CHAPTER FOUR: NATURAL SYSTEMS

4.0 Background

Auburn's natural environment has always been of importance to its citizens. The natural environment played a pivotal role in the settlement of Auburn. Judge John J. Harper and his family moved to a promising wilderness of abundant clear water and fertile cotton land to found Auburn in 1836[1]. One hundred and eighty years later, many people find their way to Auburn because of its natural environment.

Auburn sits on the fall line at the juncture of the piedmont plateau and the coastal plain. The last foothill of the Appalachian Mountains extends to Chewacla State Park, located in southeast Auburn. Due to the confluence of these three physical features, Auburn's natural environment is extremely diverse. Some regions of the city are marked by plains, flat lands with very few trees, while other areas are marked with thick forests and deep hollows. Auburn is also very fortunate to have several creeks and streams that meander through the city limits. These diverse lands and waterways provide the City with a unique sense of place and are just as important to Auburn's citizens today as they were when the city was founded.

Auburn has experienced years of significant growth and is currently one of the fastest growing metropolitan areas in Alabama. As Auburn continues to grow, it is imperative natural systems and the habitats they provide are protected for future generations to enjoy.

As Auburn has grown, the City has expanded geographically as well as increased the intensity of its development in infill areas. The cumulative effect of sprawl development on the natural environment is often detrimental, so this plan pursues an integrated strategy of protecting natural systems while encouraging infill development in an effort to allow the City to grow responsibly.

4.1 Land Resources

4.1.1 Tree Cover

Understanding the structure, function and value of an urban forest can promote management decisions that will improve human health and environmental quality. According to the *Dictionary of Forestry*, urban forestry is the "art, science, and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits trees provide society."[2] Tree cover (also known as canopy cover) is typically expressed as a a percentage that represents the amount of a given area covered by tree canopy. Cities often set tree cover goals in an effort to increase the amount of tree canopy cover within their jurisdiction. The benefits of urban forests are summarized as follows:

[1] Auburn, A Pictorial History of the Loveliest Village
[2] Planning the Urban Forest: Ecology, Economy, and Community Development

4.1.2 Environmental Benefits of Urban Forests

Trees help to improve water quality by intercepting rainwater, slowing stormwater runoff and filtering pollutants out of the water before they enter creeks and streams. By shading surfaces such as concrete, asphalt and brick, trees prevent sunlight from reaching those surfaces, ultimately reducing the heat that radiates from them. This is commonly called the urban heat island effect, a phenomenon of warmer air occurring in city centers, compared to lower ambient air temperatures in the surrounding countryside. Trees also act as air purifiers, as they remove many pollutants from the atmosphere. Trees in our urban forests also provide a habitat for a variety of wildlife.

4.1.3 Social and Health Benefits of Urban Forests

Trees help protect against harmful sun exposure, which can lead to skin cancer. Air pollution is reduced by trees. Air pollution can affect the health of people in areas with high air pollution rates and may be contributed to increased asthma rates in recent years[3]. An acre of trees also absorbs 2.6 tons of carbon dioxide, which is equivalent to the emissions emitted by a car driven 26,000 miles annually.[4]

Aerial view of Auburn University's campus

4.1.4 Economic and Aesthetic Benefits of Urban Forests

Urban forests contribute to the economic value of both commercial and residential properties. A 1999 study[5] found that customers who shopped at venues with tree-lined landscapes believed the quality of the merchandise sold there to be higher, and were willing to pay, on average, 12 percent more for goods and services. The quality of landscaping along approach routes to business districts has been found to positively influence consumer perceptions. According to the same 1999 study, property values may be up to six percent greater than in similar areas without trees.

4.1.5 Auburn's Urban Forest

Understanding the structure, function and value of an urban forest can promote management decisions that will improve human health and environmental quality. An assessment of the vegetation structure, function, and value of the Auburn urban forest was conducted during 2008, with a report produced in 2010. Data from 100 field plots located throughout Auburn were analyzed using the Urban Forest Effects (UFORE) model, developed by the U.S. Forest Service, Northern Research Station.[6]

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[3] National Institutes of Environmental Health Sciences https://www.niehs.nih.gov/
[4] Planning the Urban Forest: Ecology https://www.na.fs.fed.us/urban/planning_uf_apa.pdf
[5] Planning the Urban Forest: Ecology https://www.na.fs.fed.us/urban/planning_uf_apa.pdf
[6] I-Tree Ecosystem Analysis – Auburn

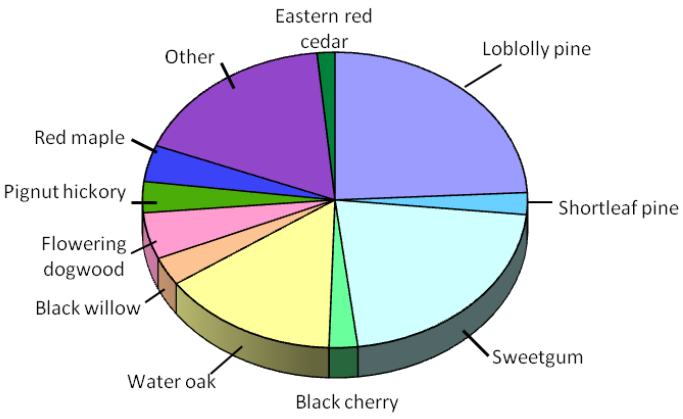
4.1.6 Benefits of Auburn's Urban Forest

The key findings from the January 2010 Urban Forest Effects and Values study, conducted by Auburn University, found the following in regard to the City of Auburn. Included are estimated monetary values of the pollutant removal and storage effects of Auburn's urban forest:

- Number of trees: 19,536,000
- Tree cover: 49.2%
- Most common species: Loblolly pine, Sweetgum, Water oak
- Percentage of trees less than 6" (15.2 cm) diameter: 81.9%
- Pollution removal: 1,080 metric tons/year ($5.75 million/year)
- Carbon storage: 636,000 metric tons ($14.5 million)
- Carbon sequestration: 46,800 metric tons/year ($1.7 million/year)
- Structural values: $400 million
- Statistics on building energy savings and reduced carbon emissions were not available.

Pollution: [ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter less than 10 microns (PM10), and sulfur dioxide (SO2)]
Metric ton: 1000 kilograms
Carbon storage: the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation
Carbon sequestration: the removal of carbon dioxide from the air by plants through photosynthesis
Structural value: value based on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree)

Figure 4.1: Tree species composition in Auburn



Loblolly pine	24.2%
Sweetgum	21.5%
Water oak	14.9%
Red maple	4%
Flowering dogwood	5.1%
Pignut hickory	3.4%
Black willow	3.1%
Shortleaf pine	2.4%
Black cherry	2.4%
Other	17.5%
Eastern red cedar	1.5%

4.1.7 Soils

Soils play a vital role in the natural environment. Some of the functions that soils perform include: sustaining plant and animal life; regulating water flow; filtering, buffering, degrading, and detoxifying pollutants; storing and cycling nutrients; and providing support to structures.

The most recent *Soil Survey of Lee County, Alabama* was performed by the United States Department of Agriculture's Soil Conservation Service from 1973 to 1978. The detailed soil map from the survey shows that a majority of the soil within the Auburn city limits is Pacolet sandy loam of 1 to 6 percent slopes and 6 to 10 percent slopes. Following is a description of these two soils:

Pacolet sandy loam, 1 to 6 percent slopes
"This is a moderately deep, well drained, gently sloping soil on moderately broad to broad ridgetops of the Piedmont Plateau. Slopes are smooth and convex. Typically, the surface layer is brown sandy loam about six inches thick. The subsoil is yellowish red sandy clay loam to a depth of 11 inches, red clay to a depth of 23 inches, and red sandy clay to a depth of 33 inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acidic or very strongly acid throughout, except for the surface layer where lime has been added. Permeability is moderate, and the available water capacity is low. The soil has fair to good tilth and can be worked within a moderately wide range of moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

This soil is used for pasture and cultivated crops as well as woodland. It has good potential for most urban uses. Low strength is a moderate limitation for roads and streets[7].

Pacolet sandy loam, 6 to 10 percent slopes
This is a moderately deep, well drained, sloping soil on narrow ridgetops and side slopes of the Piedmont Plateau. Slopes are smooth to complex and convex. Typically, the surface layer is reddish brown sandy loam about three inches thick. The subsoil is yellowish red sandy clay loam to a depth of seven inches, red clay to a depth of 26 inches, and red clay loam to a depth of 34 inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acidic or very strongly acidic throughout except for the surface layer where lime has been added. Permeability is moderate, and the available water capacity is low. The soil has fair to good tilth and can be worked within a moderately wide range of moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

This soil is used for pasture and cultivated crops as well as woodland. It has fair potential for most urban uses. Slope is a moderate limitation that can be easily overcome by proper design and installation. Low strength is a moderate limitation for roads and streets."[8]

4.1.8 Open Space

As cities develop, they typically grow both upward and outward. Outward growth of cities requires the use of land that was previously used for some other purpose; often this land was undeveloped or used for agriculture. As the population of the United States has become increasingly urbanized (19.3% of the U.S. population lives in rural areas as of 2015, according to the Census), the pressure to develop

[7] Soil Survey of Lee County, AL
[8] Soil Survey of Lee County, AL

outward in the form of sprawl has grown, with a resulting loss of land that was once open space. It is this loss of open space that has led to increased consideration being given to open space preservation.

Open space, a term often used interchangeably with greenspace, is an area of land whose primary purpose is to remain open and undeveloped. It is protected as such, providing a guarantee that future development will not occur on that site. Open space is beneficial to communities in numerous ways: open space helps in creating a high quality of life that attracts tax-paying businesses and residents to communities, safeguarding drinking water, promoting sustainable development, and preventing flood damage. Open space can provide valuable wildlife habitat, help act as a city's "lungs" by providing space for trees to grow, remove pollutants and carbon dioxide, and it can provide valuable areas for recreation. Open space can be active open space, which includes parks and playgrounds, or passive open space encompassing other uses typically designated for sitting and relaxing. Passive open space is addressed in this section; for more information on active open space, please see the Parks and Recreation section.

The City of Auburn has long had a great interest and concern with open space preservation, and as early as the 1970s began formulating policies to address this concern. The *City of Auburn Subdivision Regulations* were developed and adopted in 1976 to guide the division of land and mandated that consideration be given to suitable sites for common areas of public use (e.g. schools, parks, playgrounds). The adoption of the *City of Auburn Zoning Ordinance* in 1984 contained a detailed section for the preservation of open space and natural resources. After the creation of the Greenspace Taskforce in 1999, and the issuance of their final report to the City Council, the Greenspace Advisory Board was developed. A goal of the Greenspace Advisory Board is to preserve greenspace, natural beauty, wildlife habitats, and critical environmental areas as the City of Auburn continues to develop and expand. Promoting both infill and compact developments as well as encouraging higher density residential and greater non-residential development intensity should result in conservation of public resources and slow developments in the periphery of the City. However, infill and redevelopment can have a negative impact on open space in older portions of the City. While infill development and new development on the edge of the City is appropriate for some of the rural lands, areas in need of protection should be prioritized for protection, such as acquisition of larger undeveloped tracts for future parks and greenspace.

Conservation Subdivisions

Conservation subdivisions are a tool that can be used successfully to protect and preserve environmentally sensitive areas, farmland, or natural resource areas. Developers have not taken advantage of conservation subdivisions and may not be aware of the benefits associated with them, such as the clustering of development and a smaller infrastructure footprint in exchange for a fifty percent openspace preservation. Since the implementation of conservation subdivision regulations, three such subdivisions have been developed. Further review of the zoning and subdivision regulations should be explored to help promote preservation of open space, such as the ability to convey to a public agency such areas for use as parks, schools or other public facilities.

Performance residential subdivisions require the designation of open space. The amount of open space varies from 15 to 45 percent depending on the underlying zoning classification. The platted open space is to be used as recreation, agriculture, resource protection, or as an amenity available as passive or active recreation for all of the residents of the subdivision.

It is common practice when dedicating open space to designate undevelopable areas, such as steep slopes and wetlands: however, the dual nature of open space (some for passive uses and some for active uses) is to provide some areas as safe and desirable for human activity. The location of the open space is also important, centrally located common lawns or park space, and not a buffer area along the periphery of the subdivision.

The Trust for Public Land divides open space for conservation into three categories: working lands (timberlands and agricultural lands), heritage lands (lands with historic significance), and natural lands (places of exceptional natural beauty or significance). While the City of Auburn has planning documents and regulations related to open space, there is not currently a master plan for the acquisition and preservation of open space. This plan recommends developing a city-wide open space and preservation plan, in the form of an element added to the Greenspace/Greenways Plan. Any such plan should include a comprehensive inventory of open space by the categories listed above, as well as development of a conservation toolbox of open space preservation methods for use in Auburn. Dialogue with large local landowners and Auburn University would also be productive in identifying open space for conservation.

The City of Auburn Zoning Ordinance defines open space as:

> Any parcel or area of land or water, either publicly or privately owned, set aside, dedicated, designated, or reserved for the private use or enjoyment of owners or occupants of land adjoining such open space, or for the public at large. Any parcel or area or land or water that is essentially unimproved and devoted to an open space use for the purpose of (1) the preservation of natural resources; (2) the managed production of resources; (3) outdoor recreation; or (4) public health and safety.[9]

Open space in Auburn can be categorized in the following ways:

Auburn University Open Space includes undeveloped land that is owned by Auburn University. Some of the larger tracts of land include the Forest Ecology Preserve and the Fisheries Unit located along North College Street, the Fraley property located along Moore's Mill Road, the pastures used by the Veterinary School located along Shug Jordan Parkway and Wire Road, and the Turfgrass Research field located along South College Street.

City of Auburn Open Space is made up of land publicly owned by the City of Auburn. The properties included are used for recreational activity by the entire community and undeveloped properties that will be used in the future for community recreational use. This classification may also include land used for natural resource preservation, such as for wetland protection.

Private Open Space is land associated with golf courses. The Auburn – Opelika area is very fortunate to have several golf courses which are enjoyed by their residents and the many visitors that travel to the area. Auburn is home to three private golf courses and Indian Pines golf course, jointly owned by the Cities of Auburn and Opelika.

[9] City of Auburn Zoning Ordinance

Common Open Space is land that has usually been dedicated as open space during subdivision plat approval and is freely accessible to all residents of the development. This type of open space may serve as either passive or active recreation to the residents of a development or serve a visual role in separating a development from existing public ways or from other existing or potential developments. Land that is designated as open space cannot be separately sold, subdivided, or developed, and no structures can be built on such land with the exception of recreational areas that are designed for specific, active recreational uses. Common open space and subdivision amenity lots in Auburn can be further divided into (from § 417.01 of the City of Auburn Zoning Ordinance):

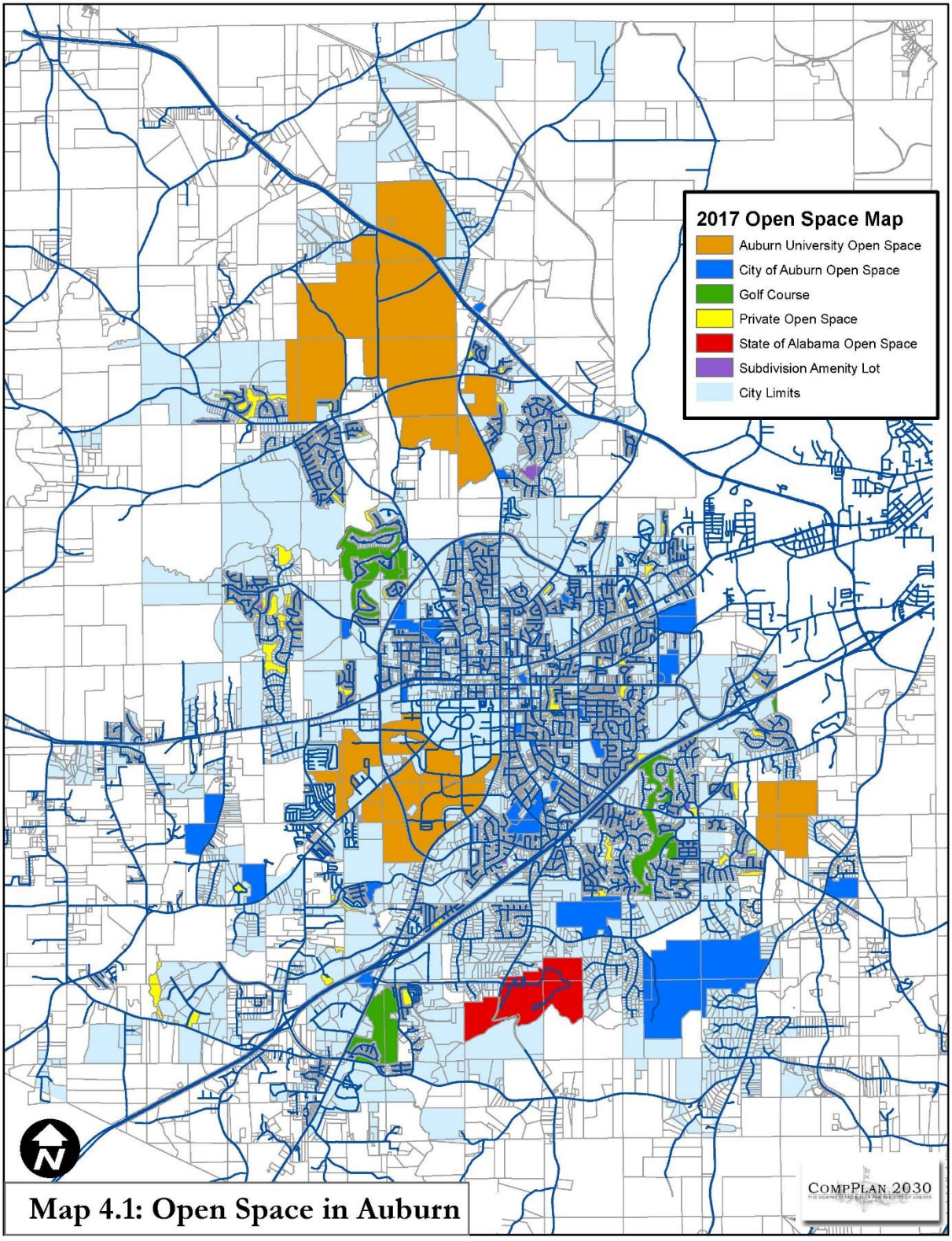
- Natural areas: areas of undisturbed vegetation or areas replanted with vegetation after construction; includes wetlands, woodlands, and natural water courses.
- Agricultural uses
- Garden plots: the division of open space into plots for cultivation as gardens
- Recreational areas (see also subdivision amenity lot): areas designed for specific, active recreational uses having minimal requirements for structures, such as tennis courts, swimming pools, softball fields, and golf courses.
- Greenways: are linear green belts linking residential areas with other open space areas. These greenways are encouraged to designate developed bicycle paths, footpaths, bridle paths, fitness trails, or other similar development.
- Commonly-owned lawns: consisting of grass with or without trees.

A Subdivision Amenity Lot is land within a subdivision that is secondary and incidental to the principal residential uses. Amenity lots serve only residents of the subdivision in which they are located or other developments that are directly adjacent and can include but are not limited to, swimming pools, playgrounds, parks, and courts or fields for particular sports such as tennis or basketball.

Photo of Solamere subdivision pool and playground. Provided by www.realestateinauburn.com.

State of Alabama Open Space is land that is owned by the State of Alabama. These properties include Chewacla State Park and undeveloped land that is adjacent to Chewacla State Park.

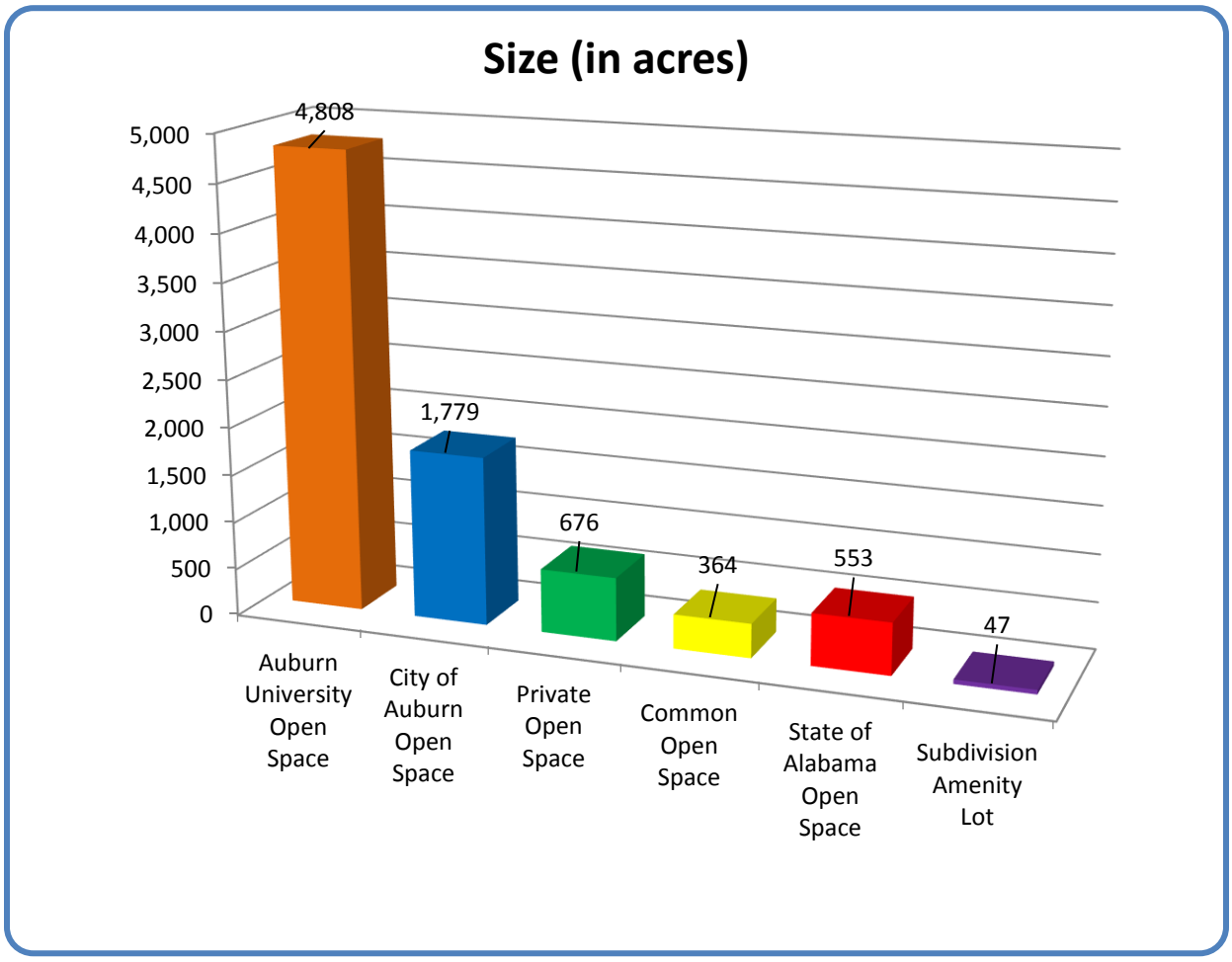
All six types of open space are important and each contributes to the overall quality of life in Auburn. Open spaces also help to preserve and protect natural features such as groundwater and wildlife habitats. The protection of these significant open spaces will play an important role in guiding the future sustainability of our community. Map 4.1 shows the location of all the classifications of open space within the City.



Map 4.1: Open Space in Auburn

As the community continues to grow, there has been an additional 150 acres of Common Open Space and five (5) acres of Subdivision Amenities added through new subdivision activity since 2011. See also Table 4.2 Open Space in Acres 2016.

Figure 4.2 Open Space in Acres 2016



The City of Auburn's Greenspace Task Force reported that "preserving open space is a means of managing growth, while concomitantly reflecting a community's awareness of the value of the natural environment and an understanding of the importance of protecting natural and scenic amenities[10]."

Acquiring areas of land to protect as open space is a critical step in preserving existing natural resources. The City of Auburn Greenspace Advisory Board lists several methods used for acquiring land for protection as open space. Some of these methods used include:

- Conservation Easement – a legal agreement between ~~the~~ a landowner and the City that permanently limits the uses of the land in order to protect the conservation or recreational value and conveys a permanent right of public access across the property for a greenway

[10]City of Auburn Greenspace Task Force Final Report

- Land Donation – an outright donation of land for the purpose of open space
- Bargain Sale - Sale by the landowner of land to the City for less than the appraised fair market value of the land
- Fee Simple Acquisition - The outright sale of land by a private landowner to the City, based upon an agreed upon price
- Land Trust - non-profit, community-based organizations that employ all of the methods of land acquisition previously described to protect land for future generations.

4.2 Local Water Resources and Quality

A watershed, also referred to as a drainage basin, is defined as a collective area of land that drains to a particular point. By this definition, a watershed can be delineated from any particular point along a concentrated path of flow, such as a stream, creek, or river. Regardless of the method of delineation or point of origin, they are all part of a larger watershed. For example, Lee County is divided along a north-south axis where land drains westward to the Tallapoosa River and eastward to the Chattahoochee River. Each of these watersheds combine with other watersheds before finally discharging into the Gulf of Mexico. Watershed protection is necessary to support a habitat for plants and wildlife in addition to providing safe and quality drinking water for people. They also provide an opportunity for recreation and the enjoyment of nature. As such, it is important to protect our watersheds to maintain the health and well-being of all living things, both now and in the future.

> "What we do in the watersheds where we live has a direct effect on the quality of water in our local streams. As rainwater flows across the land, it picks up and carries pollutants to our creeks, rivers, and lakes. We commonly refer to this as stormwater and we refer to this type of pollution as polluted runoff or nonpoint source pollution because it does not come from any one source. Land uses such as forestry operations, mining, road construction, urban development, and certain farming practices can increase nonpoint source pollution and negatively impact water quality, if they are not properly managed." - Protecting Our Waters: The Tallapoosa River Basin"

The City of Auburn lies within a unique transitional zone between the Piedmont and Coastal Plain regions of the Southeastern United States. More specifically, the City is located within the Level IV sub-ecoregion known as the Southern Outer Piedmont. This ecoregion is generally characterized as having lower elevations, less relief, and less precipitation than that exhibited in other regions of the Piedmont. Specific to these transitional areas in the southeast is the presence of the "fall line," the geographic divide~~r~~ between the Piedmont and Coastal Plain.

The City's presence within this sub-region provides for a unique fluvial geomorphic diversity of water features. There are three "major" watersheds that encompass the surrounding areas, of which Auburn lies at, or near, the headwaters of each. These three water bodies are Chewacla Creek, Saugahatchee Creek, and Uphapee Creek, all of which ultimately drain to the Tallapoosa River. Contributing to these "major" watersheds are numerous smaller streams which are scattered throughout the City limits. Of these smaller streams, four are named USGS water bodies. These are Choctafaula Creek, Moore's Mill Creek, Parkerson Mill Creek, and Town Creek. Each of these water bodies and/or their

respective tributaries exhibit varying degrees of current and historical impacts, ranging from agricultural use modifications to excessive erosion and/or modification from rapid urbanization."[11]

Water Quality

With the Auburn – Opelika area ranked as one of the fastest growing areas in the southeast and with this growth and development comes the additional risk of erosion and sediment control issues caused by construction stormwater runoff.

Impaired Water Bodies

The United States Environmental Protection Agency or EPA defines "impaired waters" as waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes for their designated uses(s). In Alabama, bodies of water that are considered impaired are placed on the State's 303(d) list. This list is submitted to the EPA for approval after public comments are received. The list includes the causes and sources of water quality impairment for each water body listed and a schedule for development of Total Maximum Daily Loads (TMDLs) for each pollutant causing impairment.

The primary water quality concerns in the City of Auburn are attributed to sediment, nutrients and pathogens. Sediment pollution can come from a number of sources, but is usually attributed as a non-point source pollutant of construction site stormwater, streambank erosion, agricultural runoff, runoff from dirt/gravel roads, and unauthorized discharges. Excess nutrients in waterbodies can cause harmful algal blooms and deplete oxygen levels in the water leading to detrimental water quality impacts for aquatic biota, microorganisms, fish and wildlife. Excess nutrients are typically a result of improper fertilizer and lawn chemical use, as well as nutrient-laden household detergents and chemicals. Pathogen pollution is typically a result of human or animal waste and is often the result of an illicit discharge (sanitary sewer overflow, sanitary/storm sewer cross connection, etc.) or animal defecation.

The stormwater runoff risk from the Auburn University campus is augmented during football season, when thousands of visitors use the campus for recreational purposes. Illegal dumping, littering, and illicit discharges from RV septic systems are all potential threats to water quality. Other risks include four large golf courses, commercial developments, and housing developments within the City of Auburn and the surrounding area which pose a potential for elevated use of fertilizers, pesticides, herbicides, and other lawn and household maintenance chemicals."[12]

The City of Auburn's Water Resource Management Departments operates and manages numerous programs that are developed specifically to "protect, preserve, and restore our local water resources". The keystone of these programs is the City's Municipal Separate Storm Sewer System program, or more commonly referred to as the Stormwater Management Program. Mandated by federal and state law, the City performs five principal control measures to minimize pollution to local waters. These five control measures are: 1) Public Education and Public Involvement; 2) Illicit Discharge Detection and Elimination; 3) Construction Site Stormwater Runoff Control; 4) Post-Construction Stormwater Management: and 5) Good Housekeeping and Pollution Prevention. Although these are the minimum requirements, the City prides itself in going above and beyond the federal and state mandated

[11] City of Auburn Annual Surface Water Quality Report, 2007
[12] City of Auburn Annual Surface Water Quality Report, 2007

minimum requirements to protect its local water resources, including performing numerous water quality studies, operating an extension Source Water Monitoring Program, promoting and implementing the use of Green Infrastructure and Low Impact Development Practices, and supporting numerous local programs and initiatives associated with water resource protection, preservation, and/or restoration.

Site Development Review Tool

The City requires that a stormwater quality analysis and treatment plan be provided for any development being planned within the Lake Ogletree Watershed, or any other watershed deemed impaired by federal, state or local regulations, to provide proof of adequate targeted pollutant removal efficiency. The current list of impaired water bodies within the City of Auburn include: Saugahatchee Creek (nutrients), Parkerson Mill Creek (pathogens) and Moore's Mill Creek (sediment). To aid with the meeting the requirements the city has developed a Site Development Review Tool. This tool uses a Microsoft Excel platform to aid in developing Stormwater Pollution Prevention Control Plans (SWPPC) and provide City staff an efficient and uniform manner to review plans. It allows for the assessment of various traditional and alternative combinations

4.2.1 Chewacla Creek Watershed

Lake Ogletree – photo provided by City of Auburn Water Resource Management

Chewacla Creek's headwaters emerge in Opelika and converge with Uphapee Creek near Tuskegee National Forest. The Chewacla Creek watershed drains an approximate 143 square mile territory. "The majority land cover is forested and the majority land use pattern within this watershed is agricultural, with varying degrees of urbanization around its headwaters in Opelika and its headwater tributaries in Auburn. Lake Ogletree, the City's main source water supply reservoir, is located on Chewacla Creek. The location of this reservoir is the reason for dual designation of Chewacla Creek as both a Public Water Supply and Fish and Wildlife habitat. The contributing drainage area of Lake Ogletree is approximately 33 square miles, of which the majority is within the Lee County or Opelika Planning Jurisdiction. The City is currently construction a new labyrinth spillway to replace the older, broad crested spillway (originally constructed in the late 1930's to early 1940's). This new spillway will raise the full pool elevation from a current 486' Above Mean Sea Level (AMSL) to 486.5 AMSL, increasing storage capacity by ~50 million gallons. At the future full pool elevation of 486.5' AMSL, Lake Ogletree will cover a surface area of 301 +/- acres and will provide an estimated water storage capacity of 1.55 billion usable gallons of water. Aside from serving as the City's primary source water supply, the surrounding 500+/- acres is owned by the Water Works Board of the City of Auburn

(AWWB) and serves as source water protection, a sanctuary for fish and wildlife, and limited recreational activity."[13]

To help protect this valuable water resource, new developments over 10 acres within the City's planning portion of Lake Ogletree Watershed are afforded an optional method of development through the City's Conservation Subdivision Regulations (see Section 4.1.8). These regulations were put in place in 2007 to protect water quality in the Lake Ogletree Watershed through increased restrictions on lot density, septic tank usage, impervious surface ratios, and open space management. Projects in the Lake Ogletree Watershed are required to develop and submit to the City a stormwater quality analysis and treatment plan to provide proof of adequate targeted pollutant removal efficiency

4.2.2 Saugahatchee Creek Watershed

"Saugahatchee Creek is a large (70 miles long) perennial stream with headwaters originating northeast of Saugahatchee Lake in Opelika, from which it flows west until its discharge into Yates Lake at the Saugahatchee Embayment. The contributing watershed encompasses a 220 +/- square mile region with agriculture as the majority land use type and mixed forest and pasture as the majority land cover. Saugahatchee Creek is a multi-use designated waterbody and is classified as best used for public water supply, swimming, and fish and wildlife."[14]

The Saugahatchee Embayment, where Saugahatchee Creek discharges into Yates Lake, was placed on the final 303(d) list from 1996 – 2008. The Embayment was placed on the 303(d) list primarily for excess nutrients and organic enrichment. ADEM (Alabama Department of Environmental Management) and the EPA issued the final TMDL for excess nutrients and organic enrichment/dissolved oxygen for Pepperell Branch and the Saugahatchee Embayment in April 2008. Pepperell Branch is a small tributary of Saugahatchee Creek located in southwest Opelika.

Saugahatchee Watershed Management Plan (SWaMP)

The Saugahatchee Watershed Management Plan (SWaMP) was written in February 2005 as a joint effort between local stakeholder groups and Auburn University to address the specific water quality issues related to the listing of Saugahatchee Creek on the State's 303(d) list of impaired waters. The SWaMP group received implementation funding from ADEM in 2007. SWaMP completed the first three (3) years of implementation (Phase I) in January 2010 with the final report submitted in March 2010. SWaMP received a Phase II implementation grant in January 2011, which was implemented until its expiration in December 2013 and the final report was submitted in January 2014. The Phase II Implementation provided funding for numerous best management practices to reduce nutrient pollution in the Saugahatchee Watershed. Through strategic use of data collection and assessment, education and outreach, and best management practices, SWaMP was able to significantly reduce nutrient and sediment pollution into Saugahatchee Creek from non-point sources. Recent studies by the ADEM suggest that these reductions have resulted in improvements in water quality that may lead to a recovery of Saugahatchee Creek and removal from the states 303(d) list of imparted waters.

[13] City of Auburn Annual Surface Water Quality Report, 2007
[14] City of Auburn Annual Surface Water Quality Report, 2007

Saugahatchee Streambank Stabilization Project
Completed in 2008. (see Appendix L)

Save Our Saugahatchee
Save Our Saugahatchee (SOS) is a grass-roots citizen effort to raise awareness and response about point-source and non-point source pollution loading in Saugahatchee Creek. Formed in 1997, SOS has conducted on-going efforts of citizen water quality monitoring, training and education, lobbying for stricter local and state water policies, and hosting of recreational activities on Saugahatchee Creek. With well over 50 members and numerous monitoring locations throughout the watershed, SOS serves a pivotal role in the protection and ongoing effort to restore water quality in Saugahatchee Creek. In March 2011, SOS received a grant from the World Wildlife Fund for $3,100 to help fund their work on E. coli monitoring in the Saugahatchee watershed. The City of Auburn provides support to SOS's citizen water quality monitoring activities, which in-turn provide valuable water quality data to the City for the purposed of investigating pollutant sources.

4.2.3 Choctafaula Creek Watershed

"Choctafaula Creek is a large perennial tributary of Uphapee Creek and lies along the western limits of the City. Its headwaters originate along State Highway 14 and it discharges at the confluence with Uphapee Creek near Tuskegee National Forest. The drainage area of the Choctafaula Creek Watershed encompasses +/- 62 square miles with agriculture/silviculture as the majority land use type, with a mostly forested landcover. Choctafaula Creek has a designated use category as supporting of Fish and Wildlife. Similar to the headwaters of Chewacla Creek, Choctafaula Creek exhibits frequent riffle-pool complexes near its headwaters with an increasing frequency of pools and runs as its longitudinal profile shallows near the coastal plain. Choctafaula Creek is listed as "Critical Habitat" for the three species of threatened and endangered freshwater mussels known to occur in Lee and Macon Counties – the Ovate Clubshell Mussel *(Pleurobema perovatum)*, the Southern Clubshell Mussel *(Pleurobema decisum)*, and the Fine-Lined Pocketbook Mussel *(Lampsilis altilis)*. These three species of mussels are the same as the "listed species" known to occur in Chewacla Creek and those identified in the Chewacla Creek Safe Harbor Agreement (SHA)."[15]

Chewacla Creek Safe Harbor Agreement
The Water Works Board of the City of Auburn (AWWB) entered into the Chewacla Creek Safe Harbor Agreement (SHA) with the US Fish and Wildlife Service, Martin-Marietta Aggregates, and several surrounding property owners in 2003 to provide for a continuous and "steady" flow of 2 MGD (million gallons per day) in Chewacla Creek between the Lake Ogletree Dam and what is designated as "Gauge Station 4" (near downstream end of Martin-Marietta property) in the SHA. The primary goal of the SHA is to protect the existing populations of threatened and endangered freshwater mussel species in Chewacla Creek and to promote the natural recruitment and proliferation of future populations. In this agreement, the AWWB agrees to provide a discharge of not less than 2 MGD at the base of the Lake Ogletree dam. Obligations of the other parties in the agreement vary, but are meant to ensure the continuous flow of 2 MGD throughout the specified reach. To monitor the effectiveness of this agreement, a shared obligation of both the AWWB and Martin-Marietta is to provide

[15] City of Auburn Annual Surface Water Quality Report, 2007

funding for continuous stream flow monitoring and annual bioassessments at five strategic stations within the reach. These reports are currently performed and submitted annually.

4.2.4 Moore's Mill Creek Watershed

"Moore's Mill Creek is one of the many perennial tributaries of Chewacla Creek. Its headwaters originate just north of the intersection of Highway 280 and Interstate 85, from which its general flow direction is south-southwest until its confluence with Chewacla Creek, below the Chewacla State Park Lake. Moore's Mill Creek has a contributing drainage area of 11.5 +/- square miles, of which the majority land use type is medium to low-density residential. The current designated use is for Fish and Wildlife."[16]

Moore's Mill Creek Stream Restoration Project

Moore's Mill Creek, which is listed on the State's 303(d) list of impaired waterbodies for siltation (habitat alteration), is a perennial tributary of Chewacla Creek. The reaches of Moore's Mill Creek and its tributaries within the Moore's Mill Golf Club are major contributors of sediment to the system. Historic manipulation of the stream channels, the lack of riparian buffers, and urbanization effects within the watershed have all led to instability within the proposed project area. Efforts to fix the erosion problems using traditional channel engineered methods have proven unsuccessful. Beginning in January 2007, a collaborative restoration effort began between ADEM, the Alabama Clean Water Partnership, Cleveland Brothers Construction, Inc., Wildlands, Inc. and the City of Auburn. The project was partially funded by an ADEM 319 Non-Point Source Program Grant, with the majority in-kind match provided by Cleveland Brothers Construction, Inc. Original estimates of the project deliverables included over 10,000 linear feet of stream restoration and/or stabilization, the development of a Moore's Mill Creek Watershed Management Plan, and the establishment of the Lee County Business Partners for Clean Water. However, unexpected financial hardships associated with the economic recession, combined with frequent and heavy rains received throughout 2009, ultimately resulted in a moderate reduction of the extent of physical restoration. Regardless of these setbacks, over 60 percent of the total project was able to be completed by the end of 2010. The remaining portions of the project may be completed in the future, as the original design proposed by Wildlands, Inc., allows for a phased implementation. Though it is impossible to directly attribute any marked improvements in water quality to the restoration efforts thus far, early turbidity data is encouraging that conditions are improving (City turbidity data, 2007 – 2010). This project has been one step, albeit a critical one, in the many efforts that stakeholder groups are utilizing to improve conditions in Moore's Mill Creek and to reestablish its capacity to sustainably meet State Water Quality Criteria.

4.2.5 Parkerson Mill Creek Watershed

"Parkerson Mill Creek is also a perennial tributary of Chewacla Creek. Its headwaters originate on the Auburn University campus from which it flows generally south-southwest until it discharges at the confluence with Chewacla Creek, immediately below the City of Auburn H. C. Morgan Water Pollution Control Facility. The Parkerson Mill Creek watershed encompasses 9.6 +/- square miles,

[16] City of Auburn Annual Surface Water Quality Report, 2007

of which the majority land use is divided between institutional, industrial, rural residential, and agricultural."[17]

> Parkerson Mill Creek has also been placed on the State's 303 (d) list of impaired water bodies for pathogen pollution due to urban runoff (ADEM 303(d) List of Impaired Waters, 2010) A draft Total Maximum Daily Load (TMDL) for Parkerson Mill Creek was issued for public comment in July 2011 and the final TMDL for Parkerson Mill Creek was issued and finalized in September 2011.
>
> The Parkerson Mill Creek Watershed Project is a cooperative effort between ADEM, Auburn University, the City of Auburn, the Alabama Cooperative Extension System at Auburn University, the Auburn University Water Resources Center, and other local stakeholders. The project has already provided for $179,810 in federal funding, matched by $120,558 in local and in-kind funding. The funding supported the implementation of numerous best practices targeting pathogens and improving water quality and habitat for aquatic organisms in the Parkerson Mill Creek Watershed. The project also provided education/outreach opportunities for local citizens and Auburn University students to learn about the importance of protecting water quality. The most visible of these projects was the restoration of a large reach of Parkerson Mill Creek through Auburn University's main campus and in from of its new Wellness Kitchen. This project has served as a keystone demonstration project, serving as a model for integrating functional aquatic ecosystems in highly contained urban environments.

4.2.6 Town Creek Watershed

"As are Moore's Mill Creek and Parkerson Mill Creek, Town Creek is also a perennial tributary of Chewacla Creek. The headwaters of Town Creek originate near downtown Auburn from which it flows generally south and south-southwest until its confluence with Chewacla Creek immediately downstream of the old Wright's Mill Road bridge. The contributing watershed of Town Creek encompasses 5.6 +/- square miles and has a current majority land use of medium to low density residential and a majority landcover of forested and forested/developed."[18]

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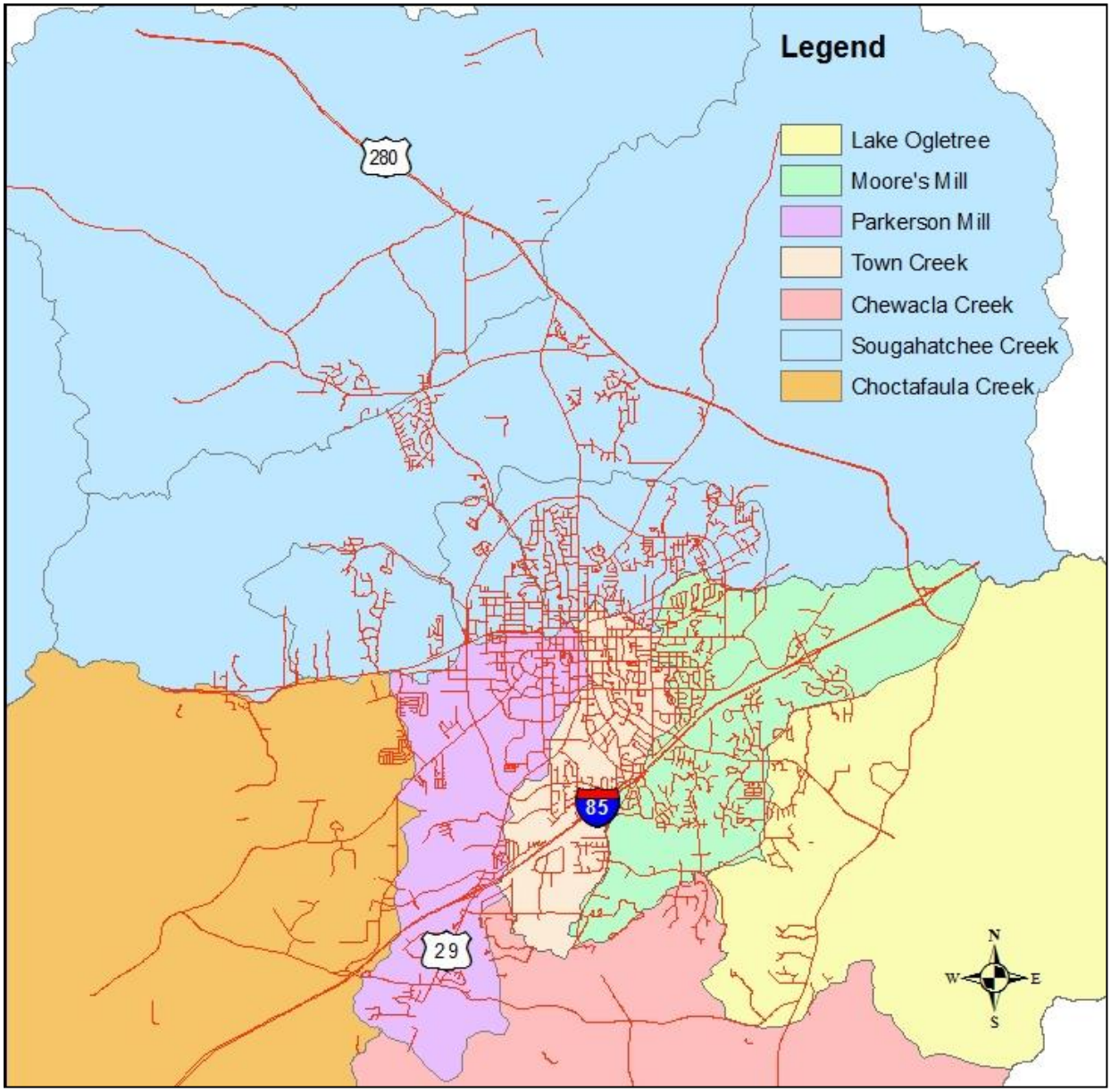
[17] City of Auburn Annual Surface Water Quality Report, 2007
[18] City of Auburn Annual Surface Water Quality Report, 2007

Map 4.2: Watersheds of Auburn



Water Resource Management Design and Construction Manual

The Water Resource Management Design and Construction Manual along with the Public Works Design and Construction Manual, was adopted by the Auburn City Council in October 2010 and became effective January 1, 2011. It consolidates all design and construction standards related to potable water distribution systems, fire protection systems, wastewater collection systems, wastewater pumping stations, erosion and sedimentation control, and post-development storm water quality management that were previously published in the City Code, Zoning Ordinance, Subdivision Regulations, Standard Details and Standard Specifications. New stormwater management best practices are included in the manual.

Educational Programs and Public Involvement

Public education and involvement is a vital component of the City of Auburn's Phase II Stormwater Management Program. The City conducts a wide variety of stormwater public education and outreach through programs such as: Open Line articles, brochures, website information, presentations, workshops, Earth Day activities for the City school system and the Lee County Water Festival. Additional information on these programs can be found in the City's annual Phase II Stormwater Reports as well as the City's Stormwater Management Plan (available on the City's website).

City of Auburn Water Resource Management staff teaches students about water quality, aquatic ecology, aquatic insects, and watershed management and protection at the 2011 Ogletree Elementary School Earth Week at Chewacla Park

The City actively engages and involves its citizens in the City's Phase II Stormwater Program through activities such as the Storm Drain Marking Program, the Auburn, Lee County, Opelika, Auburn University, and Smiths Station (ALOAS) Citizen Advisory Group, the annual Citizen Survey, and the annual Stormwater Management Survey. Information on these public involvement programs can be found in the City's annual Phase II Stormwater Reports as well as the City's Stormwater Management Plan.

4.3 Stormwater Management Infrastructure

Stormwater runoff is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect the chemical, biological, and physical integrity of our water resources if the runoff is discharged untreated. The primary method to control stormwater discharges is the use of best management practices (BMPs). In addition, most stormwater discharges are considered point sources and require coverage under an NPDES (National Pollutant Discharge Elimination System) permit, administered by the Alabama Department of Environmental Management. [19]

The National Pollutant Discharge Elimination System (NPDES) Stormwater Program regulates stormwater discharges from three potential sources: municipal separate storm sewer systems (MS4s), construction activities, and industrial activities. Most urban stormwater discharges are considered point sources because they are collected via storm sewer conveyance infrastructure and are discharged at a discernable outfall. Operators of storm sewer systems may be required to receive an NPDES permit before they can discharge stormwater to any receiving water bodies classified as a Waters of

[19] http://cfpub.epa.gov/npdes/stormwater/swbasicinfo.cfm

the State and/or Waters of the United States. This permitting mechanism is designed to minimize stormwater impacts to our nation's streams, rivers, lakes, wetlands, and coastal waters.[20]

Auburn owns and operates a municipal separate storm sewer system (MS4) that is regulated under Phase II of the NPDES. This means that the City of Auburn is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges. Additionally, the City must perform water quality monitoring if any stormwater is to be discharged to an impaired water or to a water for which a Total Maximum Daily Load (TMDL) has been approved by the EPA.

4.4 Air Quality

Because air pollution harms human health and damages the environment, EPA tracks pollutant emissions. Air pollutants are emitted from a variety of sources including stationary fuel combustion, industrial processes, vehicles, and non-road sources. These pollutants react in and are transported through the atmosphere. The EPA, other federal agencies, and state, local, and tribal agencies monitor air quality at locations throughout the United States. Data collected through ambient monitoring is used in models to estimate population and environmental exposures. Personal health monitoring is conducted via special studies to better understand actual dosage of pollutants. The EPA uses monitoring data, population exposure estimates, and personal dosage data to better understand health effects of air pollutants. Ambient monitoring data and models are also used to estimate environmental exposures to air pollutants.

Air pollution can have numerous effects on our environment. Ozone damages vegetation by injuring leaves, reducing photosynthesis, impairing reproduction and growth, and decreasing crop yields. Particulate Matter (PM) impairs visibility, adversely affects ecosystem processes, and damages soils and property. Lead is harmful to plants and wildlife, accumulates in the soil, and adversely impacts terrestrial and aquatic systems. Sulfur Dioxide contributes to the acidification of soil and surface water and mercury methylation in wetland areas. It also causes injury to vegetation and local species losses in aquatic and terrestrial systems." [21]

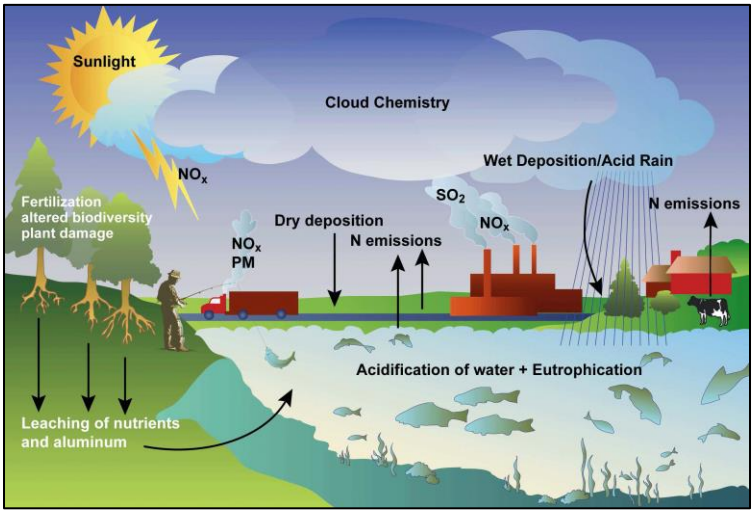


Image provided by www.epa.gov

[20] http://cfpub.epa.gov/npdes/stormwater/munic.cfm
[21] EPA – Our Nation's Air – Status and Trends through 2008

The State of Alabama monitors air quality through an air quality surveillance system. This system is operated by the Alabama Department of Environmental Management (ADEM), the Jefferson County Department of Health (JCDH), and the Huntsville Department of Natural Resources (HDNR). The objectives of the air quality surveillance system are to ensure areas of the state are meeting the National Ambient Air Quality Standards (NAAQS), the Air Quality Index reporting for larger Metropolitan Statistical Areas MSAs, and to provide data to air quality researchers.

Federal regulations require all states and local agencies meet the minimum monitoring requirements for the pollutants that are to be compared with the NAAQS. "These minimum requirements are for the most part based on population, the level of monitored pollutants and metropolitan statistical area boundaries as delineated by the Office of Management and Budget. The "minimum monitoring requirements were revised in 2006 for ozone, for particulate matter less than 10 microns PM10, and particulate matter less than 2.5 microns, (PM2.5). It has been determined by ADEM that due to the close proximity of ozone monitors in neighboring areas which were below the NAAQS, additional monitors would not be needed for the Auburn/Opelika MSA. The monitors in the adjacent areas still provide adequate monitoring coverage."[22] The Auburn/Opelika MSA is monitored by the monitoring stations in the Columbus, GA – Phenix City MSA. There are currently two monitoring stations in this area. One station is operated by ADEM in Ladonia (Russell County) and the other stations are located in Columbus, Georgia and are operated by the State of Georgia.[23]

Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from power plants.

Auburn's air quality is a major asset to the environment and scenic beauty of the town. The Urban Forest Effects model which was used to estimate tree cover in Auburn was also used to determine the amount of pollution that is removed from the air by trees and shrubs. Pollution removal by trees and shrubs in Auburn was estimated using field data and recent pollution and weather data available. Pollution removal was greatest for ozone. It is estimated that trees and shrubs remove 1,080 metric tons of air pollution (ozone), carbon monoxide, nitrogen dioxide, particulate matter less than 10 microns (PM10), and sulfur dioxide) per year with an associated value of $5.75 million (based on estimated national median externality costs associated with pollutants).[24]

4.5 Analysis of Existing Conditions

4.5.1 Trees and Landscaping

Trees and other landscaping provide benefits other than just their aesthetic purpose. There are many environmental benefits provided by trees (see Sections 4.1.1 through 4.1.6), so it is very important that the City work to preserve existing trees and expand efforts to plant additional trees throughout the City. Since 2011, the City has planted over 180 trees in parks and openspace and added 130 street

[22] 2016 Ambient Air Quality Monitoring Plan adem.alabama.gov/programs/air/airquality.cnt
[23] 2016 Ambient Air Quality Monitoring Plan adem.alabama.gov/programs/air/airquality/2016AmbientAirPlan.pdf
[24] 2010 I-Tree Ecosystem Analysis – Auburn

trees as part of improvements with street plans recommended in the Downtown Master Plan and the Renew Opelika Road Plan. The City should continue to do its part and plant additional trees in public spaces, along public streets and pedestrian pathways. Although the landscaping regulations were amended in 2007, further amendments are warranted to allow ample planting space for street trees which would allow them room to grow to maturity. In doing so, careful attention needs to be made with respect to tree planting for those developments with overhead power lines and other utilities. Planting trees now, only to find that they will interfere with utilities in years to come and have to be removed, should be avoided. Requiring appropriate setbacks for canopy trees along streets should be incorporated into the zoning ordinance. Performance residential subdivisions that have required buffer yards are currently the only residential developments that are required to plant trees and shrubs. New regulations should be put in place that would require all new residential construction to plant at least one canopy tree per parcel. Incentives to encourage tree preservation and reduce the need for landscape waivers should also be examined.

Education and communication are key elements in any effort to expand and preserve tree canopy in the City. Existing efforts such as the City's Arbor Day and Christmas Parade tree giveaway (approximately 12,000 seedlings given away) should be maintained, while efforts should be expanded to provide information to the public, including the development community, regarding the benefits of tree canopy preservation. The Greenspace Advisory Board and the Tree Commission could benefit from increased communication and collaborative efforts with the Planning and Parks and Recreation Departments. Consideration should also be given to promoting drought-tolerant and native tree species. In addition, the City should continue to draw on the resources of the Forestry Department at Auburn University.

4.5.3 Stormwater Management

Beneficial reduction and reuse of stormwater can help reduce runoff and provide an alternate non-potable water source for purposes such as irrigation and greywater reuse. Increased development will result in increased impacts to the floodplain, watersheds, and stormwater. Low-impact development techniques such as the stormwater quality best management practices found in the Water Resource Management Design and Construction Manual, as well as the Conservation Subdivision Regulations, can significantly reduce the amount of stormwater making its way off of individual sites and can promote beneficial recharge of the groundwater table. Reuse of stormwater via closed-loop systems or rainwater harvesting to reduce or eliminate the use of supplemental irrigation would be beneficial. This along with design standards for non-traditional best management practices such as bioretention/rain gardens, stormwater wetlands, and porous pavements will be achieved in part with the continued implementation of the Water Resource Management Design and Construction Manual.

As with open space, education is one of the keys to expanded use of stormwater management best practices. Efforts should be made to expand educational offerings to the public and the development community regarding the benefits of reducing and reusing stormwater runoff.

Existing ISR (impervious surface ratio) standards in the zoning ordinance are used to limit the amount of impervious surface allowed on a particular site. While limiting ISR has several benefits, one clear potential benefit is reduction in stormwater runoff. A focused effort to review the effectiveness of ISR standards at reducing stormwater runoff would help determine the appropriateness of existing ISR ratios vis-à-vis stormwater reduction.

Detention and retention ponds are one of the most commonly-used methods of stormwater management. Nearly every major development uses one or more detention or retention ponds. Typically fenced-off and often designed with little thought to aesthetics, ponds could become assets if incentives were provided to improve their appearance, and if they are designed as amenities, with consideration given to usability and aesthetics instead of simply stormwater management considerations.

4.5.4 Water Quality

As noted in Section 4.2, water quality is an ongoing concern in the City of Auburn, and ~~to~~ the City is constantly striving to improve and/or maintain water quality in the City's watersheds through water quality monitoring, education and outreach and enforcement and enforcement of local ordinances. There are additional measures ~~that~~, if undertaken, can further enhance water quality in the City. Over time, implementation of a stormwater utility fee may be necessary to fund efforts to improve water quality and manage the City's stormwater program. Enabling legislation will be required before a stormwater utility can be created.

The City of Auburn's subdivision regulations are intended to protect both the Lake Ogletree and Martin Marietta Aggregates, Inc., Chewacla Quarry watersheds. Per the Safe Harbor Agreement, the City can obtain additional water from the Martin Marietta quarry when requested to supplement Lake Ogletree during drought conditions and to allow for a minimum discharge of 2.0 million gallons per day (MGD) from the reservoir. Most of the water that is diverted from the Chewacla Quarry pit to Lake Ogletree is groundwater that would otherwise be discharged to Chewacla Creek (for which Martin Marietta Aggregates, Inc. is permitted via an NPDES permit). The Chewacla Quarry pit has a relatively minor surface watershed, of which the Water Resource Management Department is currently in the process of delineating and may be incorporated into the City's Source Water Protection Area in the future.

Impaired watersheds require greater sensitivity in development and additional protection in the long-term. Currently, Moore's Mill Creek, Saugahatchee Creek and Parkerson Mill Creek are considered impaired within the City of Auburn. Moore's Mill Creek is currently on the State's 303(d) list for sediment. A TMDL for the Saugahatchee Creek Embayment was issued by ADEM and the EPA in 2008 for excess nutrients/organic enrichment. A draft TMDL for Parkerson Mill Creek was issued by ADEM in July 2011 for pathogens. Future development in these watersheds is inevitable and it will be increasingly important to properly manage stormwater quality from developments within these watersheds. A Stormwater Quality Plan is required for all new developments within the watersheds encompassing 303(d) listed streams or TMDL streams (currently includes Saugahatchee Creek, Moore's Mill Creek and Parkerson Mill Creek) as well as any new development within the Lake Ogletree watershed.

Increased development will result in increased impacts to the floodplain, watersheds, and stormwater. Annexing of impaired or critical watersheds into the City limits will assist in protecting the watersheds by providing additional oversight and regulation. Not all threats to water in the City come from within the City's jurisdiction. Reporting known threats to water quality identified in the Source Water Monitoring Program that are outside of the City's planning jurisdiction to the appropriate jurisdictional and regulatory agency and monitoring identified threats for correction is vital to improving and maintaining water quality. The Water Works Board of the City of Auburn (AWWB) conducts annual source water monitoring in the Lake Ogletree Watershed to identify potential

pollutants and pollutant sources that could detrimentally impact the City's water supply. Monitoring and assessing the accuracy of the estimated pollutant removal efficient ratings used in the Site Development Review Tool to account for possible regional calibration is needed to determine the actual effectiveness of stormwater best management practices used in Auburn.[25] While the City is leading the way in water resource management, we should continue to develop new public education and outreach initiatives to protect the City's watersheds.

There are several local organizations that at this time monitor the water quality of some of the area's watersheds. Organizations such as Alabama Water Watch and the AU Water Resources Center can be additional assets in water quality protection, and the City's current work with those organizations should be expanded. Interjurisdictional cooperation regarding water quality standards is also encouraged.

[25] The effectiveness of various water quality best management practices may vary by region. For example, the SDRT will say that one gets an 80% total suspended solids reduction by using a stormwater wetland as a water quality best management practice. Monitoring will allow the City to determine whether the 80% reduction is the result in this region or if the effectivess is something different (60%, 70%, 90%, etc.). This will allow the City to calibrate stormwater models to be more accurate for this region rather than using generally accepted removal efficiencies that inevitably vary by region.

4.6 Goals, Objectives & Policies

NS 1: Expand efforts to preserve and acquire open space.

NS 1.1: Encourage the preservation of open space in new development.

NS 1.1.1: Research and incentivize the use of conservation subdivisions, particularly in environmentally-sensitive areas.

NS 1.1.2: Review existing conservation subdivision regulations to make their use more desirable.

NS 1.1.3: Consider implementing an open space requirement for conventional subdivisions.

NS 1.1.4: Review open space requirements to encourage more usable open space.

NS 1.1.5: Monitor existing open space to ensure that it is protected, maintained and used as required.

NS 1.1.6: Review existing parking requirements to assess the impact of excessive parking on open space.

NS 1.2: Identify and protect environmentally-sensitive areas such as wetlands and riparian corridors along streams.

NS 1.2.1: Develop an environmental protection model to assess areas in need of protection.

NS 1.2.2: Work with Water Resource Management and other partners to refine the results of the environmental protection model and identify other areas in need of protection.

NS 1.2.3: Develop a plan to implement open space protection recommended by NS 1.2.1 and NS 1.2.2.

NS 1.2.4: Continue implementation of the City's stream buffer regulations.

NS 1.2.5: Continue and expand efforts to eliminate invasive species, especially in environmentally-sensitive areas.

NS 1.3: Identify and consider measures to protect working lands (farm, timberlands and agricultural lands), heritage lands (lands with historic significance), and natural lands (places of exceptional natural beauty or significance).

NS 1.3.1: Review and assess conservation methods (such as conservation easements or land trusts) for use in preserving working lands, heritage lands, and natural lands.

NS 1.3.2: Engage large local landowners to determine if open space preservation is feasible.

NS 1.3.3: Develop an Open Space and Preservation Plan element of the Greenspace/Greenways Master Plan.

NS 1.3.4: Engage in formal dialogue with Auburn University on issues of open space preservation.

NS 1.3.5: Continue to develop a unified Geographic Information System (GIS) resource with proposed greenways, open space, parks, *et cetera.*

Note: Refer to HP 3.2 for additional recommendations related to heritage lands (Chapter 9).

NS 2: Expand efforts to plant trees in public spaces and along streets and pedestrian pathways, while educating the public about the benefits of planting and preserving trees.

NS 2.1: Expand efforts and programs to plant trees in public spaces and along streets and pedestrian pathways.

NS 2.1.1: Give consideration to look for opportunities to employ street trees along new streets.

NS 2.1.2: Work to resolve potential conflicts between street trees and utilities, both above and below ground, such as by increasing the amount of space allocated for trees, requiring coordination between utilities and landscaping prior to construction and encouraging the use of underground utilities.

NS 2.1.3: Continue and expand efforts to provide citizens with free trees, such as through the Arbor Day tree giveaway, at City Fest, and at the Christmas parade.

NS 2.1.4: Encourage the use of greenspace planting agreements for tree plantings in areas with inadequate space in the right-of-way.

NS 2.2: Work to educate the public about the benefits of planting and preserving trees.

NS 2.2.1: Work with the Auburn University School of Forestry and Wildlife Sciences to educate the public about the many benefits of planting and preserving canopy trees.

NS 2.2.2: Increase communication and collaborative efforts between the Parks and Recreation Department, the Planning Department, the Environmental Services Department, the Greenspace Advisory Board, and the Tree Commission.

NS 2.2.3 Continue to regulate private plantings in City right-of-way to reduce conflicts with infrastructure.

NS 3: Promote the preservation of existing tree canopy and the planting of plentiful canopy trees as development occurs.

NS 3.1: Preserve existing tree canopy using a combination of regulatory tools and incentives.

NS 3.1.1: When tree credits are requested, increase efforts to ensure that tree preservation plans are provided prior to issuance of permits allowing tree clearing.

NS 3.1.2: Work with Auburn University and the Tree Commission to provide information to the public, the development community, and all persons preparing landscape plans in the City of Auburn regarding the benefits of preserving existing tree canopy.

NS 3.1.3: Consider the development of requirements for tree protection for small projects such as remodeling.

NS 3.2: Promote the planting of plentiful canopy trees as development occurs.

NS 3.2.1: Consider allowing parking orchards as a landscape option for parking lots.

NS 3.2.2: Provide incentives to reduce the use and need for landscaping waivers, including using the existing tree trust account administered by Parks & Recreation as a "tree bank."

NS 4: Manage stormwater to reduce runoff and impacts to local waterways.

NS 4.1: Promote reduction in the amount of stormwater runoff from existing and newly-developed sites and smart reuse of stormwater.

NS 4.1.1: Promote the use of reclaimed stormwater (greywater) for use in irrigation and the creation of more closed-loop systems/water catchments.

NS 4.1.2: Provide information to the public and the development community about the benefits of reducing and reusing stormwater runoff.

NS 4.1.3: Improve the aesthetics of detention/retention ponds by offering incentives.

NS 4.1.4: Promote the distributed use of volume-reducing best management practices (low-impact development) while simultaneously promoting dual use/expanded use of larger peak-flow best management practices.

NS 4.1.5: Consider the use of detention/retention ponds as amenities, designed to ensure usability for recreational activities.

See the Utilities section for additional recommendations related to water conservation.

NS 5: Protect and improve water quality in the City's watersheds.

NS 5.1: Continue to provide regulations and programs to protect and improve water quality within watersheds that feed the City's municipal water sources.

NS 5.1.1: Promote the use of conservation subdivisions within the Lake Ogletree Tree and Martin-Marietta Quarry watersheds to reduce impervious surfaces and protect open space.

NS 5.1.2: Work to clearly delineate the boundaries of the Martin-Marietta Quarry watershed so that areas within the watershed receive appropriate protection.

NS 5.2: Continue to provide regulations and programs to protect and improve water quality within all of the City's watersheds.

NS 5.2.1: Support open space preservation programs, as these can contribute to better water quality.

NS 5.2.2: Continue to prioritize annexation of critical and impaired watersheds to provide additional oversight and regulation.

NS 5.2.3: Report known threats to water quality identified in the Source Water Monitoring Program that are outside of the City's planning jurisdiction to the appropriate jurisdictional and regulatory agency and monitor the identified threat for correction.

NS 5.2.4: Continue to identify and correct sources of sanitary sewer overflows to protect the City's watersheds.

NS 5.2.5: Monitor and assess the accuracy of the estimated pollutant removal efficient ratings used in the Site Development Review Tool (SDRT) to account for possible regional calibration.[26]

NS 5.2.6: Continue to develop new public education and outreach initiatives to protect the City's watersheds.

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[26] The effectiveness of various water quality best management practices may vary by region. For example, the SDRT will say that one gets a 80% total suspended solids reduction by using a stormwater wetland as a water quality best management practice. Monitoring will allow the City to determine whether the 80% reduction is the result in this region or if the effectivess is something different (60%, 70%, 90%, etc.). This will allow the City to calibrate stormwater models to be more accurate for this region rather than using generally accepted removal efficiencies that inevitably vary by region.

NS 5.2.7: Expand work with various partners to improve water quality protection in and around the City of Auburn.

NS 5.2.8: Encourage improved interjurisdictional cooperation regarding water quality standards, such as between local governments.