on stormwater volume generation, especially in urban environments. It is good practice to ensure that parking requirements are consistent with demand. For example, the city can reduce required parking ratios for shopping centers from 1:200 to 1:250 parking spaces per square foot of gross floor area.

13. **Adopt a stormwater utility fee to fund stormwater retrofits.** Stormwater utility fees are a mechanism for funding stormwater management based on the amount of impervious surfaces generated for land cover by parcel. Utility fees usually offer credits for reducing impervious surface on-site. Planting trees can be one way to achieve such credits to reduce the fee. The City of Alpharetta does not currently have a stormwater utility fee. The city should adopt a stormwater utility fee and offer tree plantings as one credit mechanism to reduce the fee.

BEST PRACTICES FOR CONSERVING TREES DURING DEVELOPMENT

Tree planting or preservation opportunities can be realized throughout the development process. A first step is to engage in constructive collaboration with developers. The City of Alpharetta requires extensive review site plans and tree conservation on development sites.

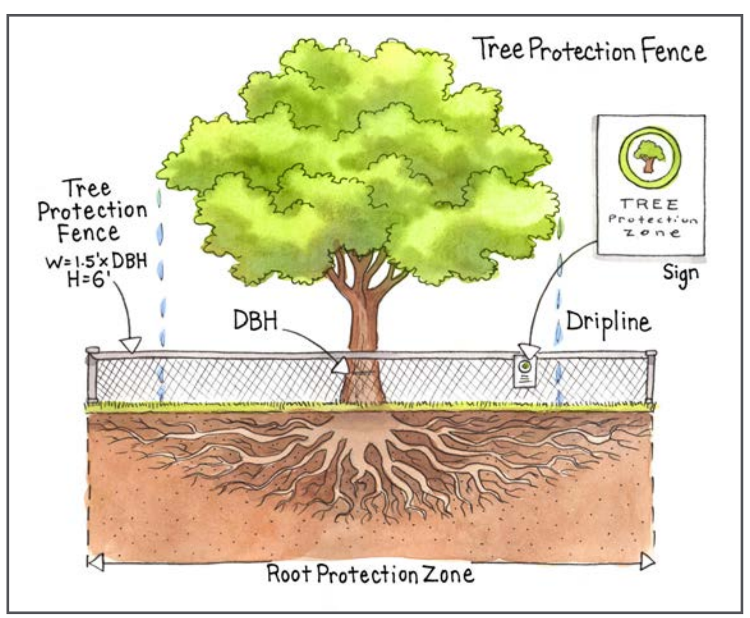
Encouraging Tree Conservation

While the city encourages site layouts that conserve trees, developers may not always agree to implement staff suggestions. The GIC has found that economic arguments (real estate values for treed lots, access to open spaces, and rate of sales) are usually the most compelling way to motivate developers to take the extra effort and care to design sites and manage construction activities to promote tree conservation. This will facilitate site designs which save more trees and thereby require less constructed stormwater mitigation. Many developers are willing to cooperate in such ventures, as houses often sell for a higher premium in a well-treed development.

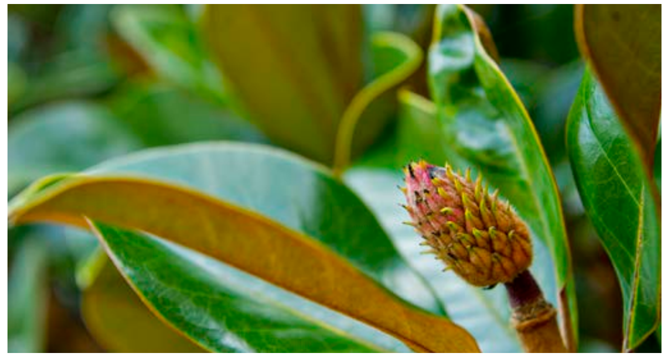
Tree Protection Fencing

Small roots at the radial extents of the tree root area, uptake water and absorb nutrients. Protection of these roots is critical for the optimal health of a tree. While protection at the dripline is an accepted practice, it does not adequately protect the roots.

Trees slated for protection may still suffer development impacts such as root compaction and trunk damage. The most common form of tree protection during construction is tree protection fencing. It is a physical barrier that keeps people and machines out of tree's critical root zones during land disturbance.



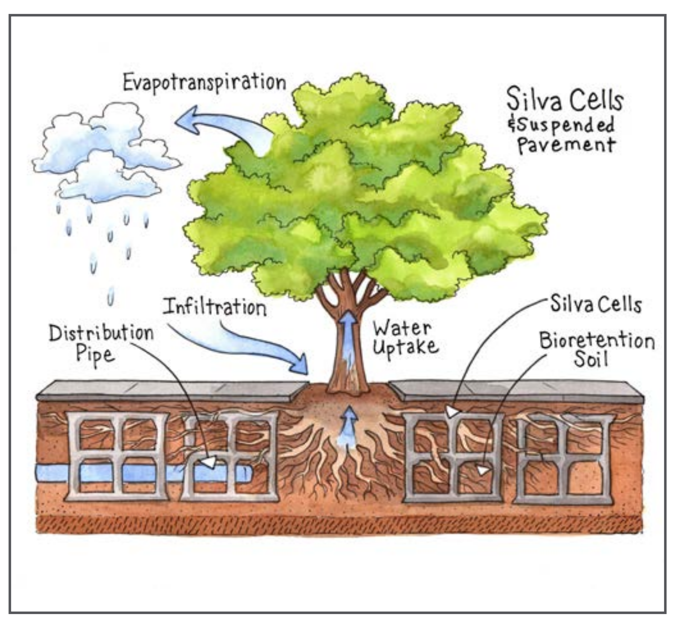
Tree Protection Fence and Signage



TREE PLANTING

In urban environments, many trees do not survive to their full potential life span. Factors such as lack of watering or insufficient soil volume and limited planting space put stresses on trees, stunt their growth and reduce their lifespans. For every 100 street trees planted, only 50 will survive 13-20 years (Roman et al 2014). This means that adequate tree well sizing standards are a critical factor in realizing the advantages of a healthy urban forest. At a minimum, canopy trees require 1000 cubic feet of soil volume to thrive. In areas where space is tighter or where heavy uses occur above roots, 'Silva cells' or other trade technologies can be used to stabilize and direct tree roots towards areas with less conflicts (e.g. away from pipes).

In addition, large trees should not be planted where they may interfere with overhead lines. These and other practices, implemented to provide long term care, protection and best planting practices for the urban forest, will help ensure that investments in city trees will pay dividends for reducing stormwater runoff, as well as cleaner air and water, lower energy bills, higher property values and natural beauty long into the future.



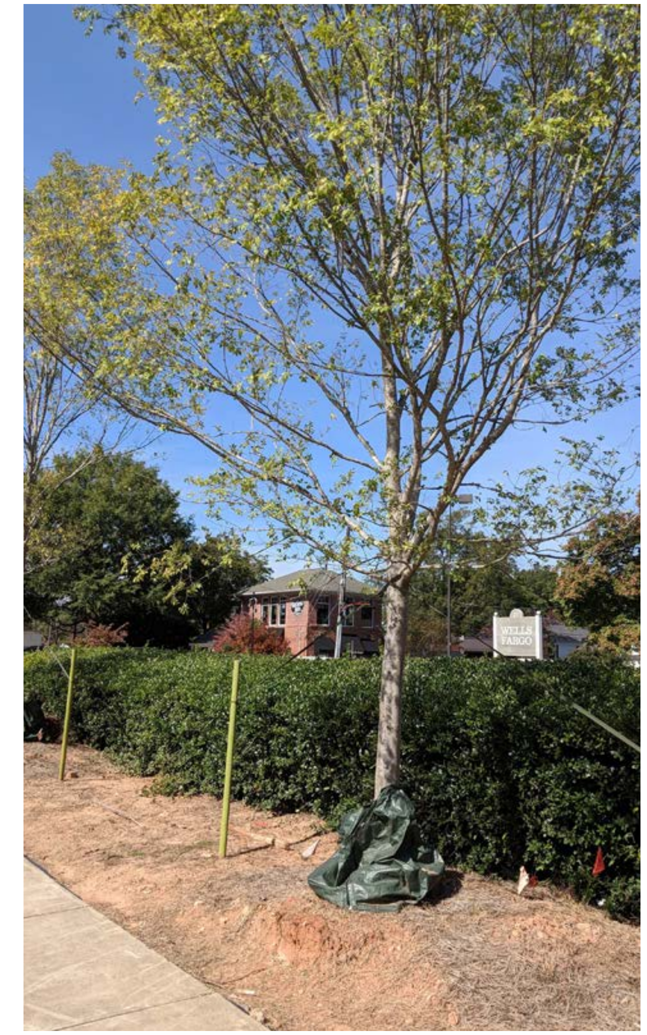
Silva Cells and Suspended Pavement

CONCLUSION

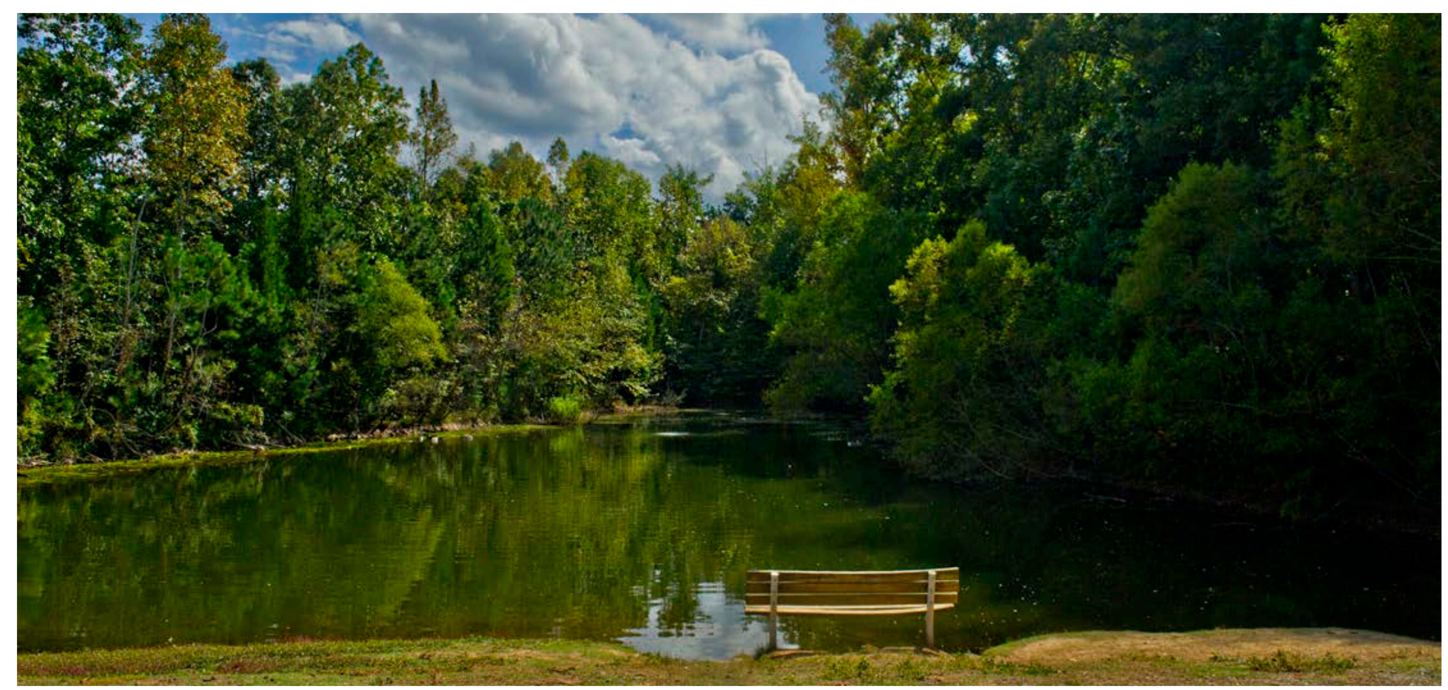
Adapting codes, ordinances and municipality practices to use trees and other native vegetation for greener stormwater management will allow Alpharetta to treat stormwater more effectively. Implementing these recommendations will significantly reduce the impact of stormwater sources (impervious cover) and benefit the local ecology by using native vegetation (trees and other vegetation) to uptake and clean stormwater. It will also lower costs of tree cleanup from storm damages, since proper pruning or removal of trees deemed to be 'at risk' can be done before storms occur.

Alpharetta has committed to maintaining its canopy coverage at 53 percent. Due to the city's rapid pace of development, additional tree canopy has been lost since the project began. This means that the current canopy may already be below 53 percent. New trees should be planted in areas of the city where canopy is lower and where soils have sufficient permeability to allow the water to soak in. And, since most of the city's land is in private ownership, achieving and maintaining 53 percent canopy will require the full participation of residents and businesses to care for existing trees and to plant the next generation of Alpharetta's urban forest. Once new leaf-on aerial imagery data are available from the USDA, the city can verify achievement of the canopy coverage goal.

Alpharetta should use the canopy map and updates to track change over time and to set goals for increasing or maintaining canopy by neighborhood. The city can use the canopy data, analysis and recommendations and stormwater calculator tool to continue to create a safer, cleaner, cost-effective and more attractive environment for all.



Newly planted trees on Main Street are not in the way of power lines.



APPENDIXES

APPENDIX A: METHODS — TECHNICAL DOCUMENTATION

This section provides technical documentation for the methodology and results of the land cover classification used to produce both the Land Cover Map and Potential Planting Scenarios for Alpharetta.

Land cover classifications are an affordable method for using aerial or satellite images to obtain information about large geographic areas. Algorithms are trained to recognize various types of land cover based on color and shape. In this process, the pixels in the raw image are converted to one of several types of pre-selected land cover types. In this way, the raw data (i.e. the images) are turned into information about land cover types of interest, e.g. what is pavement, what is vegetation? This land cover information can be used to gain knowledge about certain issues; for example: What is the tree canopy percentage in a specific neighborhood?

Land cover classification

NAIP 2015 Leaf-on imagery (4 band, 1-meter resolution) was used for the land cover classification. The full set of NAIP data was acquired through the Earth Resources Observation and Science (EROS) Center of the U.S. Geological Survey.

Pre-processing

The NAIP image tiles were first re-projected into the coordinate system used by the city.

NAD_1983_StatePlane_Georgia_West_FIPS_1002_Feet
WKID: 2240 Authority: EPSG

Projection: Transverse_Mercator
False_Easting: 2296583.333333333
False_Northing: 0.0
Central_Meridian: -84.16666666666667
Scale_Factor: 0.9999
Latitude_Of_Origin: 30.0
Linear Unit: Foot_US (0.3048006096012192)

Geographic Coordinate System: GCS_North_American_1983
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.0
Semiminor Axis: 6356752.314140356
Inverse Flattening: 298.257222101

Supervised classification

The imagery was classified using an object based supervised classification approach. The ArcGIS extension Feature Analyst was used to perform the primary classification with a "bull's eye" object recognition configuration was used to identify features based on their surrounding features. Feature Analyst software is an automated feature extraction extension that enables GIS analyst to rapidly and accurately collect vector feature data from high-resolution satellite and aerial imagery. Feature Analyst uses a model-based approach for extracting features based on their shape and spectral signature.

For better distinction between classes an NDVI image was created using Raster Calculator used instead of ArcGIS' Imagery Analyst menu for consistency. The NDVI image along with the source NAIP bands (primarily 4, 1 and 2) were used to identify various features where they visually matched the imagery most accurately.

Post-processing

The raw classifications from Feature Analyst then went through a series of post-processing operations. Planimetric data were also used at this point to improve the classification. Roads, sidewalks, and trails were "burned in" to the raw classification (converted vector data to raster data, which then replaced the values in the raw classification). The 'tree canopy' class was not affected by the burn-in process, however, because tree canopy can overhang streets. These data layers were also used to make logic-based assumptions to improve the accuracy of the classification. For example, if a pixel was classified as 'tree canopy,' but that pixel overlaps with the roads layer, then it was converted to 'Tree Cover over Impervious.' The final step was a manual check of the classification. Several ArcGIS tools were built to automate this process. For example, the ability to draw a circle on the map and have all pixels classified as "tree canopy" to 'non-tree vegetation,' which is a process usually requiring several steps, is now only a single step.

Potential Planting Area Dataset

The Potential Planting Area dataset has three components. These three data layers are created using the land cover layer and relevant data in order to exclude unsuitable tree planting locations or where it would interfere with existing infrastructure.

1. Potential Planting Area (PPA)
2. Potential Planting Spots (PPS)
3. Potential Canopy Area (PCA)

The Potential Planting Area (PPA) is created by selecting the land cover features that have space available for planting trees, then eliminating areas that would interfere with existing infrastructure.

Initial Inclusion

selected from GIC created land cover

- Pervious surfaces
- Bare earth

Exclusion Features: (buffer distance)

Excluded Cover Features

- Existing tree cover
- Water
- Wetlands
- Imperious surfaces
- Ball Fields (i.e.: Baseball, Soccer, Football) where visually identifiable from NAIP imagery. (Digitized by GIC)

Exclusion Features: (buffer distance)

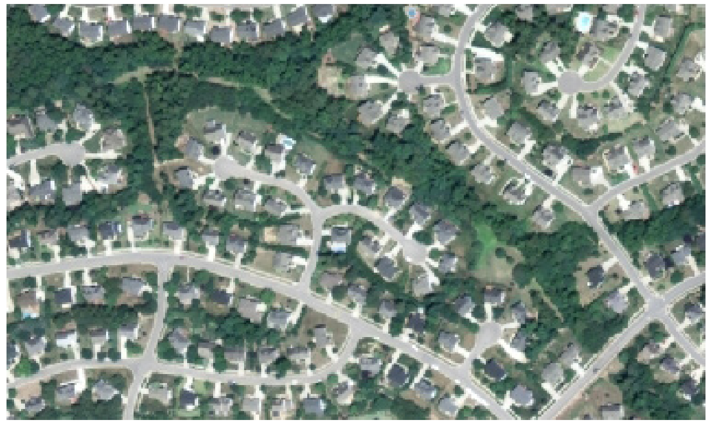
- Roads Areas (10ft)
- Rail roads (10ft)
- Structures (10ft)
- Power lines and other identifiable utilities (10ft)

Potential Planting Spots

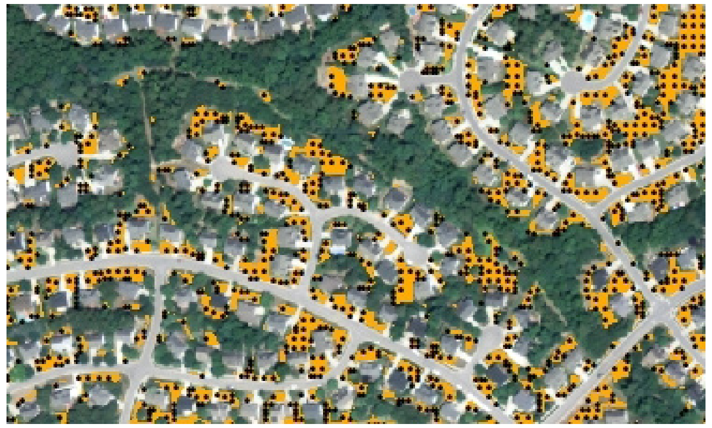
The Potential Planting Spots (PPS) are created from the PPA. The potential planting areas (PPA) is run through a GIS model that selects spots a tree can be planted depending on the size tree's that are desired. Tree planting scenario was based on a 20 ft. and 40 ft. mature tree canopy with a 30 percent overlap.

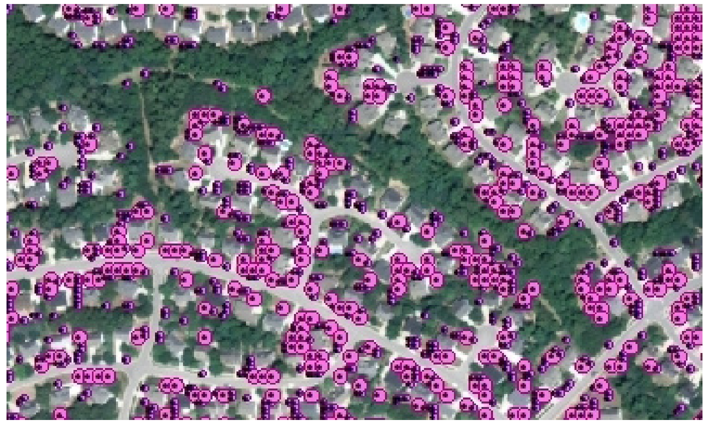
Potential Canopy Area

The Potential Canopy Area (PCA) is created from the PPS. Once the possible planting spots are given a buffer around each point, this represents a tree's mature canopy. For this analysis, they are given a buffer radius of 10 or 20 ft. that results in 20 and 40 ft. tree canopy.


NAIP Image 2015


Potential Planting Area (PPA)


Potential Planting Spots (PPS)


Potential Canopy Area (PCA)

APPENDIX B: BIBLIOGRAPHY

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