Restorative Landscape Plan

Existing Conditions Report
Reidsville and Collins, GA

October 2023

SHERWOOD DESIGN ENGINEERS
Biohabitats

Executive Summary

The purpose of this report is to summarize the initial efforts that were completed as part of a 12-month regional watershed study for flood alleviation recommendations in Reidsville and Collins, GA. This study is supported by grant funding awarded by the US National Fish and Wildlife Service's National Coastal Resilience Fund on behalf of the non-profit organization Anthropocene Alliance, an environmental justice advocacy group. The information presented will be the basis for continuing efforts throughout the project, and serve as the first half of the larger Restorative Landscape Plan report that is to be published at the project's completion (June 2024). The final report will include additional sections that discuss infrastructure and policy recommendations, conceptual plans for identified residences, and next steps.

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Introduction

1.1. Project Context

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1.1 Project Context

Residents in the towns of Reidsville and Collins have been living with flooding that has significantly degraded their quality of life for more than 60 years, While the reasons for why these communities are prone to flooding are due to geological influences that date back millennia, the placement of development did not take these conditions into account, exacerbating the area's flooding characteristics. Within this study, both towns are considered in conjunction due to their geographical, hydrological, and socioeconomic similarities.

Flooding impacts felt in the area are extensive in both time and spatial extent. Residents note flooding frequently, especially in the winter and spring seasons, and often experience flooding remaining for periods exceeding three months at a time. This nuisance flooding disrupts economic activity in commercial spaces, threatens safe egress of residents on roads, causes property damage, and results in undue stress placed on socially vulnerable residents.

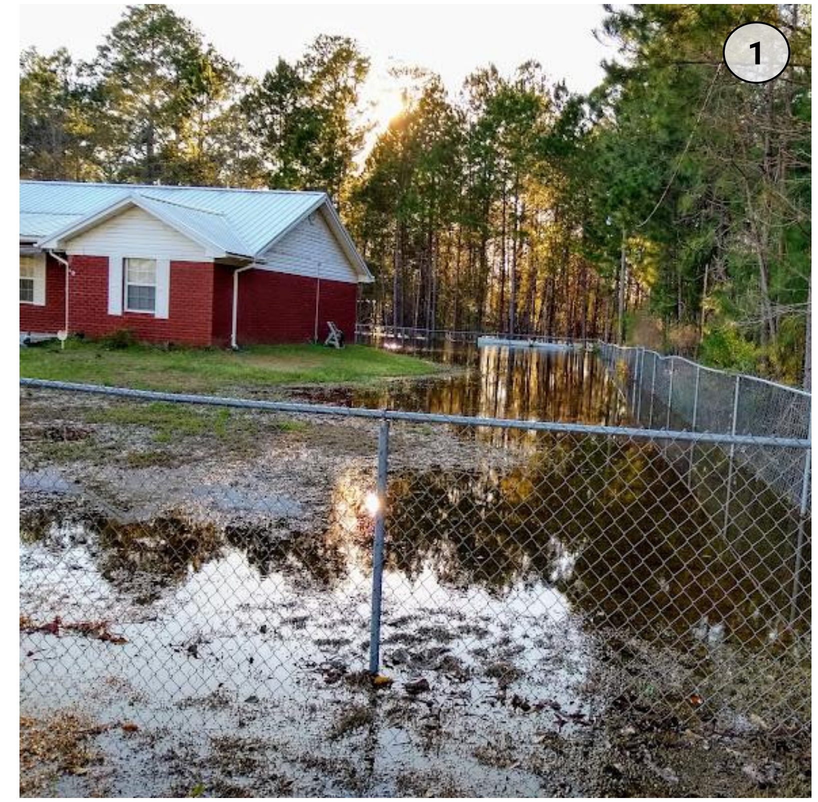
As both of these towns are on the edges of their respective watersheds, flooding concerns result from a lack of infrastructure in place to convey the water downstream and away from the community, rather than a large volume of stormwater reaching any one area. These drainage concerns are regional-scale inefficiency of infrastructure in the area, yet the symptoms of these problems are only noted in concentrated site-scale areas, with many other areas dry and neighbors with no knowledge of the flooding that is occurring.

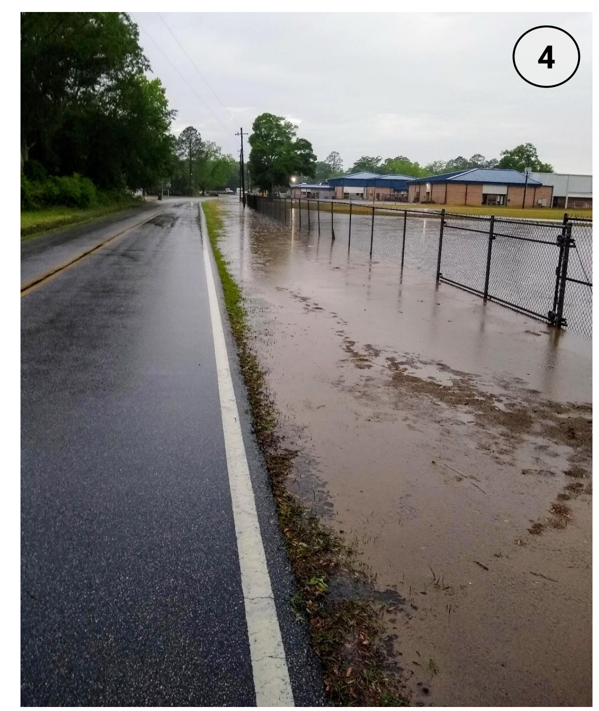
Due to the impacts of flooding being so acutely felt in small pockets of properties across the two towns, flooding problems are not well known or understood across the communities. FEMA floodplains are not designated for the areas that flood, as the flooding doesn't exhibit traditional characteristics for delineation, and the lack of flood disclosure laws in the state of GA facilitate the secrecy of the flooding that the properties and residents are facing in these areas.

Although flooding is already a concern, Reidsville and Collins are both anticipated to face exacerbating conditions as rainfall events are projected to increase in intensity and development is expected to increase in the area with the construction of large-scale manufacturing plants nearby, bringing jobs to the area.

The purpose of this report is to explore the impact that development has had on the landscape, with a strong lens of regional drainage and resultant flooding, and provide both structural and policy-oriented recommendations interactions that may alleviate the impacts of flooding on residents today, and protect the community in the future as the area continues to develop.

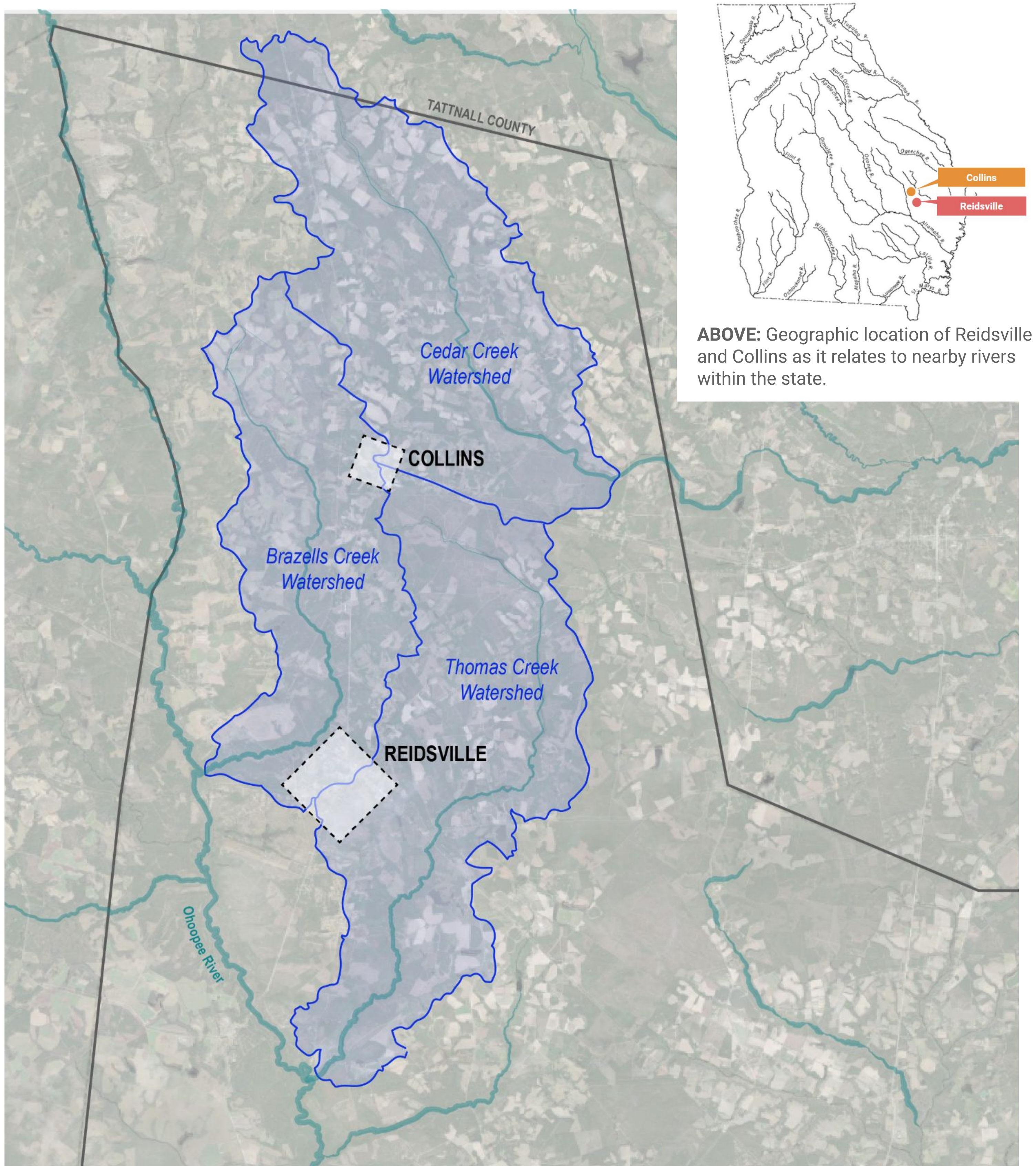
1.0 Introduction





ABOVE:

1. Flooding at 103 Deloris St. in Reidsville started in March 2020 and flooding remained for over 3 months
2. Flooding on Plant St. in Collins days after storm event remain on side of road
3. Flooding at residence on GA-292 in Collins remains for days after rain events
4. Flooding on Chandler Ave. near Elementary School floods recreational fields and threatens safe egress
5. Flooding on Deloris St. in Reidsville threatens safe egress of residents for needs, degrading quality of life.

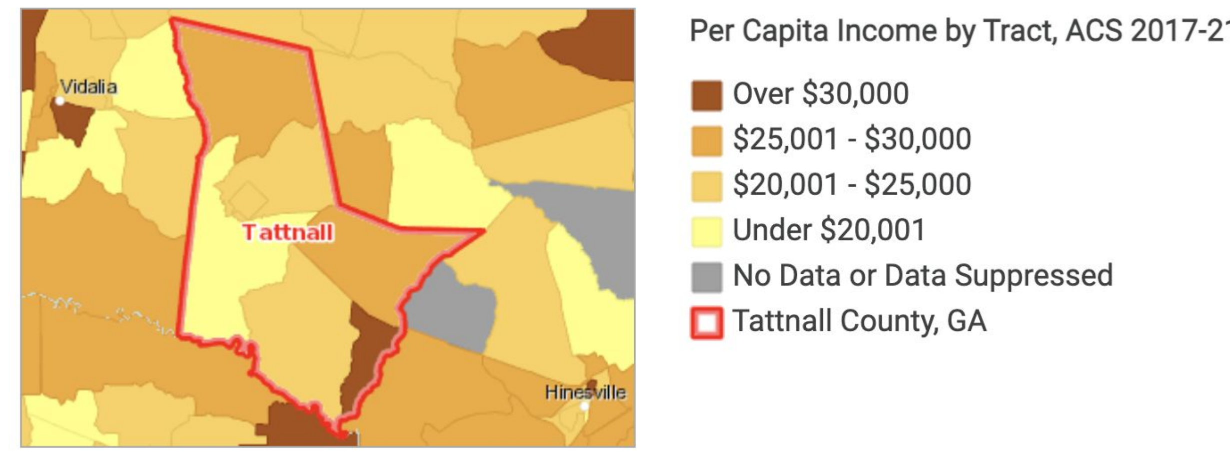


ABOVE: Geographic location of Reidsville and Collins as it relates to nearby rivers within the state.

ABOVE: *Reidsville and Collins shown in relation to the three primary watersheds that influence the hydrology of the two towns (Brazell's Creek, Thomas Creek, and Cedar Creek Watersheds).*

1.2 Area of Interest

This study focuses on the rural communities of Collins (population 568) and Reidsville (population 2,567), which are located approximately 10 miles apart in Southeast Georgia. Both towns lie within Tattnall County, where the per capita income is 43% below the national average and the median household income is at least 25% below the national and state average.[1]



ABOVE: Tattnall County's Average Per Capita Income, where Reidsville and Collins are located in the upper middle part of the county.[2]

Collins straddles three local watersheds - the Brazell's Creek watershed, Thomas Creek watershed, and Cedar Creek watershed. Stormwater within the western portion of the City drains towards Brazell's Creek while stormwater from the eastern portion of the City eventually drains towards either Cedar Creek or Thomas Creek. The watersheds for the eastern portion of the City are separated by a local ridgeline, marked by the rail line that traverses the City from West to East, where stormwater from North of the rail line drains towards Cedar Creek and stormwater originating south of the rail line drains towards Thomas Creek.

Reidsville also straddles the Brazell's Creek watershed and the Thomas Creek watershed at a downstream point to both creeks, as compared to Collins. Stormwater from the western portion of Reidsville drains towards Brazell's Creek, while stormwater from the eastern portion of the City drains towards Thomas Creek.

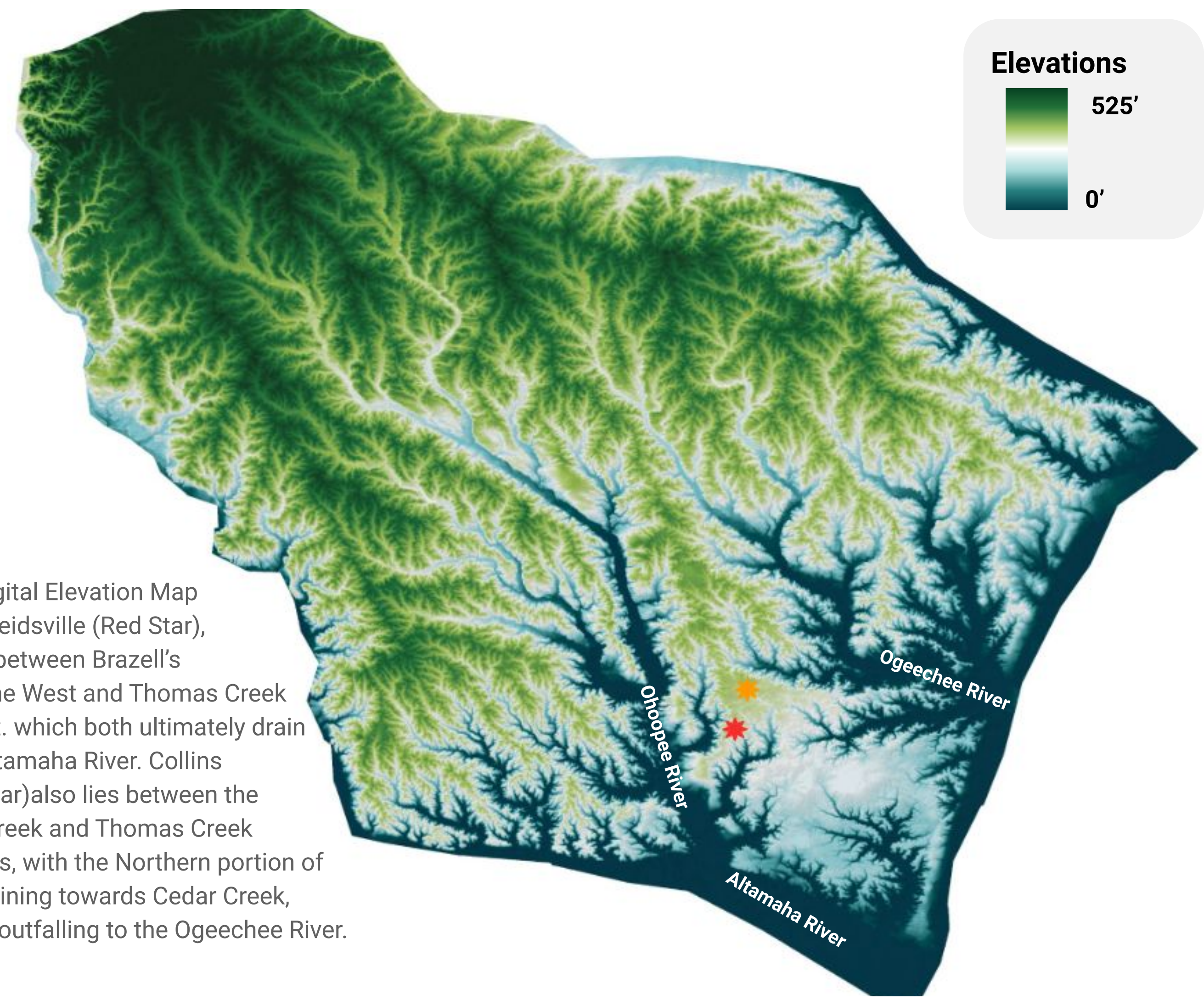
Both Thomas Creek and Brazell's Creek are classified as impaired streams on the state's 303(d) Water Quality list for extents of watercourse that that lie between Reidsville and Collins to their respective confluence points with the Ohoopee River. Brazell's Creek is less vulnerable to pollutants, with only biota impacts, while Thomas Creek has been subjected to excessive levels of fecal coliform bacteria, dissolved oxygen, and biota impacts. These water quality issues can be, at least partly, attributed to the pollutants (e.g. sediment, fertilizers, etc) that are suspended within the stormwater of the community draining directly into the Creeks.

[1] Appendix C — Socioeconomic indicators from the American Community Survey, 2017-2021. Georgia Rural Health Innovation Center. Georgia Health Data Hub.

[2] US Census. American Community Survey. 2017-2021

Area of Interest at a Larger Scale

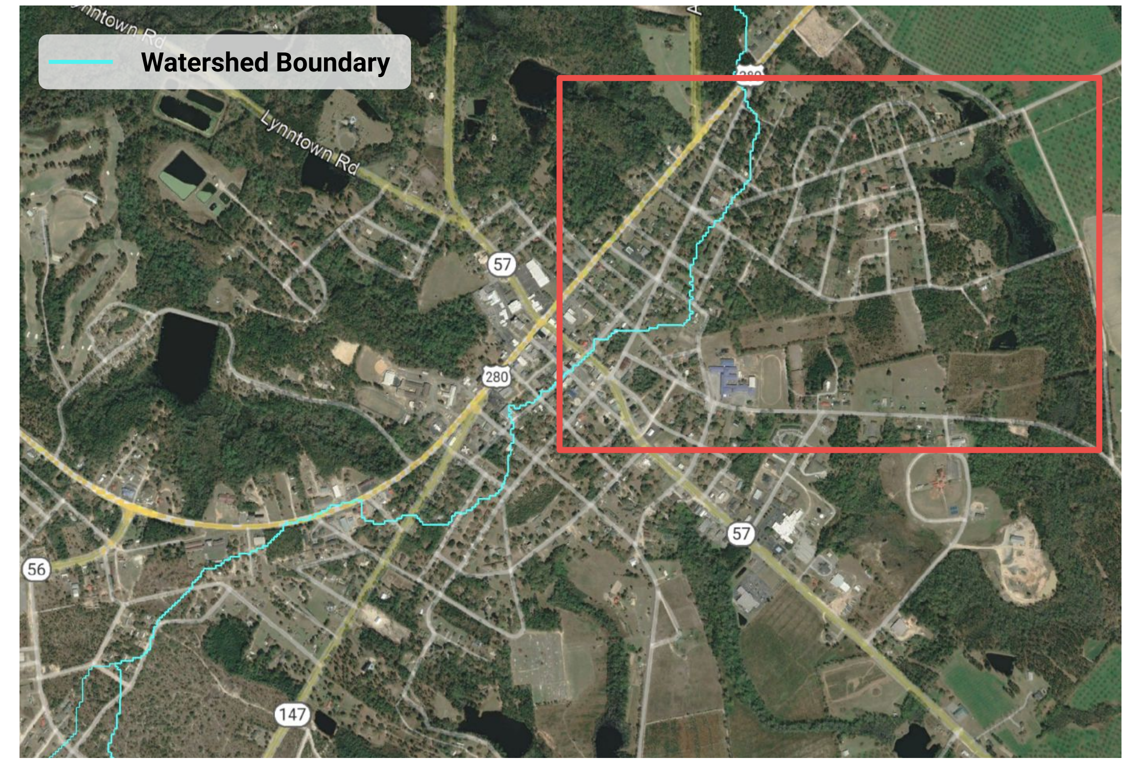
At a larger scale, both Brazell's Creek and Thomas Creek convey water south until their respective confluence points with the Ohoopee River, which eventually meets with the Altamaha River before the river outfalls to the Atlantic Ocean. Cedar Creek conveys water southeast towards a confluence point with the Canoochee River, which eventually meets with the Ogeechee River before outfalling to the Atlantic Ocean north of the Altamaha River.



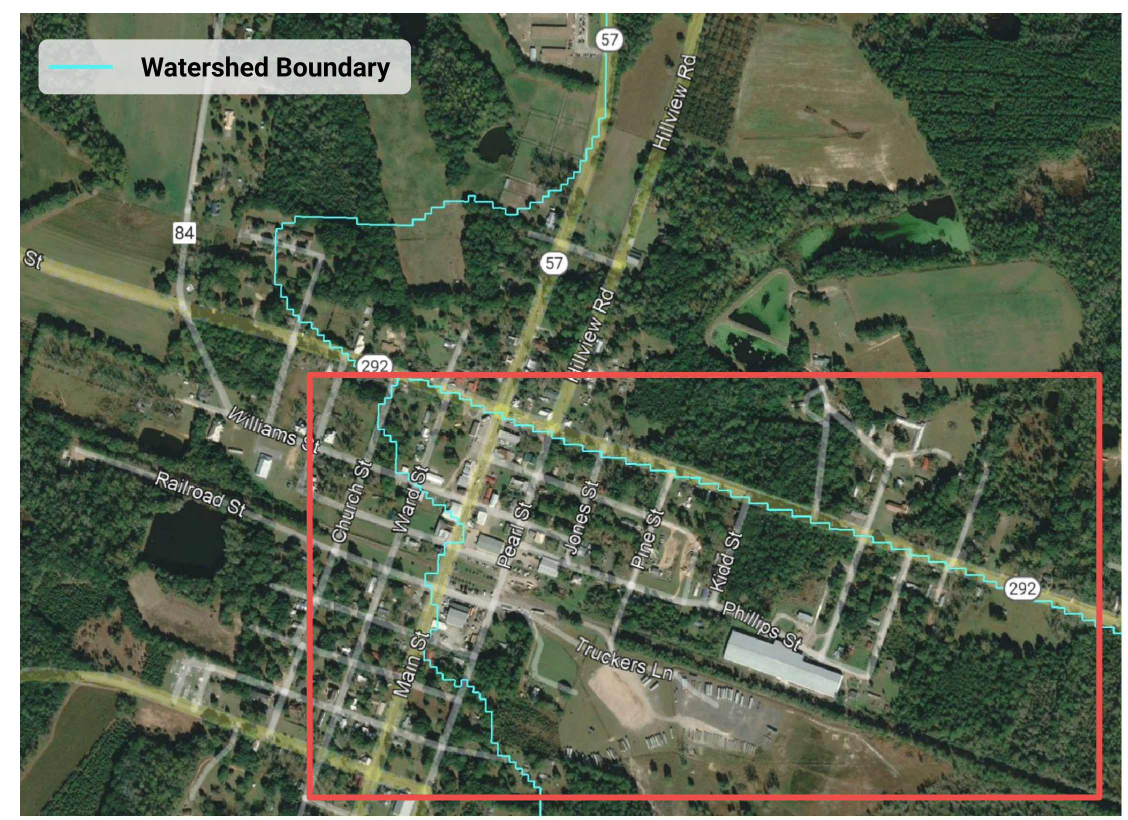
RIGHT: Digital Elevation Map showing Reidsville (Red Star), straddled between Brazell's Creek to the West and Thomas Creek to the East. which both ultimately drain into the Altamaha River. Collins (Orange Star)also lies between the Brazell's Creek and Thomas Creek watersheds, with the Northern portion of Collins draining towards Cedar Creek, ultimately outfalling to the Ogeechee River.

Refined Study Limits

Based on the team's initial analysis, flooding concerns in both Reidsville and Collins are acute, with certain areas facing the inequitable brunt of symptoms for a larger regional drainage problem. It was determined that ecological disruptions, and reported flooding, were limited to areas within the Thomas Creek and Cedar Creek watersheds of the two cities. For this reason, while the regional characteristics of the area were studied for understanding, this report will primarily focus on the areas of Northeast Reidsville (primarily in the Thomas Creek watershed) and East Collins in the Thomas Creek and Cedar Creek watersheds.



LEFT: Focus Area of Reidsville, GA which is limited to areas east of 280, The area N of Main St. and S of Lloyd St. was determined based on anecdotal evidence and denoted drainage trends. All of area is within the Thomas Creek watershed.



LEFT: Focus Area of Collins, GA which is limited to areas E of Main St. and primarily S of GA-292 (Manassas Road) was determined based on anecdotal evidence and denoted drainage trends. All of area is within the Thomas Creek or Cedar Creek watershed.

1.3 Community Context

Data from the 2023 County Health Ranking highlights the health disparities in Tattnall County compared to other areas in Georgia and the United States. Residents in Tattnall County experience higher rates of premature death, lower quality of life, higher unemployment, and limited access to clinical and mental health care.[3]

Tattnall County is ranked less favourably than the state average across three primary measures of socioeconomic status, including:

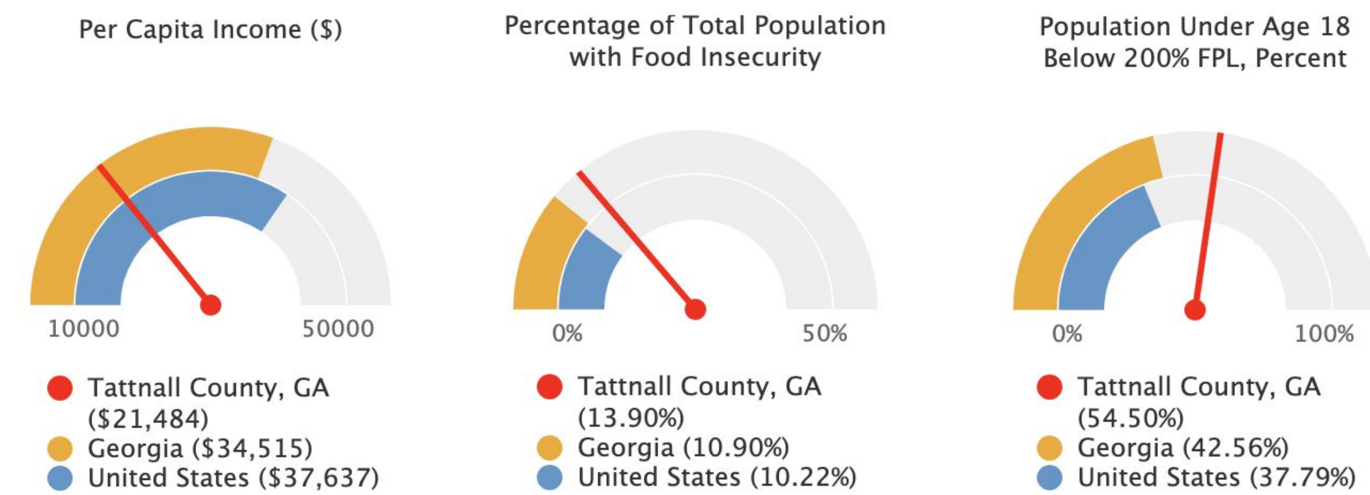
- **Social Vulnerability Index**: Evaluates measures of socioeconomic conditions that indicate a community's capacity to react to a disaster, including poverty rates, percentage of vehicle access, size of household
- **Opportunity Index:** Evaluates communities based on economy, education, health, and community well-being.
- **Area Deprivation Index:** Evaluates communities based on education, income & unemployment, housing, and household characteristics

Demographic Index	Tattnall County	Georgia
Social Vulnerability Index 0 to 1 (least to high vulnerability)	0.90	0.65
Opportunity Index 0 to 100 (minimal to maximum opportunity)	37.7	48
Area Deprivation Index 1 to 100 (least to most disadvantaged)	70	46

ABOVE: Comparison of Tattnall County socioeconomic status, as compared to the state average for Georgia.[3]

The economic disturbances resulting from flood damage disrupt agricultural activities and exacerbate poverty and food insecurity. For certain demographics, such as Black, Hispanic/Latin, and female residents, the disparities are even more pronounced, compounded with lower income levels and higher rates of both poverty and food insecurity.[4]

[3] CountyHealthRankings.Org
[4] Georgia Rural Health Innovation Center. Georgia Health Data Hub. 2023.



ABOVE: Comparison of Tattnall County financial metrics, as compared to the state and national average.[4]

Flooding events may also have significant implications for community health, ranging from physical threats (e.g. mold growth in damaged buildings) to mental threats (stress, anxiety, depression). The population's health is already vulnerable, as Tattnall County residents experience higher rates of a range of health issues associated with environmental exposures when compared to state and national disease rates, including COPD, high blood pressure, lung cancer, infant mortality, cancer-related mortality, and mortality from heart and lung diseases.[4]

Flood mitigation efforts in Tattnall County present an opportunity to create positive change and uphold environmental justice principles to the benefit of local residents and in communities nationwide facing similar challenges. As increased extreme weather events are anticipated in the future due to climate change, flood mitigation will play a critical role in building healthier, more equitable, and more sustainable communities.

Within this context of health inequities, it is essential to address both direct and indirect impacts of flooding on individual and community health. Flooding can spread infectious diseases, pose chemical hazards, mobilize toxins in local waterways, and cause direct risk of injury and premature death. The indirect impacts of flooding include long term health threats related to mold exposure, disrupted income, and property damage; as well as profound mental health effects, including anxiety, depression, and PTSD. Transformative flood management approaches are needed that prioritize improved quality of life, climate resilience, and public health.

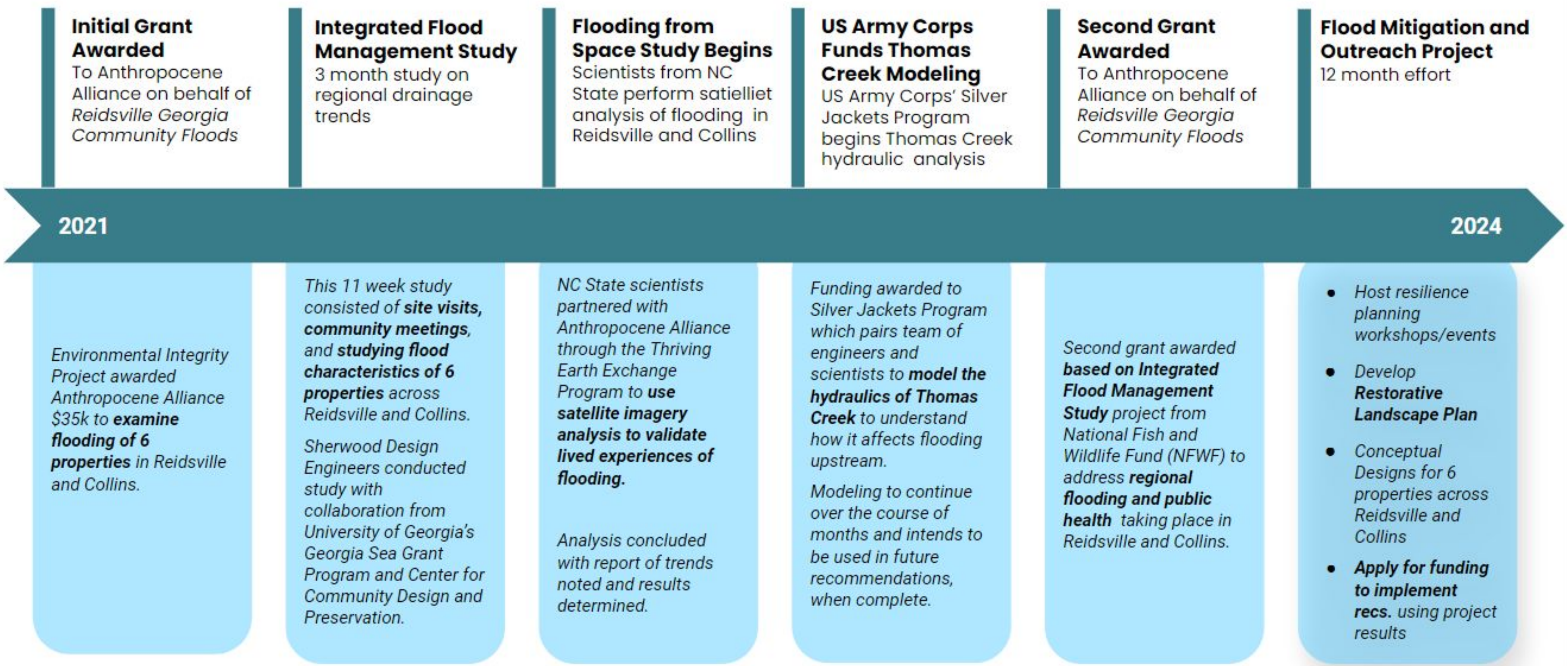
1.4 Building Upon Previous Work

This study aims to build upon the previous work completed in the area, from the connections made with community members to the technical findings that resulted from months of analysis.

In the first months of 2021, Anthropocene Alliance (A2), a coalition of frontline communities fighting for climate and environmental justice, began work with the local advocacy group for residents experiencing flooding - "Reidsville GA Community Floods" - to identify resources that could alleviate flooding in the area. In response to the concerns heard from the group, a $35k engineering study was commissioned to identify the causes of flooding for 6 properties (3 in Reidsville, 3 in Collins) and provide conceptual nature-based strategies for recommendations.

Findings of the 11-week study were summarized in the Integrated Flood Management Study report, published May 2022, where the primary takeaway was that the six properties in question were facing an inequitable brunt of symptoms from a regional drainage problem that resulted from a disrupted landscape. Individual site-solutions for each property would result in the shift of issues to other properties and would address the symptoms of the problem, not the problem itself.

In early 2023, A2 learned that the team's 2022 grant application for the US National Fish and Wildlife Foundation (NFWF)'s Coastal Resilience Fund was successful and funding would be provided to conduct a regional study of the drainage patterns for recommendations. This application was submitted using the findings of the Integrated Flood Management Study and the funding was used to sponsor the 12 month study that is summarized within this report.



LEFT: Timeline of previous work completed for alleviation of flood impacts in Reidsville and Collins, GA.

1.5 Opportunities and Project Goals

The primary goal of this study is to understand how the historic conditions of this area, and the negative impact that development had on the hydrological landscape, affects regional drainage patterns and to inform recommendations that alleviate negative impacts of flooding.

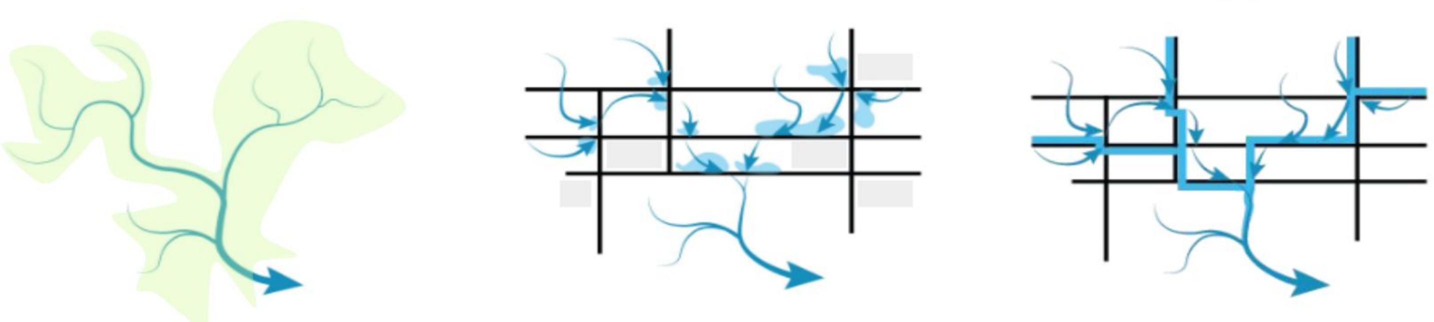
Even as development has obscured a significant portion of the natural landscape that once thrived in the area, this natural landscape comes back to life after rain events - when historic creek beds, swamps, and coastal lowlands attempt to manage stormwater in ways they were meant to do. Development in these areas has hindered the processes of the natural landscape - from covering/inhibiting drainage paths, to placing properties in old swamp lands, and diverting water in stormwater infrastructure in directions that water cannot drain towards the creek. To recognize the influences of environmental processes and provide meaningful recommendations that will alleviate flooding both today and in the future, stormwater should be considered at a holistic scale, considering not only the areas where symptoms of flooding occur, but also in the areas where the underlying cause of downstream symptoms are originated.

Within all recommendations outlined in this report, the core philosophy is to mimic the natural drainage patterns of the landscape so that recommendations may work with the natural drainage processes, and how it would operate in development's absence, rather than working against it. As both towns are at the top of their respective watersheds, flooding occurs as a result of stormwater not effectively conveying away from the communities. By aligning recommendations with the natural landscape, we can leverage the natural processes of a functioning landscape to effectively convey water away from properties, reduce recurring maintenance needs, and reap the benefits of ecosystem services as co-benefits to the design.

Historic Flows
Stormwater draining towards Creek are uninterrupted and supporting ecology along the way.

Present Flows
Stormwater draining towards Creeks is impeded by development and accumulating in locations that flood properties.

Future Flows
Can stormwater infrastructure be retrofitted and expanded upon to mimic historic drainage patterns and leverage nature rather than working against it?



ABOVE: The holistic philosophy of recommendations is rooted in restoring natural drainage patterns to mimic natural conditions to drain water towards the creeks and out of town as it would before development occurred.

Specific recommendations that are mentioned as part of this holistic philosophy are designed to work in alignment with one another to operate as a comprehensive, regional solution to address a regional problem. Wherever possible, each design component is optimized to maximize co-benefits provided to both the natural and built landscapes of the study area beyond flood alleviation. Co-benefits of the nature-based solutions could include enhanced ecosystem services such as water filtration, reduced erosion, cleaner air, habitat provision, and improved aesthetic/placemaking amenities for residents. Implementation of nature-based solutions can even have socio-cultural benefits such as increased property values or bolstered local identity and sense of place.

ABOVE: When identifying recommendations that abide by the overarching philosophy, designs are intended to act as comprehensive solutions that address additional problems in the community through a layered approach to flooding.

Through the community engagement process, anecdotal evidence from local stakeholders suggested that development is anticipated to increase in both towns in the near future with the construction of nearby factories. This engagement has shaped the decision making process by including an additional project goal of curating policy recommendations and community engagement initiatives to increase the resilience of communities like Reidsville and Collins.

While the construction and restoration-based recommendations that are outlined may alleviate impacts of flooding today, the policy solutions to be offered in the report are to work in tandem to mitigate against exacerbated flooding in the future. While this plan is the current focus of these efforts and funding, it is the intention of said work to assist in starting critical conversations locally and regionally that will lead to greater collaboration and creating resources through grassroots action.

2.0 Analysis

2.1. Historical Environmental Context

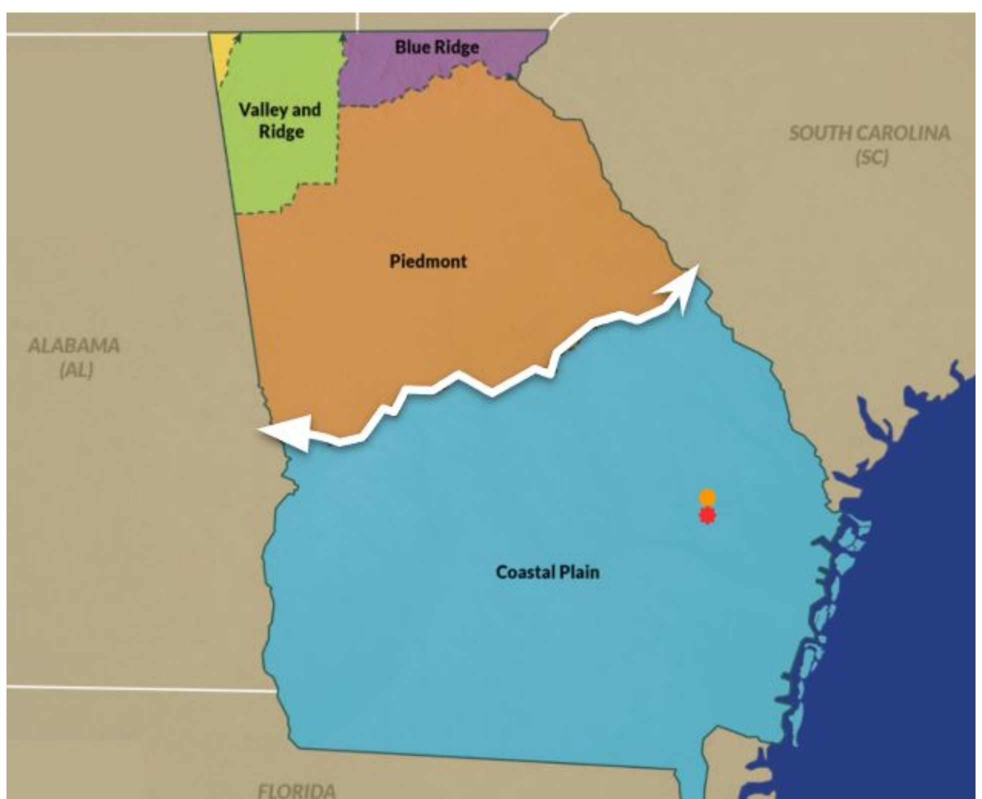
2.2. Existing Conditions

2.3. Trends of Development Impacts on Drainage

2.1 Historic Environmental Context

Reidsville and Collins are rural towns experiencing acute flooding due to the interplay between geologic interactions that predispose the area to wetness and disruptions to drainage patterns brought about by development. Understanding how the landscape has changed is crucial for understanding a path forward to mitigate future flooding. Given the region's susceptibility to flooding, residents will continue to experience nuisance flooding unless interventions are employed. Investigating the natural landscape provides insight on how future strategies can alleviate flooding while considering ecological and health benefits possible with coexisting with water.

The land on which both Reidsville and Collins stand today are located within the Georgia Coastal Plain south of Georgia's prehistoric shoreline, known as the Fall Line. During the Pleistocene geological age, the Coastal Plain was marked by repeated cycles of glacial advance and retreat affecting sea levels. A shallow sea covered what is Reidsville and Collins today when sea levels were high, but periodically became dry land with the presence of large rivers and broad floodplains when sea levels were low. Over the course of several millennia, repeated cycles of sea level advance and retreat from glacial fluctuations resulted in geomorphological formations that still impact drainage patterns today.



LEFT: Georgia's Fall Line (shown as white line)is a geologic boundary marking the prehistoric shoreline of the Atlantic Ocean as well as the division between the Piedmont and Coastal Plain regions of the state. Everything below the Fall Line is historic sea bed, including Reidville (Red Dot) and Collins (Orange Dot).

Even if areas of the coastal plain are no longer near the current shoreline, these areas still exhibit many coastal characteristics, including presence of flat terrain, swamps, sandy soils, and historic sand dunes.

Due to these influences, rivers in the Coastal Plain tend to be slower moving, larger, and easier to navigate than those above.

Image Source: "The Coastal Plain Region of Georgia" - Georgia Public Broadcasting

2.0 Analysis

Despite the fact that the coast is over fifty miles away, Reidsville and Collins exist on ancient seabed within the Coastal Plain and exhibit many coastal characteristics. Being within the lowest-lying region of the state, the presence of water has persisted since long before the impact of human development. Similarities to coastal landscapes are expressed through the omnipresence of water – water lingers on the surface, in the air, and in the ground for long periods of time.

ABOVE: Despite the area's inland geography, many areas in the region still exhibit coastal characteristics due to historic geologic influences, including wetlands, sandy soils, and water tolerant vegetation palettes. Image on left is taken of wetland along Lloyd Ave. near Reidsville and image on right is of Thomas Creek just SE of Reidsville.

This history directly influences the drainage behavior of the landscape. Key Coastal Plain characteristics in the area that influence drainage behavior include:

- **Topography:** Terrain is relatively flat and low-lying, with little changes in elevation that force water to drain with gravity.
- **Groundwater Interactions:** As typical in coastal areas of the Southeastern U.S., the depth below the ground surface at which the soil is saturated with water in the voids between the soil is relatively shallow.
- **Soil Characteristics:** Soils of the area are composed of deep alluvial deposits of marine material accumulated over millennia, mixed with finer and organic particles that render many of the sandy soils hydric, meaning drainage can be exceptionally poor.
- **Coastal Vegetation Communities:** The native vegetation communities in the project area are typical of the coastal plain, with diverse assemblages of plants adapted to both relatively dry and very wet or swamp conditions also.

Topography

The city centers of Reidsville and Collins are located at the top of multiple watersheds. Water flows at the top of watersheds contribute to watercourses that serve as natural drainage networks for the region and ultimately lead to respective confluence points before outfalling at the Atlantic Ocean. Being at the top of a watershed typically indicates that the City centers features topographically such as ridges or high points.

While the cities are elevated with respect to their surroundings, the topography of this region is still characterized as low-lying with respect to the rest of Georgia. An extensive dune terrain consisting of gentle rolling hills and interdunal lowlands, referred to as hammocks or bays, directs water movement towards the creeks. Research suggests inland dunes formed during times of prehistoric coastal retreat when drier climates exposed riverbeds. Conditions enabled wind to transport sediment and create an extensive network of dune formations and coastal estuaries within the Lower Georgia Coastal Plain.[5] This typology of land is still present as evident in the Ohoopee Dunes State Natural Area just northeast of the Reidsville and Collins townships and throughout Tattnall County. [6]

Present-day dunes, known as “sand hills”, are composed of sand that drains water very quickly, making it difficult for plants to colonize and stabilize the dunes. Dunes are most often present along the northeastern banks of creeks and rivers, existing parallel to the streams, due to impacts of sediment deposition caused by wind. These remnants of prehistoric dunes are ecologically identical to their seashore counterparts.[7]

Between sand hills, interdunal lowlands (i.e. hammocks or bays) exist, formed by a combination of sedimentation and tectonic uplift, inland areas, and topographically predisposed to serve as a regional low point where water from the surrounding area collects and remains for long periods of time.[4] These areas, due to the amount and frequency that water is present, are often characterized with dense vegetation and swamp-like characteristics, exhibiting characteristics of an inland freshwater wetlands ecology. [8]

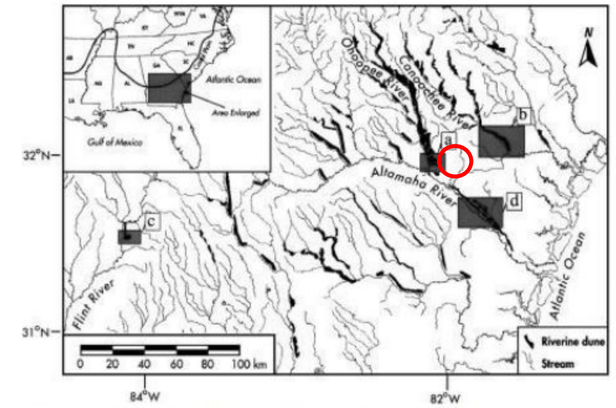
Creeks in the area were formed based on the accumulation of water that drained between the interdunal lowlands towards the Atlantic Ocean. Creeks in this area, including Thomas Creek and Brazell’s Creek, and the smaller tributaries that feed into the creeks are generally sluggish and flow through broad, swampy bottoms. Both the creeks and the tributary rivers that feed the creeks flow through broad, densely wooded lowlands, very often spreading out through the trees to the extent that it’s difficult to determine the extents of the creek channel. As a result, nearly all creeks in the area are bordered by swamps, frequently inundated by overflows of the creek.

[5] Georgia Public Broadcasting. “The Coastal Plain Region of Georgia: A Virtual Exploration of Georgia’s Flatlands, Hills, and Swamp.” *Google Arts & Culture*

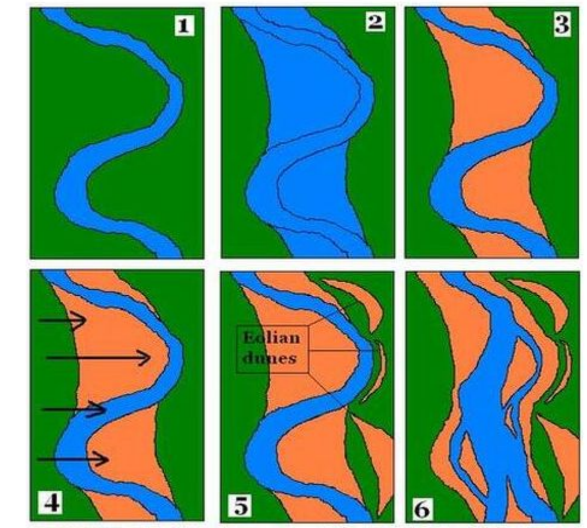
[6] Gelbart, Mark. “The Ohoopee Sand Dunes.” *GeorgiaBeforePeople*, 9 Apr. 2012, markgelbart.wordpress.com/2012/04/09/the-ohoopee-sand-dunes/.

[7] The Nature Conservancy. Places We Protect: Ohoopee Dunes Preserve.

[8] Veatch, Otto, and Lloyd Stephenson. *Bulletin No. 26: Preliminary Report on the Geology of the Coastal Plain of Georgia*. Foote & Davies, Co., 1911.



Georgia's Eolian Dune Fields (Aeolian is also correct). Located on the eastern banks of many East Georgia, Coastal Plain rivers. These wind structures tell the history of the Pleistocene ice ages in Georgia, though glaciers never came as far south as Georgia when they receded large scale, rain driven flooding filled our rivers and deposited vast amounts of sand from the Piedmont, when the rivers fell again the sand was left behind for wind to create these dunes. This happened repeatedly. Image source: Riverine dunes on the Coastal Plain of Georgia, USA; Andrew H. Ivester and David S, Leigh. Geomorphology
Published 25/April/2003. Used by permission of Elsevier.

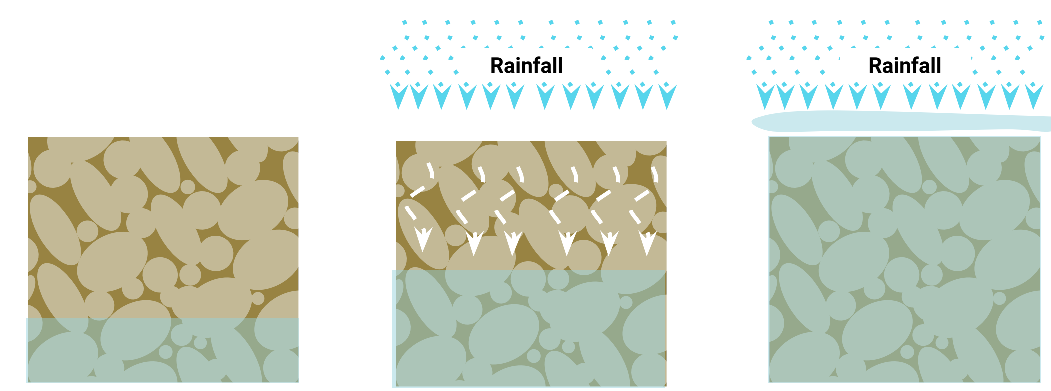


Building Eolian Dunes Illustration by T. Thurman
1: River in its original course. 2: Extensive flooding due to glacial melt. 3: Sand deposited by flooding, choking river bed. 4: Winds lift sand. 5: Sand deposited on lee side of river as eolian dunes. 6: River meanders and braids through choking sands leaving what we see today. This happened repeatedly.

ABOVE: Map of where dune fields are found in inland Georgia (LEFT) and diagram of how the Ohoopee Dunes were formed with geologic influences (RIGHT)[9]

Groundwater Interactions

The water table, the soil depth at which it’s saturated with groundwater, is relatively shallow throughout the region. As a result, stormwater cannot infiltrate into the soil in many areas because of the soil’s limited storage capacity, thus remaining until conveyed downstream or evaporated.



Low Water Table Before Rain Event | **Low Water Table During Rain Event** | **High Water Table During Rain Event**

LEFT: A high water table decreases the ability of stormwater to infiltrate, resulting in exacerbated surface ponding

Groundwater is omnipresent throughout the area, but has been especially noted in the Northeastern portion of Collins within the Cedar Creek watershed. Within this area, groundwater can be observed at play as water ponds on the surface and within the ditches for long periods of time, even during periods without rain events.

[9] Thurman, Thomas. *Georgia’s Eolian Dunes*. GeorgiaFossils.com

2.0 Analysis

Soil Characteristics

Within the historic dunes, in the highest elevations, soils are composed of Bonifay Fine Sand, which are formed from marine deposits underlain by sandy clay loam. This sandy soil is generally well drained and the depth to the water table is 48-60 inches.

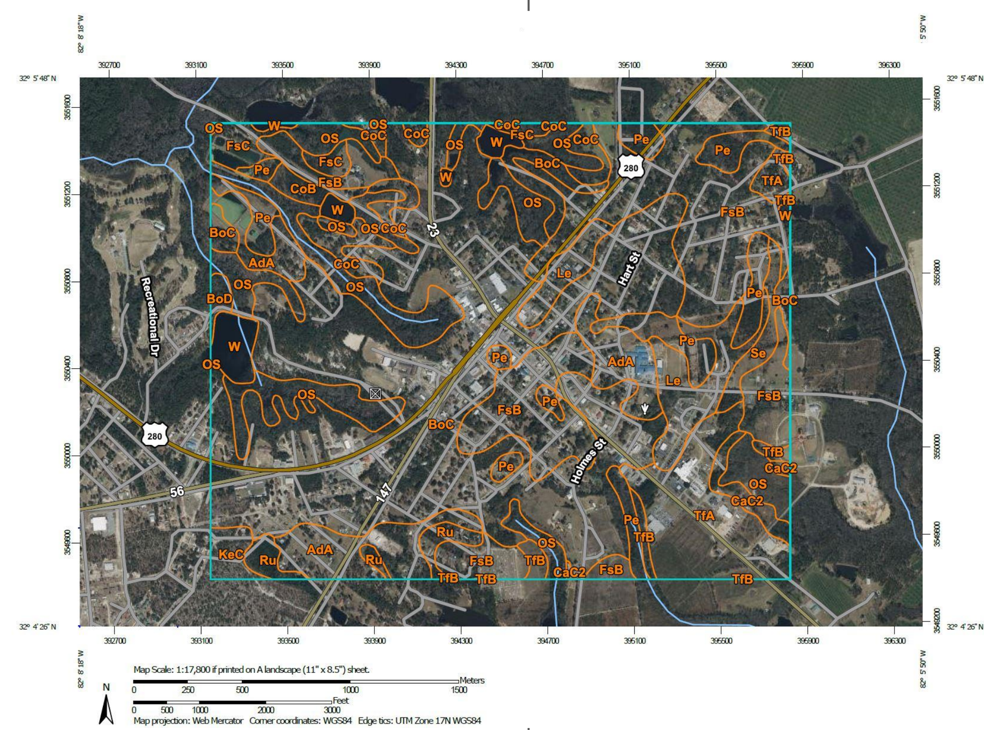
In the subtle valleys surrounding the ridge, which have gradually gathered organic material for millennia, the soils turn primarily to variations of loamy sand. With the addition of these finer particles and organic matter, the soils may hold water for longer and drain less readily.

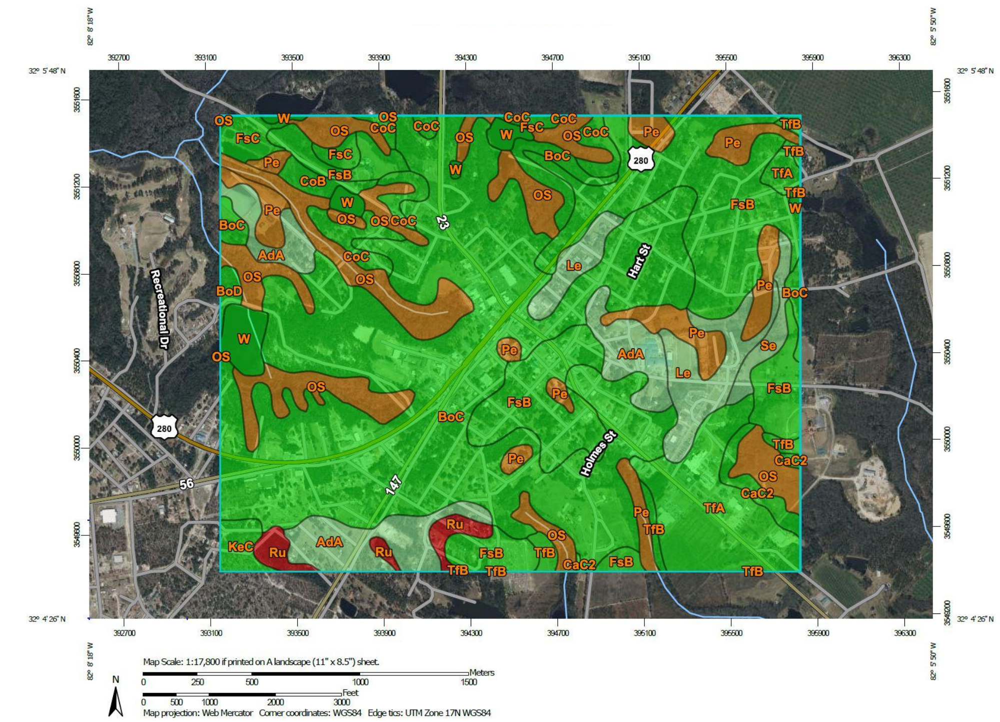
Where water accumulates in the lowest depressions, these loamy sands (e.g. Pelham loamy sand) are formed from loamy marine deposits underlain by sandy clay loam that is poorly drained and the depth to water table is a mere 0-12 inches.

In Reconnaissance Soil Survey of Tattnall County, Georgia (1912), the soils of the region around Reidsville and Collins are described thus:

> "Their surface is flat and nearly level and the drainage ways are shallow and infrequent. Consequently the water remains on the surface for some length of time after rains, most of it disappearing through percolation and evaporation. The soils are often saturated for weeks after periods of wet weather and are, therefore, in their natural state unsuited to agriculture."

The soils described in the soil survey are now recognized as hydric soils, which are strongly associated with wetlands. It is highly likely that the aforementioned areas with soils that would remain saturated for weeks after periods of precipitation were historically wetlands.





ABOVE: Soil Maps of Reidsville (left) and Presence of Hydric Soils in Reidsville (Right) Areas denoted in orange and red are considered hydric soils where water will not infiltrate into the ground, remaining ponding on the surface for long periods of time.[10]

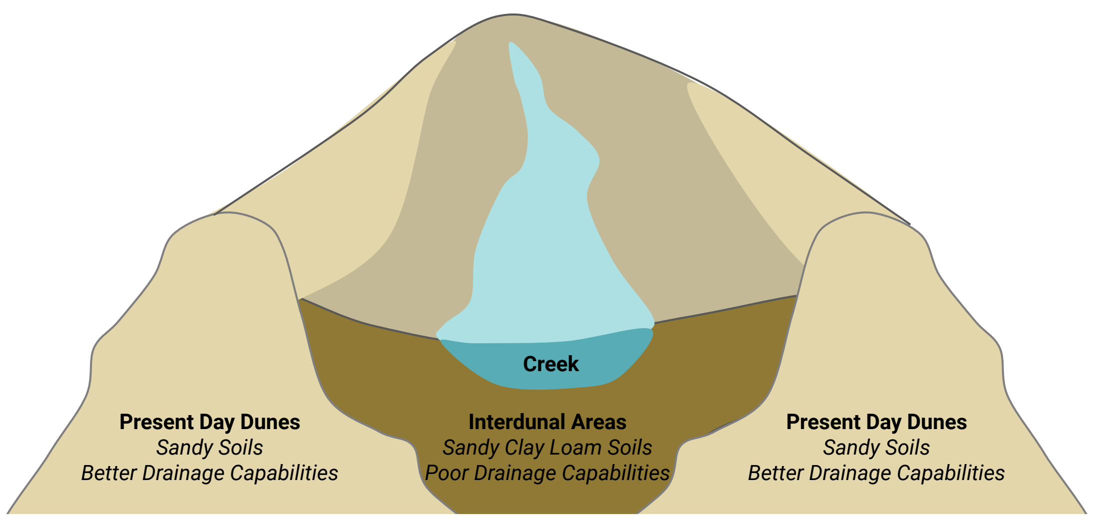
ABOVE: Soil Maps of Collins(left) and Presence of Hydric Soils in Collins (Right) Areas denoted in orange and red are considered hydric soils where water will not infiltrate into the ground, remaining ponding on the surface for long periods of time. [10]

[10] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Topography, Groundwater & Soil Interactions

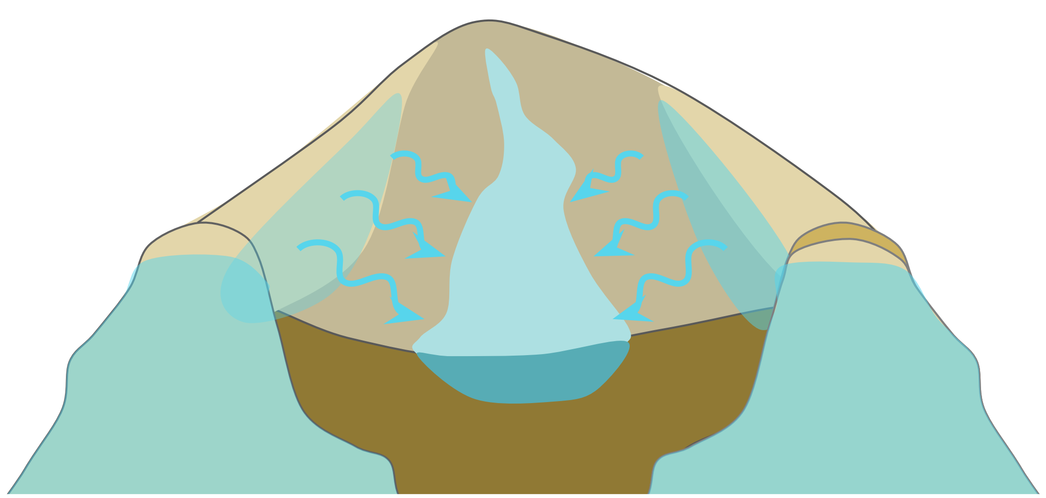
1 DRY CONDITIONS

Creeks convey between dunes, in interdunal areas, that are characterized by clay soils that do not drain well and remain wet. Dunal areas have sandy soils that drain much better and act as high points in the landscape.



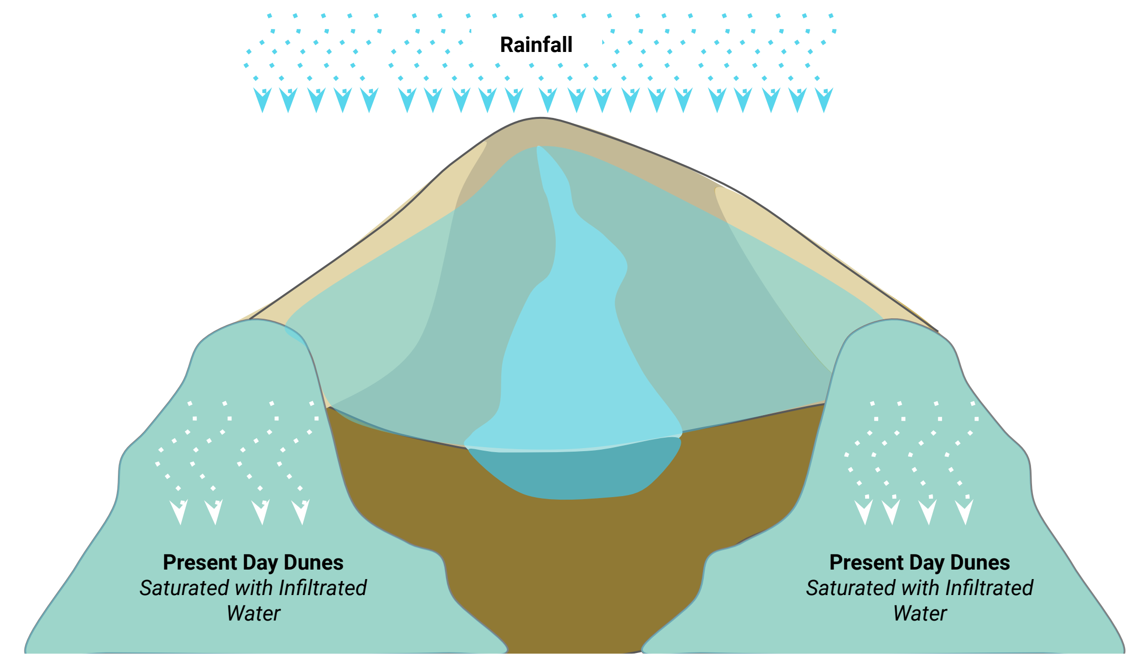
3 DAYS FOLLOWING RAIN EVENTS

Once the ponding on the surface dissipates, and the creek water levels have reduced with capacity for additional water, water stored within the dunes seeps downhill towards the creeks, resulting in presence of water days after a storm event. Water within dunes cannot move towards soils in interdunal areas because water cannot move through clay soils.



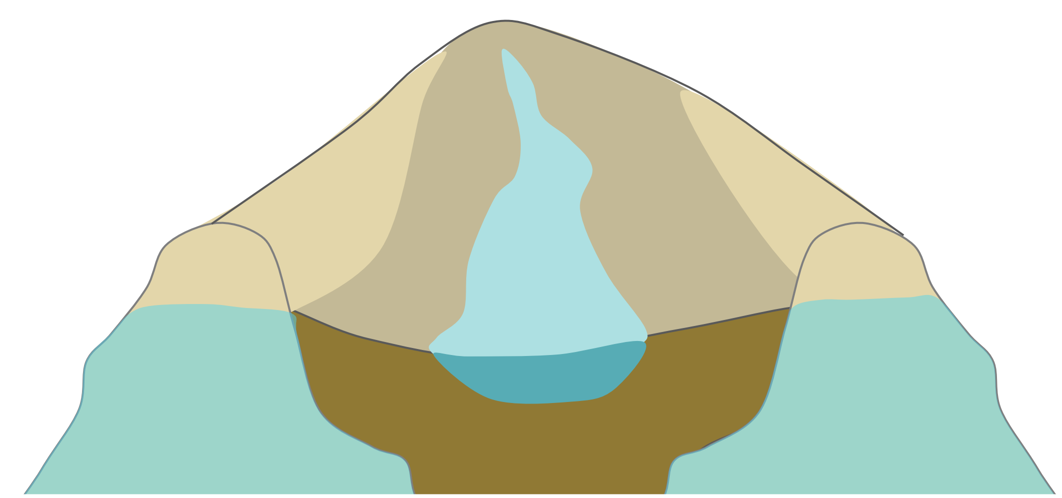
2 DURING RAIN EVENTS

Stormwater generated from rainfall drains towards the creeks. In the dunes, sandy soils are able to infiltrate stormwater and store it temporarily within the voids of the sand particles. The clay soils in the interdunal areas are not able to infiltrate water, so ponding remains on surface.



4 WEEKS FOLLOWING RAIN EVENTS

Water that is stored within dunes at an elevation that is higher than the interdunal areas will eventually all seep downstream towards the creeks. Water stored within the sandy soil of dunes that is below the elevation of the interdunes will remain for long periods of time, resulting in a high water table, as water cannot move towards clay soils of interdunal areas.

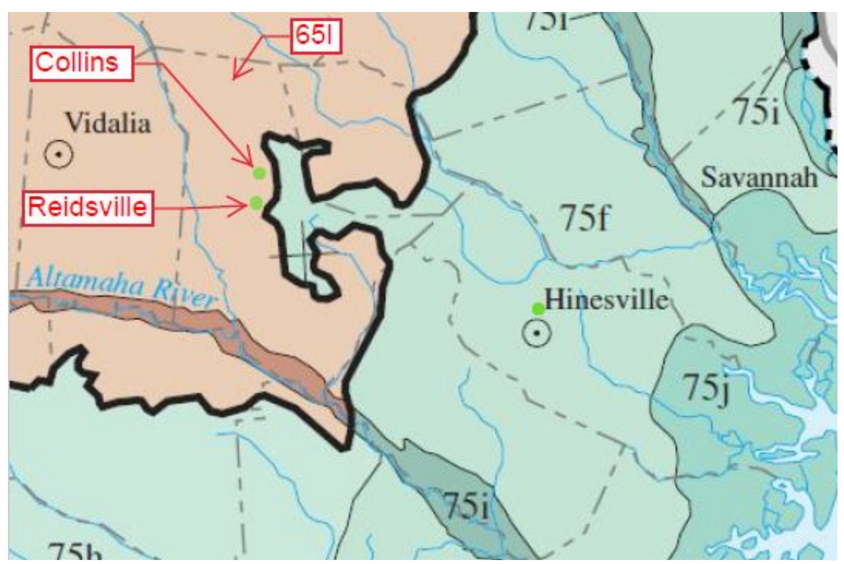


Vegetation and Ecological Character

Under natural, undeveloped conditions topography, soil texture, and soil drainage characteristics are major determinants of vegetation community types in the coastal plain region. Upland areas where stormwater runs off more rapidly are commonly dissected by lower-lying wet areas where saturated or ponded soil conditions persist for relatively long periods of time, creating a mosaic of dry and wet areas across the landscape. The vegetation communities listed **above** only include one xeric or dry upland community, because those areas aren't dominant in the Reidsville and Collins project area vicinities. Moist or mesic conditions, where the surface soil profile dries out between rain events during the growing season but soils can remain saturated for extended periods of time during the cooler months are more commonplace. Within the mesic areas, transition can abruptly occur into much wetter conditions where the soil stays saturated for longer periods of time, even during the warmer growing season months, due to flatter topography or less permeable soils.

Based on the Environmental Protection Agency's (EPA) Ecoregion mapping of Georgia, Reidsville and Collins are located in the general Coastal Plain region, on the border between the Level III Southeastern Plains and Southeastern Coastal Plains. Specifically they are adjacent to the Level IV Atlantic Southern Loam Plains (65l) in the and the Sea Island Flatwoods (75f).

The EPA descriptions state that the Atlantic Southern Loam Plains (65l), also called the Vidalia Upland in Georgia, are generally lower, flatter, and more gently rolling than 65k, the Coastal Plain Red Uplands. Similar to 65h, the Tifton Uplands, the Atlantic Southern Loam Plains have an abundance of the agriculturally important Tifton soils, but the region also contains forested areas that are more sloping or are low, flat and poorly drained.



ABOVE: Snapshot of EPA's Ecoregion mapping for state of Georgia.

The Sea Island Flatwoods (75f) are mostly poorly-drained flat plains with lower elevations and less dissection than 65l. Pleistocene sea levels rose and fell several times creating different terraces and shoreline deposits. Spodosols and other wet soils are common, although a few ridges and small areas of better-drained soils add some ecological diversity.

Descriptions of the common vegetation communities found in the project area include:[11]

COASTAL PLAIN MESIC LONGLEAF PINE FORESTS AND WOODLANDS
Occurs on upland sites with loamy sand soils in the Coastal Plain. Relative to areas with deep sandy soils, these soils retain more moisture and nutrients.The relatively fertile soils led to early conversion for agriculture and silviculture.

COASTAL PLAIN SMALL STREAM FLOODPLAIN FOREST
Occurs along the headwaters of small creeks/ streams where soils are sandy and acidic. Because floodplains are narrow, little development of floodplain features exist but some have braided stream channels that flow around surficial tree roots.

COASTAL PLAIN MESIC SLOPE FORESTS
Occurs in northeast-facing river bluffs, ravines, lower bluffs and slopes above seepages and streams, commonly in well-drained soils. The moist, nutrient-rich soils support a diversity of trees.

COASTAL PLAIN DRY DECIDUOUS HARDWOOD FORESTS
Occurs on upland sites with sandy or loamy soils that are naturally protected from fire, such as on river bluffs and steep slopes. This community is increasingly widespread in the Coastal Plain due to human fire-suppression.

COASTAL PLAIN CYPRESS SAVANNAS AND DEPRESSION MARSHES
Occurs in shallow depressions that are underlain by impervious clay layers that hold water in the depressions that are usually connected by surface flow to streams or lakes. Water levels depend heavily on rainfall and fluctuate over the seasons and years, creating unique habitats for plants, and animals.Depression marshes lack trees and support numerous species of grasses, while cypress savannas have a scattered canopy of trees over an herb layer of grasses. **These isolated wetlands currently do not receive protection from ditching, draining, and other disturbance under federal or Georgia state wetland regulations; many of these have been severely impacted or destroyed by ditching, dredging, filling, and conversion to fish ponds, agriculture, or pine plantations.**

[11] Chafin, Linda. 2013. Georgia's Natural Communities and Associated Rare Plant and Animal Species: Thumbnail Accounts, based on "Guide to the Natural Communities of Georgia," by Leslie Edwards, Jon Ambrose, and Katherine Kirkman, 2013, University of Georgia Press. Version of 2011 Georgia Nongame Conservation Section Wildlife Resources Division Georgia Department of Natural Resources

2.2 Impacts of Development

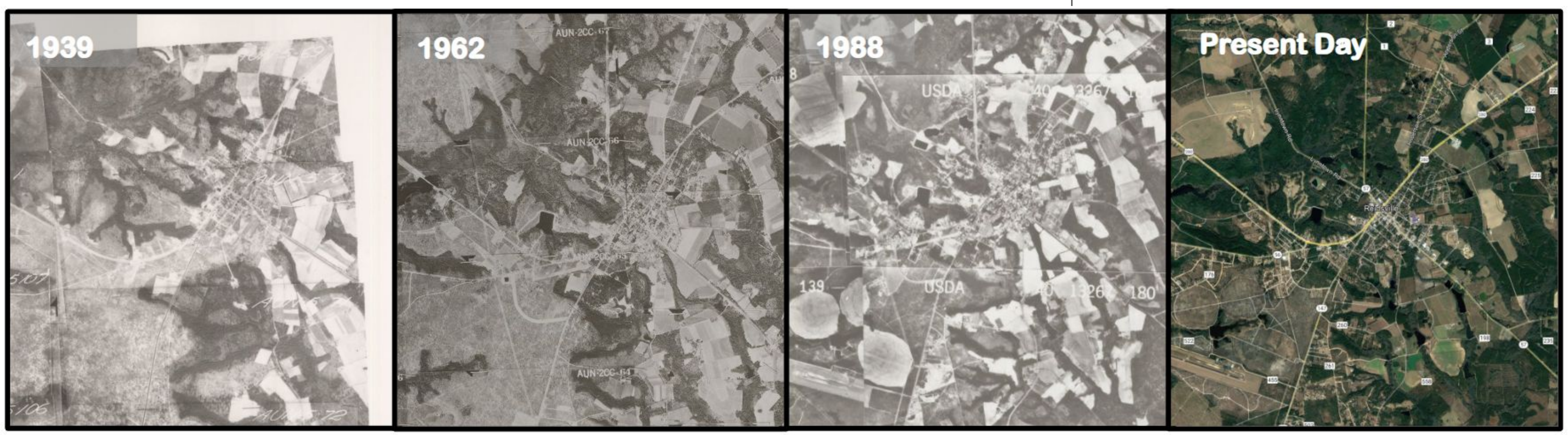
Although the region's geography and geological context predispose the area for flooding, the impacts of agricultural, forestry, and urban development in the area throughout the twentieth century have exacerbated conditions, yielding residents vulnerable to nuisances related to flooding.

Before development, the landscape was thought to be completely forested. While some forested areas remain, much has been developed for agriculture and forestry, altering vegetation, soils, and the regional hydrology. In 1912, authors of local soil studies advised that much of the land of the county was suitable for agriculture, and 40-50% of that suitable land was currently under cultivation, with opportunity to cultivate more by changing the hydrologic patterns.

2.0 Background

In the last century, wholesale clearing of the previously forested land occurred, reducing the absorptive capacity of soils and vegetation, further exacerbated by the increase of hardscape. By use of fill and ditches for agriculture, regional drainage patterns have been significantly altered, causing flooding in unnatural locations.

Beyond flooding, the increase of development has degraded the water quality. Stormwater flowing over hardscape picks up pollutants, including sediment, fertilizers, gasoline and vehicular pollutants. The pollutants alter water chemistry and can cause algal blooms that deplete dissolved oxygen in water, killing fish and other aquatic life, further damaging the landscape.



LEFT: Changes in Reidsville shown over the last century through satellite imagery. Changes can be noted in removal of wetlands, filling in of creeks, tree removal, construction of stormwater ponds, and some agricultural practices.

LEFT: Changes in Collins shown over the last century through satellite imagery. Changes can be noted in significant agricultural practices through the 20th century that are not shown today, but have left the soil fallow and unable to infiltrate stormwater.

Identifying Interactions of Development and the Landscape

As previous work of the area has denoted, flooding noted in Reidsville and Collins is spatially acute and limited to concentrated areas, but the flooding problems are symptoms of a regional conveyance issue. As a result, alleviating flooding at any one property would only shift flooding to another property, and drainage trends must be understood at a regional scale.

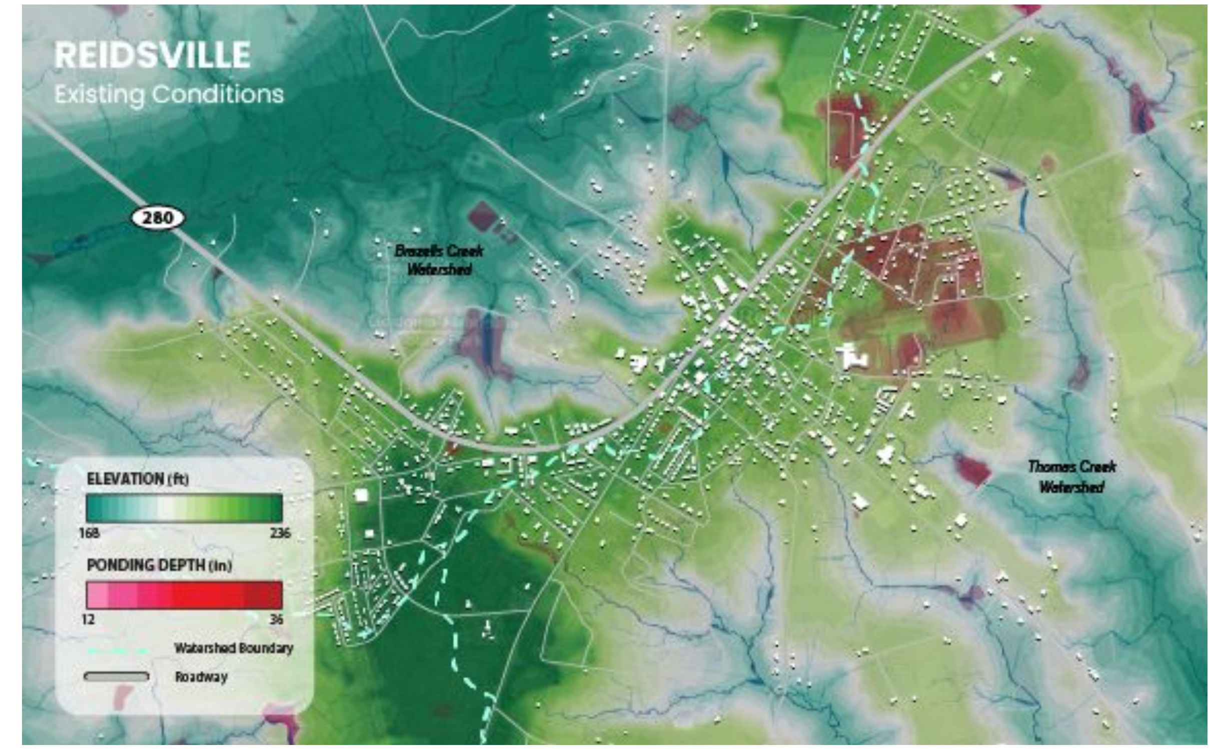
To understand regional drainage patterns and their interactions with current development, a layered approach to mapping was conducted to identify local trends of drainage inefficiencies: .

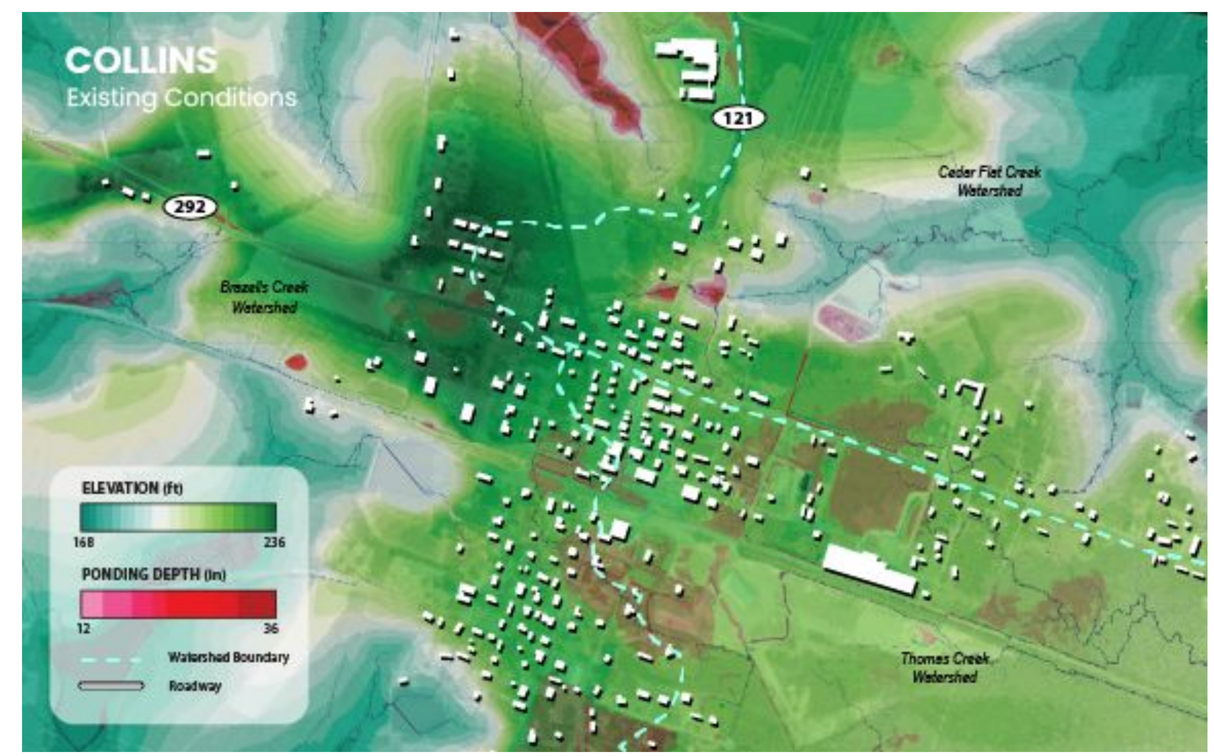
Key components of the mapping analysis include:

- **Relative Elevation Gradient:** The range of dark green to blue shows the relative changes in elevation between the elevations shown in the extents of the map, where dark green is the highest elevation and dark blue is the lowest elevation. This visual relationship of topography is generated based on publicly available USGS satellite survey data.
- **Regional Flow Patterns:** Flow Patterns shown on the map are generated based on the relative elevations and indicate the regional flow paths of surface runoff, in the absence of any subsurface pipes infrastructure to intercept the stormwater.
- **Ponding Depths:** Ponding Depths shown are the extents and depths of anticipated water ponding within closed depressions, based on analysis done of the relative elevations. Closed depressions, which are the areas shown in red on the maps, are regional low points where water from surrounding areas is anticipated to drain towards and accumulate, but has no outfall for water to drain as elevations of surrounding land is higher on all sides.
- **Watershed Boundaries:** Watershed boundaries of Brazell's Creek, Thomas Creek, and Cedar Creek to indicate the distribution and volume of stormwater that any one area may anticipate as water accumulates and drains towards the creeks.

Based on the mapping shown, regional drainage issues appear to be the result of development occurring at odds with the historic conditions - including location of development in historically wet areas and earthwork/roads impeding natural drainage patterns of stormwater towards the creeks.

The trends of drainage inefficiencies that contribute to this constriction of conveyance in the interaction of development and the landscape are shown on the following page.



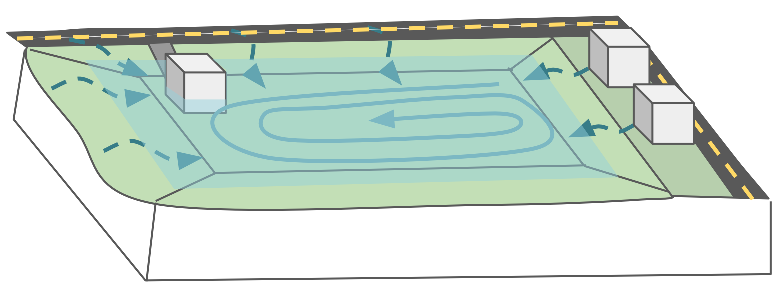


ABOVE: Maps of Reidsville (top) and Collins (bottom) overlaying natural drainage patterns and their relationship with development. While some closed depressions are likely the remnants of wetlands in the historic interdunal areas, others are the result of roads or development acting as a dam for water moving, causing water to accumulate and shape the landscape.

2.2 Trends of Drainage Inefficiencies

Development in Ecologically Sensitive Areas

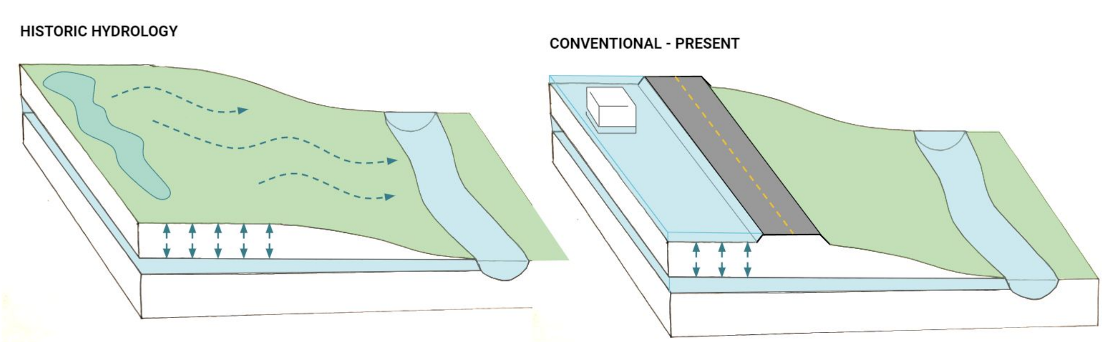
Development patterns in Reidsville and Collins occurred in conflict with the environmental context of the area - filling in historic creeks, inhibiting natural drainage patterns, and placing homes in the historic interdunal zones where wetland conditions thrive. Although these historic characteristics have slowly disappeared from view, these underlying patterns reappear during rain events, causing chronic flooding where the covered features once existed. Chronic flooding is attributed to water accumulating in these local low points, with no way to drain via surface flow, and the presence of high water tables where the soil's capacity to hold water is maximized, unable to infiltrate anymore.



LEFT: In some places, development has been placed in local low points, where wetlands once existed. Today, water accumulates in these local low points and cannot drain elsewhere, and the wetland character of the area comes back to life, leaving flooding for long periods of time.

Roads and Earthwork Inhibiting Drainage

Drainage patterns that would naturally convey water away from ecologically sensitive areas are exacerbated by roads that are at higher elevations than adjacent properties. While roads are typically built at elevations higher than adjacent landscape to ensure that roads can be safely traveled upon in events of flooding, unintended impacts have resulted, where water conveying downstream towards the creeks are often impounded by the road acting as a dam. This results in water remaining on properties for long periods of time, with no way to convey across road or off property, especially impacting areas in Reidsville and Collins where there are regional low points.



ABOVE: Roads or earthwork associated with development have inhibited regional drainage patterns, acting as dams for stormwater that would naturally convey downstream towards the creeks, resulting in water accumulating with no way to drain.

Constricted Tributaries

At many of the intersections of roads and tributaries, the streams are constricted by culvert piping to pass under the road. This constriction often causes the tributaries to back up upstream of the culvert, causing the stream to overflow into the swamps surrounding the water channel and sediment within the water to deposit, increasing the wetland footprint over time as the inundated land comes to support the swamp-like ecological character. The majority of locations where this trend is noted does not cause property flooding, but can give an indication of natural wetland characteristics that are typical for the local ecology.

LEFT: Leftmost picture is the tributary upstream of the crossing at Lloyd Ave. in Reidsville, where water moves slowly through flat culvert, causing backups of water to pond as water moves down. Rightmost picture is the tributary downstream of crossing where it transitions back into a more defined channel condition.

Ineffective Stormwater Infrastructure

Stormwater infrastructure surrounding roads that is meant to intercept stormwater and convey it downstream lacks the efficacy needed to effectively drain the water downstream. Shallow water tables and flat terrain render subsurface storm pipes largely infeasible due to pipe-groundwater interactions and limited pipe capacity due to minimal slope. Due to the flat nature of infrastructure, and the lack of regular maintenance, debris often accumulates in the bottom, further slowing down the water and reducing the infrastructure's capacity to convey water downstream.

Where infrastructure is present, networks are often sparse, fragmented, or often does not align with regional drainage patterns. Ditch networks often end abruptly, collecting water but offering no outlet, allowing water to accumulate but not convey away from properties.

RIGHT: Debris within stormwater networks reduces capacity of infrastructure to collect and drain stormwater away from properties. Leftmost picture is of stormwater inlet in Collins, rightmost picture is of stormwater inlet along Chandler Ave. in Reidsville.

3.0 Community Outreach

3.1. Goals of Community Outreach Events

3.2. Summary of Community Outreach Events

3.3. Needs Assessment

3.4. Asset Map

3.1 Goals of Community Outreach

Effective community outreach stands as a cornerstone of comprehensive flood mitigation efforts. Community engagement is the vital bridge that connects expert knowledge with local wisdom, facilitating informed decision-making, and ultimately, safeguarding infrastructure and residents' quality of life against the increasing challenges posed by flooding nuisances.

Goals of Community Outreach

- **Build Awareness:** Increase the community's understanding of the flood risks they face, including the potential impacts and consequences of flooding.
- **Ground Truth Identified Risks:** Develop an understanding of the anecdotal lived experiences of residents with the risks and vulnerabilities identified in technical analysis.
- **Gain Local Knowledge:** Gather valuable insights from community members about their experiences with flooding and any anecdotal evidence that may fill in data gaps.
- **Determine Community Priorities:** Collate an understanding of community priorities and concerns to tailor decision making processes and recommendations.
- **Community Education:** Provide training and educational resources, such as workshops, to equip community members with resources needed to empower community resilience.

Throughout the project, varying event types (e.g. listening sessions, trainings, site visits, informal interviews, and progress updates) are designed with these goals in mind.

To publicize these events, a wide variety of methods were leveraged to reach a wide audience, including: posting flyers around town, personal invitations to local government officials and stakeholders, postings in local community Facebook groups, and word of mouth.

To track the effectiveness of community outreach events, participation metrics and resident feedback are tracked at each event. A full analysis of metrics to be included in final report upon of remaining community outreach events.

RIGHT: Flyer that was used to publicize several outreach events (Nature Walks and Community Listening Session) in early October

3.0 Community Outreach

3.2 Summary of Outreach Events

The project is in the midst of hosting its official community engagement events, which is proceeding in tandem with consistents effort to communicate with local stakeholders for anecdotal evidence, alignment of efforts with ongoing projects, and collaborative conversations to facilitate progress.

Below is the summary of community engagement efforts that have been conducted so far:

Reidsville & Collins Nature Walk
The Design Team led two Nature Walks, one in Reidsville and one in Collins, on Sunday, October 8th. The purpose of these events was to host members of the community, educate residents on local flora and fauna in their community, and engage with residents on where flooding occurs and how that might relate to the local ecology.

RIGHT: Local residents were engaged to discuss natural drainage patterns during Nature Walk in Collins.

Reidsville & Collins Community Listening Session
The Design Team hosted a dinner and listening session in Reidsville on Monday, October 8th. The meeting commenced with an overview of project status, followed with breakout sessions to discuss flooding anecdotes, community priorities, and community resilience concerns. Findings from existing conditions analysis of suspected flooding trends were ground truthed against local knowledge.

ABOVE: Residents were engaged to understand community priorities for recommendations.

Upcoming Community Outreach Events
Water Quality Monitoring training is to be provided by Altamaha Riverkeeper on October 29th. Workshops to educate the community on nature based approaches, including site visits to see built examples of the approaches, are to be provided by Georgia Sea Grant on November 13th and December 3rd. Summaries of events are to be included in the final report upon completion.

3.3 Needs Assessment

The project team conducted a Needs Assessment through an integration of desktop analysis, site assessment fieldwork, and through community engagement events. During the community listening session, residents of both Reidsville and Collins shared answers to a suite of questions aimed at understanding the community's needs around flooding and related water issues.

The following themes of concerns and priorities were identified in conversation with the community.

Policy

Reidsville and Collins are both relatively small cities with limited resources for addressing issues that arise relating to stormwater management. Citizens, whether they are currently serving in local government or not, would benefit from assistance in learning what initiatives, policies, and regulations other municipalities have enacted to ensure the health and safety of their residents, infrastructure, and businesses. This could include but would not be limited to: adequate planning, land conservation measures, stormwater discharge policies, pervious cover minimums, etc.

The consensus of the community members who attended the listening session was that the community would benefit from the City growing their capacity for the oversight of development, whether it be residential, agricultural, or industrial, to ensure that it is in line with the best interests of the towns and the environment. In addition to regulatory measures, it may be valuable to both cities to incorporate incentive programs to promote conservation of trees and carefully defined green space in development projects.

Communication

Communication is absolutely essential to any municipal or societal function. Both the team and local residents of both Reidsville and Collins observed that communication barriers exist in both towns and keep positive action from being taken. There is a real need for a focused effort to improve formal communication streams to communicate, advise, and warn about flooding for increased community resilience. This could take the form of a community advisory panel, but in any case should be undertaken as a politically neutral effort to establish common ground in building community resilience and well-being that will benefit everyone in the community in the long term.

3.0 Community Outreach

Data

Policy should rest on a foundation of data, something that the project team found difficult to acquire in their analysis. A centralized database of stormwater infrastructure data with regular updates on planned maintenance, repair, and new projects would potentially assist the cities in formulating a plan for upgrading their infrastructure and accommodating expected growth. Such a portal could also be made publicly available and would help with citizen-initiated projects like this one, and strengthen public knowledge of resources and actions being taken by their government. Additionally, developing and providing readily available Flood Hazard Mapping would aid in public education and awareness of stormwater issues, and could help potential homeowners and developers understand the risks and existing hazards in the area. This mapping could also include representation of water quality issues and make visual and spatial connections between the cities and their local impaired waterways.

Education

There is a real need for education on topics relating to resilience in general and water-related issues in particular. The project team observed that a number of local residents were unaware that either Reidsville or Collins experienced flooding. In order for the communities to meet the needs of their residents, residents need to be made aware of the challenges that their neighbors are experiencing. This means education for the general public, especially those who are not already familiar with the stormwater management issues, as well as education for those people in local government who will likely be conduits for external funding and taking action to address water issues. Lastly, this also means education for residents experiencing flooding, to help them understand the causes of flooding and the conventional and nature-based solutions that can be put in place to address both water quantity and water quality.

Reidsville and Collins residents have a deep store of knowledge of their towns and surrounding environment. Any initiative or action aimed at education should account for their place-based expertise and find ways to acknowledge, value, and make use of this knowledge. In particular, those senior residents who have lived in the area for decades should be sought out and listened to.

RIGHT: Residents discussing flooding causes and trends as part of an educational component of the Community Listening Session event.

3.4 Asset Map

An asset map is a visual or representation of the various strengths, resources, and capacities within a community that can be harnessed to enhance resilience in the face of challenges and disasters. It is a tool used to identify and document the existing assets and capabilities within a community, and the threats that are occurring to these assets.

This asset map was collated to deepen the understanding of the resources and strengths available within the community, and the impacts that flooding may have on these assets, to document findings from community outreach and guide curation of recommendations for resilience building.

Key assets identified in the community include:

- **Physical Assets:** Roads, Buildings, Ditches and Pipes
  - All ditches and pipes shown in the maps are based off technical observation, but should not be considered an exhaustive documentation and subject to change.
- **Natural Assets:** Tributaries and Creeks (Current and Historic), Inland Wetlands/Interdunal Areas (Current and Historic), Stormwater Ponds
- **Emergency Management Assets:** Government Buildings, Emergency Medical Services
- **Community Assets:** Churches, Community Centers, Libraries, Public Meeting Spaces
- **Social Assets:** Community Facebook Pages, Word of Mouth, Church Small Groups

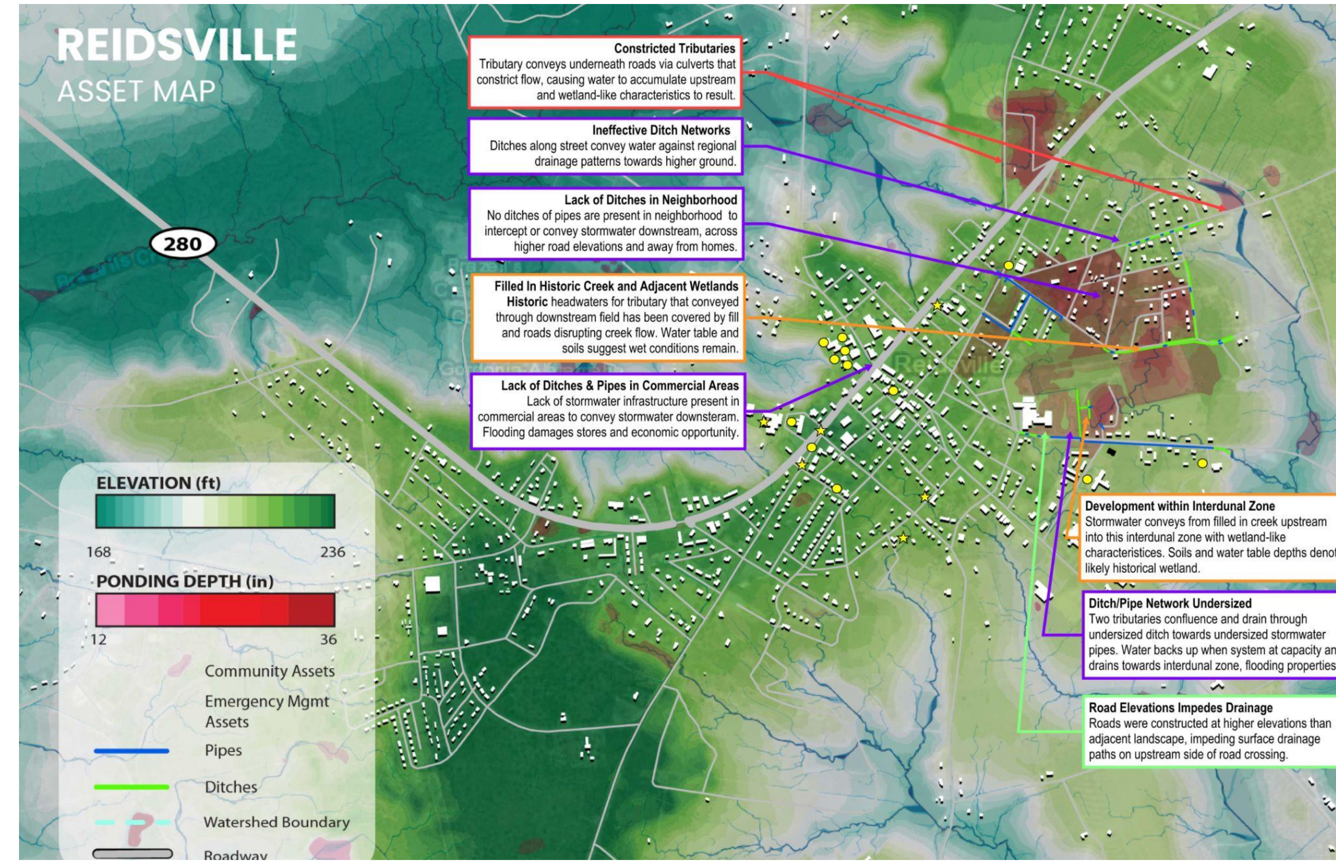
To evaluate the impact that flooding threats have on assets, examples of locations where the trends of drainage inefficiencies manifest in an interaction with assets are documented.

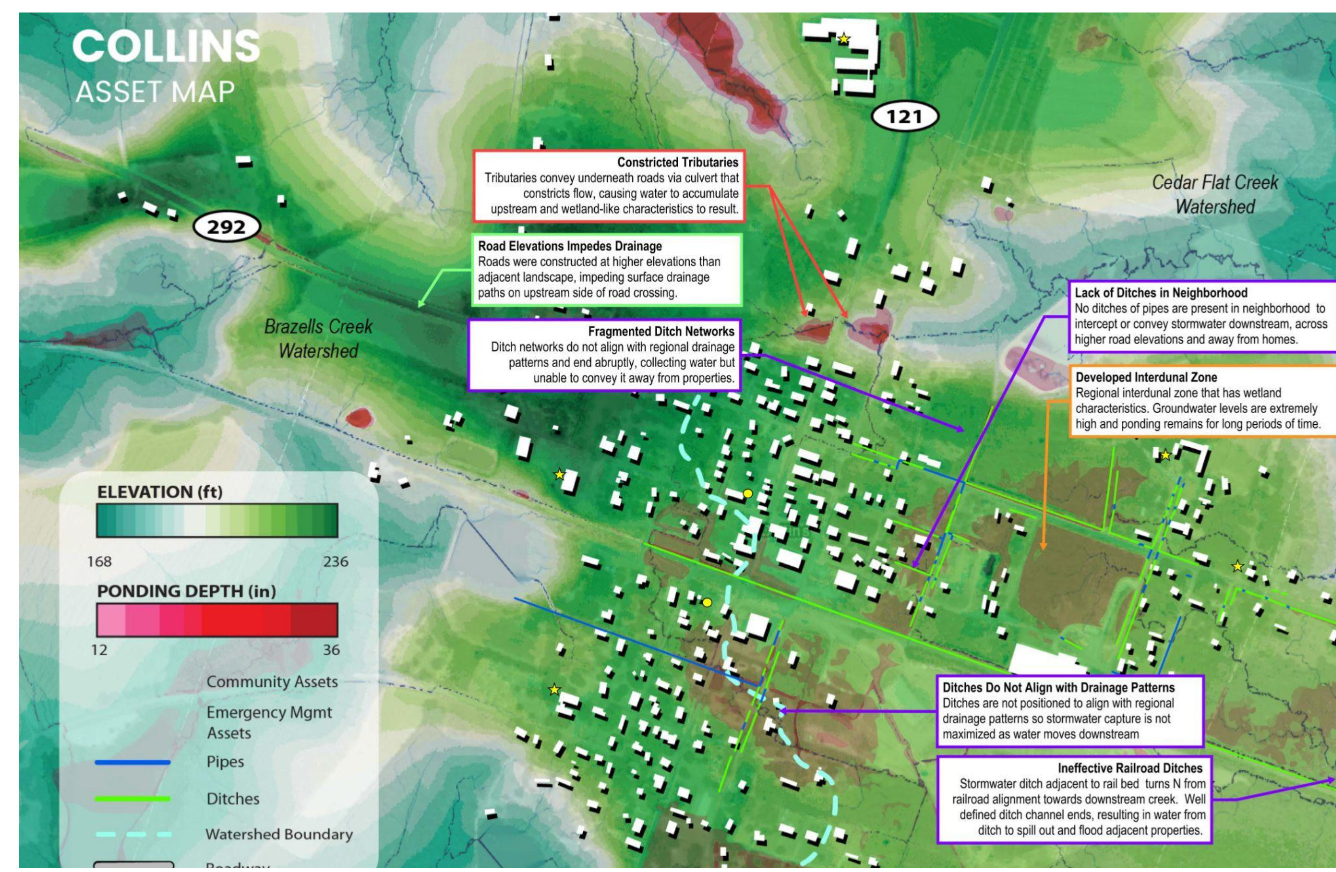
Impacts of flooding at interactions with assets are categorized by color, according to the trend that the interaction embodies.

Trends of Drainage Inefficiencies shown include:

- **Development in Ecologically Sensitive Areas**
- **Roads and Earthwork Inhibiting Drainage**
- **Constricted Tributaries**
- **Ineffective Stormwater Infrastructure**

This Asset Map is meant to serve as a starting place to facilitate discussion for further community engagements and is subject to refinement through the completion of the study.





4.0 Appendix

4.1. Glossary

4.1 Glossary

Anthropocene: The most recent period in Earth's history during which humans have had a substantial impact on the planet's climate and ecosystems

Area Deprivation Index: Area Deprivation Index ranks neighborhoods and communities based on measures of four primary domains (Education; Income & Employment; Housing; and Household Characteristics). Scores are measured on a scale of 1-100, with 100 denoting the highest level of deprivation (most disadvantaged).

Convey/Conveyance: The action of water traveling downhill on Earth, either on the ground as surface runoff or underground as groundwater, due to the forces of gravity.

Culvert: A pipe under a road or railroad that conveys water from one side of the road to another.

Georgia's Fall Line: A geologic boundary marking the prehistoric shoreline of the Atlantic Ocean as well as the division between the Piedmont and Coastal Plain Regions of the state. Rivers below this line tend to be slower moving, large, and easier to navigate than those above.

Georgia Coastal Plain: A subregion that encompasses the lowest-lying areas of the Atlantic coastal plain the state. It contains barrier islands, marshes, swampy lowlands, as well as flat plains and low terraces.

Green Infrastructure: Ecological systems, both natural or engineered, that acts as"living infrastructure" and depends on soil and plants that manage stormwater, in addition to providing aesthetic, social and sediment limiting functions.
Groundwater: Water that is held underground in the spaces (voids) between dirt in soil or in the spaces or cracks of subsurface rock.

Hydrologic Soil Group: A classification of soil, depending on the properties of the soil, that determines the ability of the soil to absorb water from the ground above.

Infiltration: The flow of water from above ground on the surface into the subsurface soil.

Low Point: A location that is lower in elevation than all of the land immediately surrounding it, resulting in a location where water travels to when traveling downhill, but has no other place to travel from, resulting in the accumulation of water (flooding).

Opportunity Index: Evaluations four dimensions of community well-being: Economy; Education; Health; and Community, with a potential score 0-100, where 100 indicates maximum opportunity.

Pleistocene: The geological epoch that lasted from c. 2.58 million to 11,700 years ago. It spans the Earth's most recent period of repeated glaciations and is also known as the Ice Age

Saturated Soil: A condition describing when soil is completely filled with water in the spaces between the dirt, limiting the ability of the soil to take on any additional water.

Sediment: Dirt or other natural material that is transported by surface runoff when the water is traveling downhill. When water reaches a point where it is no longer moving, sediment drops to ground and is left on the surface, even after the water is gone. Sediment often includes dirt with high nutrients, and is therefore good for farming, but can be dangerous for wildlife and plants by disrupting natural systems if the sediment enters creeks, rivers, and water bodies.

Social Vulnerability Index: The social vulnerability index is a measure of the degree of social vulnerability in counties and neighborhoods across the United States, where a higher score indicates higher vulnerability.

Soil Type: The classification of soil in an area based on its physical and chemical characteristics. Characteristics of soil differ between areas due to the presence of water, the depth of subsurface water, and the presence of rock.

Surface Runoff: Excess water from rain that cannot be absorbed into the ground,or evaporated into the atmosphere, and travels downhill following gravity towards ditches, creeks, rivers, and the ocean. In some developments, stormwater pipes intercept surface runoff and transport the water underground with pipes.

Tributary: A smaller stream or creek that drains to a larger stream or creek.

Water Table: The point underground where any soil beneath the point contains water in all the spaces between the dirt.

Watershed: An area of land that drains all the surface runoff, ditches, and streams to a common outlet such as the outflow of a pipe network, reservoir, or any point along a stream.