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A Hidden History of Asheville: Investigating Subterranean Streams through Environmental Interpretation

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Abstract

The City of Asheville is located within the greater French Broad River drainage basin and features many unique subwatersheds. The River Arts District (RAD) subwatershed within Asheville possesses a rich cultural history connected to the river. The City of Asheville is collaborating with multiple local organizations to complete a public beautification project which incorporates creatively highlighting the history of the RAD along with the ecology of the French Broad River. This research supported the beautification project and produced signs to benefit the Asheville community. A review of cultural and ecological history and subterranean streams within the RAD watershed informed the creation of an interpretive sign to be installed in the district, along with designs of two other signs. This synthesis paper aims to investigate the melding of creative design, ecological knowledge, and environmental education. Research methods included both correspondence with local stakeholders and literature reviews of interpretive sign techniques and historical ecology of the region. The sign exemplifies the overarching theme of the beautification project in promoting a sense of place and stewardship for natural resources and cultural heritage within the French Broad River basin.

1. Introduction

The River Arts District (RAD) is a unique area of Asheville with a rich cultural and ecological history. Once an industrial district, the RAD now houses over 200 artists and is a popular tourist destination[1]. The French Broad River runs along the western boundary of the district. The river held a vital role in the early establishment of the RAD and is still a major factor in the continued growth of the area. The relationship between the RAD and the French Broad River is an important narrative to communicate to visitors and citizens alike. This project sought to combine the artistic style of the RAD with ecological and historical knowledge to create permanent interpretive signage to be featured in the district.

In a continued effort to make the RAD more accessible by multi-modal transportation, the City of Asheville is undertaking the River Arts District Transportation Improvement Project (RADTIP)[2]. Through infrastructure changes made within the RADTIP, public art will be featured along new sidewalks, greenways, and river access points as a means of re-connecting the public to the French Broad River and the RAD watershed. The interpretive signs created in this project were planned in conjunction with other art installations within the RADTIP, in efforts to create complimentary themed pieces.

Three signs were originally proposed for design and fabrication. The signs were to be posted at the Bacoate Branch tributary, the Town Branch tributary, and an unnamed tributary near the Craven Street Bridge (Figure 1).

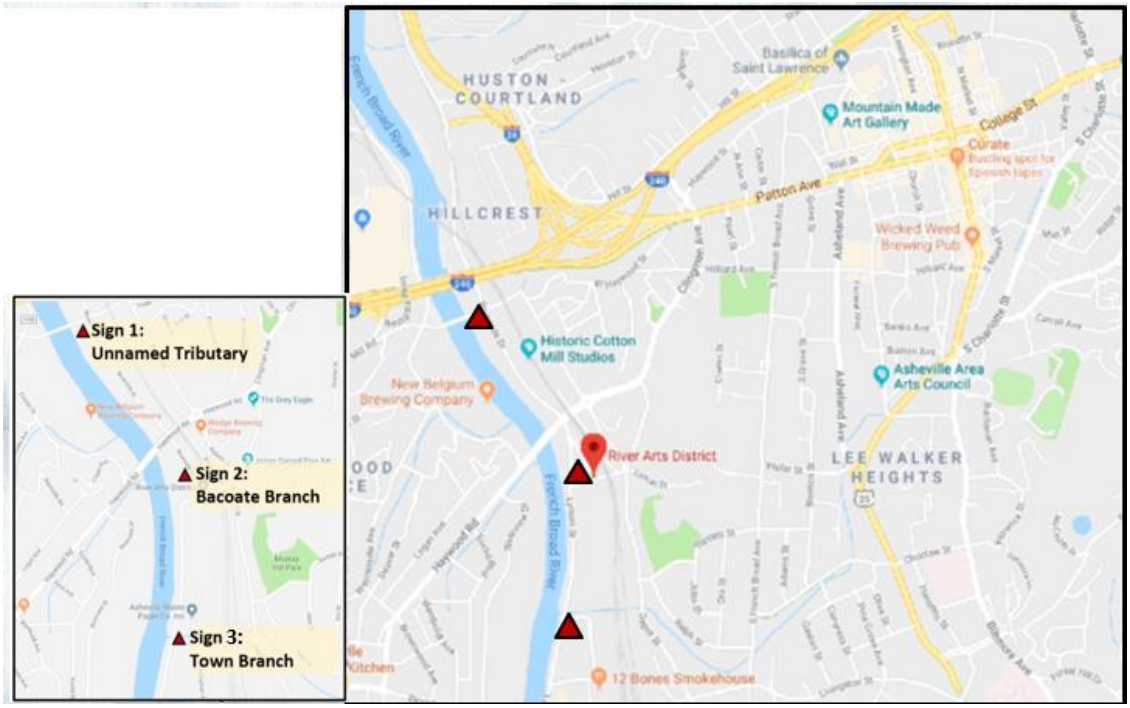

Figure 1. Proposed locations of three signs.

1.1 French Broad River

North Carolina is segmented into four prominent bioregions: mountains, piedmont, coastal plain, and tidewater[3]. The North Carolina portion of the French Broad River watershed is located in the mountainous bioregion in the western portion of the state (Figure 2).

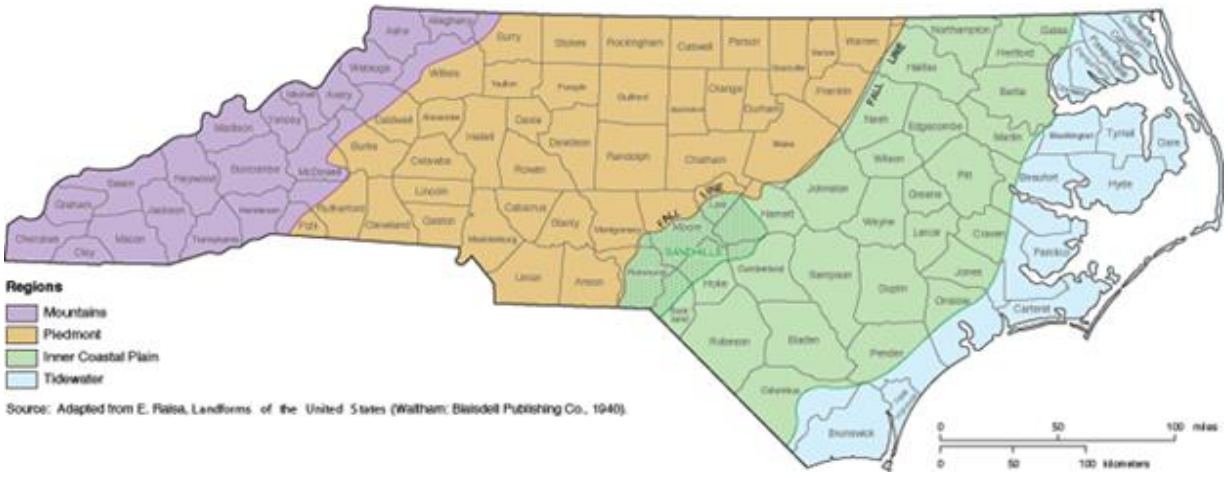

Figure 2. State of North Carolina with recognized bioregions. From left to right: mountains, piedmont, inner coastal plain, tidewater.
Source: https://www.ncpedia.org/exploring-north-carolina-geography-geology-climate

Western North Carolina is classified as the mountainous bioregion of the state and hosts ten river basins which cumulatively drain approximately 11,460 square miles (Figure 3)[4].

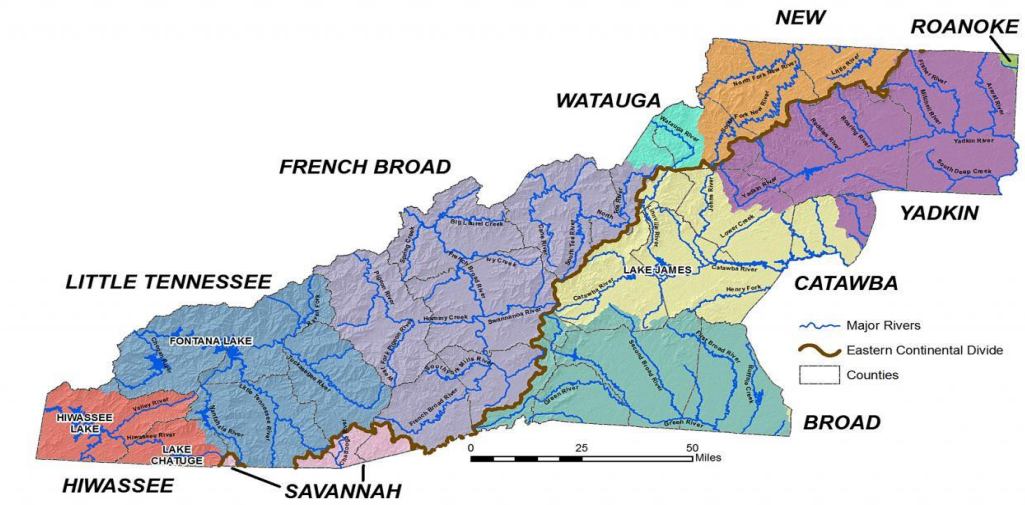

Figure 3. River basins in Western North Carolina.
Source: http://www.wncvitalityindex.org/water/river-basins

The French Broad River (FBR) is the largest waterway in western North Carolina, draining 2,830 square miles, approximately one quarter of the total region[4]. A unique attribute of the FBR is that it originates from four large tributaries that flow together from the four cardinal directions[5]. The FBR basin portion of the Appalachian mountain range has been recognized by the U.S. Forest Service as an area of highest importance in ensuring supplies of surface drinking water (Figure 4)[6].

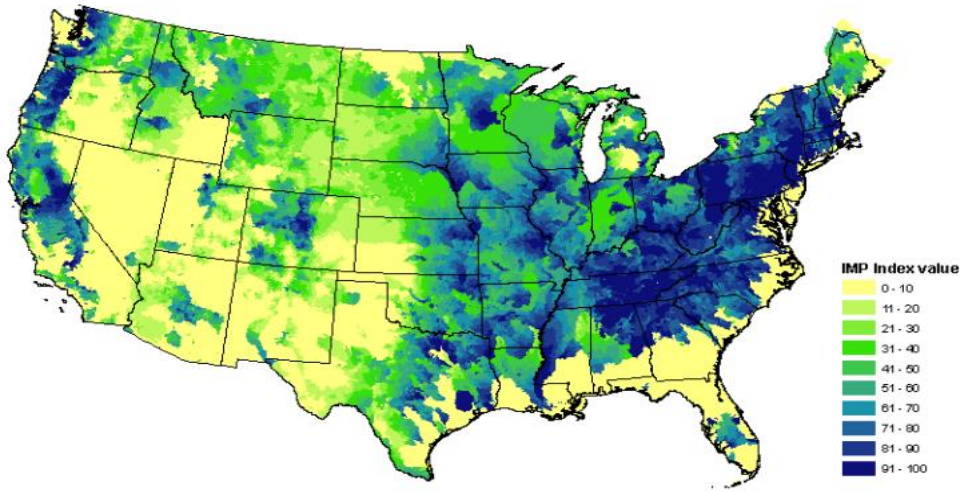

Figure 4. U.S. Forest Service surface drinking water importance index. Areas of higher index value represent areas most important for surface drinking water.
Soure: https://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml

The river holds cultural significance as it was a vital part of life for the Cherokee. During the thousands of years the Cherokee and their predecessors occupied the region, the river was known as Agiqua, translated as "Long Man", while the tributaries were his "chattering children"[5]. Cherokee settlements and hunting areas could be found throughout the North Carolina portion of the French Broad River basin, with the remains of over 20 villages lining major tributaries such as the Swannanoa River. When European settlers began colonizing the region in significant numbers in the mid 1700s, the river provided food, transportation, and drinking water[5]. Despite cultural significance, as population and development increased through the industrial revolution, the river and many of the tributaries were treated as sewers along their entire length[5]. Industrial operations such as paper mills, oil and gas factories, and waste processing plants dumped millions of gallons of raw sewage and industrial contaminants directly into the river. This direct dumping is an example of point source pollution[7].

Point source pollution in the FBR basin has since been restricted and continually regulated by the Clean Water Act, passed in 1972[7]. Restorative treatment of the FBR by both state and private agencies began in the early 1990's to improve water quality, primarily centered around erosion and sedimentation[8]. While point source pollution is no longer the main threat to the river system, the river is still facing contamination, invasive species introduction, and bank degradation due to non-point source factors. Non-point sources include runoff from agricultural fields and impervious surfaces and sediment from development sites.

The FBR flows along the western portion of the City of Asheville and the RAD. The watershed that encompasses the RAD was delineated by local environmental organization RiverLink for conservation and public awareness purposes (Figure 5). The French Broad Riverkeeper deems the concept of a watershed as one of the most critical components to beginning to understand rivers and remedy our relationship to them[8]. Watersheds include not only the waterways draining an area, but encompass all of the land within the delineated area[9]. This distinction is critical in building a public understanding of conservation and stewardship. By bringing attention to the area encompassed in the watershed, community members can begin to visualize the relationship occurring between the RAD and the river.

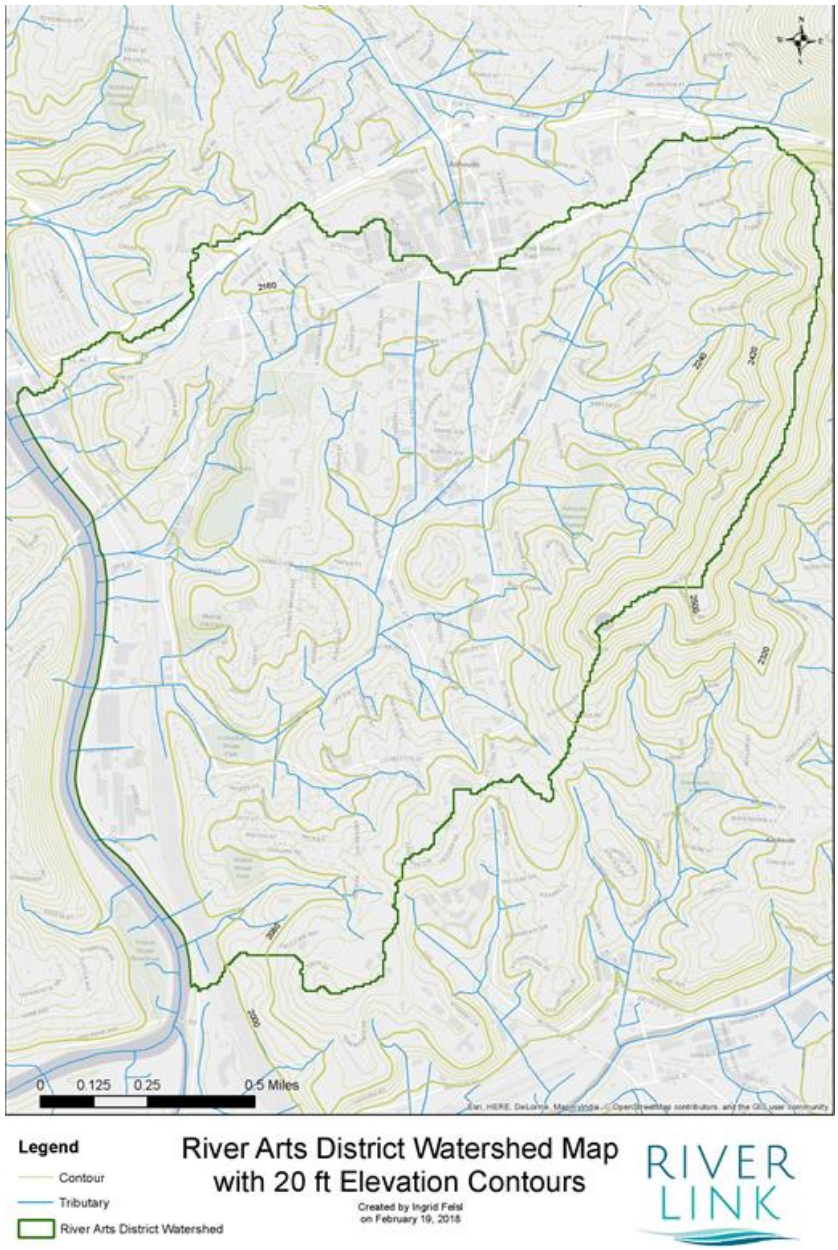

Figure 5. River Arts District watershed delineation. Portions of some tributaries are subterranean. Provided by RiverLink.

There are five major tributaries within the RAD watershed, some portions of which historically flowed freely above ground. Although the tributaries in Figure 5 may appear as though they are all flowing at surface level, many are actually now channelized underground. As the built environment encroached upon these waterways, it became common practice to route the streams through underground pipes. These pipes travel below sidewalks, roads, and even buildings as the streams flow towards the river[10]. Recent research has revealed the importance of "daylighting" these waterways: the practice of removing pipes and allowing streams to be visible at surface level[11]. Surface tributaries provide critical ecosystem functions to the watershed as a whole, including habitat for aquatic and riparian species, nutrient processing, and debris filtration[12]. These functions, as well as diversity of species, are impaired for the entire river basin when waterways are routed underground[13].

Daylighting has provided numerous positive contributions to associated communities and ecosystems when implemented in various cities throughout the United States[11]. Many contributions are specifically pertinent to the southern Appalachian bioregion including the reduction of flash floods, erosion, and pollution transport, all of which are common issues for the region[14]. There is a need to bring community awareness to buried streams, as it is not common public knowledge. As evaluated in 2002, most successful daylighting projects completed in the U.S. were paralleled with a strong component of community involvement[15].

1.2 Interpretive Signs: Principles and Design Considerations

Interpretation is the practice of communicating information that requires various forms of translation to convey[16]. This translation can occur across languages or through simplifying complex information into relatable and interesting concepts and visuals. The latter is true for environmental interpretation, which seeks to translate scientific understanding into a pleasurable and relatable experience for the public[16]. Techniques in environmental interpretation are most commonly applied in the creation of public educational signage, brochures, and displays. Transforming environmental facts into a relatable visual experience can allow audiences to gain a personal sense of enjoyment and appreciation for environment, heritage, and conservation[17]. Interpretive signs have shown success in increasing visitor knowledge of public natural areas[18].

Environmental interpretation provides an accessible means of conveying environmental understanding to an audience that may not be likely to attend a structured, organized event led by an individual or group. While interpretation offers a unique educational opportunity, the voluntary participation of the practice requires the interpreter to adapt to reach a non-captive audience. This marks a key distinction between formal and informal educational practices: non-captive audiences in informal settings are not held accountable for gaining information through grades or other measurable outcomes, as occurs in formal school-based education[16]. This is also referred to as free-choice learning, indicating self-directed and voluntary behavior[19]. Due to the lack of structured assessment, non-captive audiences must be enticed to participate in the learning experience by believing there is something intrinsic to be gained from the time invested.

A key means of gaining and sustaining the interest of free-choice learners is ensuring information is regionally relevant, audience-appropriate, and of multiple perspectives of importance[16]. Incorporating multiple perspectives allows for the audience to engage with the information in a personalized manner, which heightens the likelihood of prolonged interactions with signs and long-term retention of information[17].

2. Methods

All signs were designed in response to the needs expressed in a public workshop with visiting environmental artist Betsy Damon on April 6th, 2018. Damon was invited to visit Asheville to help catalyze community collaboration as part of a course at UNC Asheville with support from the RADTIP initiative. Damon creates sculptural works that meld creativity and science together around the theme of water quality[20]. During the workshop with Damon, community members in attendance voiced the importance of portraying the shape of the RAD watershed (delineated by local organization RiverLink) and bringing public attention to the tributaries within the watershed that are hidden from view. This illustrated an overall interest in heightening a sense of place for local citizens. These concepts formed the basis for the creation of signs within this project.

Meetings following this workshop with Stephanie Monson from the City of Asheville, Dr. Ormsby, and Lyric Antio led to the City's support for the design and fabrication of three interpretive signs.

ArcMap 10.6 digital mapping software was used to create the watershed graphic for use on all signs. The shapefile of the RAD watershed delineation was acquired from RiverLink. Public domain street and building files were acquired from the Buncombe County GIS database. Stream flow lines were acquired from the United States Geological survey database. All files were run through the Clip function to create a contained graphic within the borders of the delineated watershed. The Smooth function eliminated pixelated edges of the watershed and interpolated a curved and distinct shape. Other refinements included display line sizing, color variations, and orientation/resolution adjustments.

The map graphic was exported as a high resolution JPG file for extended editing in Adobe Photoshop, where all other aspects of the Bacoate Branch sign were created. To honor the history and current style of the RAD as an industrial district, the aesthetics of the sign intended to convey an industrial, urban theme. This theme informed the decisions to feature cog, bolt, and sheet metal vector files, acquired from royalty-free online download sources.

Additionally, stylistic choices such as font choice (Baskerville Oldface and Capture It fonts), color scheme, and background features were cohesive with the industrial theme. Aesthetic decisions such as these are critical in captivating an audience and perpetuating a sense of place and familiarity when interacting with the sign[16]. Spacing and size considerations were drawn from principles of white space balance, governing that the active portions of the sign (text and images) are not overwhelming, yet the sign does not feel empty[21].

Throughout the sign design process in Spring and Summer of 2018, correspondences with the City of Asheville, RAD artists, community members, and local environmental organization RiverLink aided in decisions regarding the Bacoate Branch sign content. The watershed map graphic warranted textual elaboration on tributaries of the French Broad River, with emphasis on the subterranean aspect of the tributaries. An explanation of the origin of the name of the tributary, Bacoate Branch, was determined valuable to include. Personal communication with Matthew Bacoate Jr. on June 7th, 2018 informed the portrayal of the Bacoate family story. Bacoate Branch emerges to daylight where the sign has been installed, before being routed beneath an adjacent building. The historical usage and renovation of the building was suited for inclusion as the third subject on the sign.

The unnamed tributary sign was unable to be funded and fabricated within this project, and thus a pencil draft was created. The concept of this sign was to inform the public of three native riparian species. The species were chosen through personal communication with local botanists and horticulturists. The concept and species chosen were used by local business Equinox Environmental to create a sign to be installed near the unnamed tributary location. The map graphic created within this project was also the main feature of the Equinox sign.

Also unable to be funded and fabricated within this project was the Town Branch sign, which was drafted in pencil. This draft featured three unique species of animals native to the French Broad River Basin. A literature review and communication with local ecologists informed the choice of animals for the draft.

3. Results

3.1 Overview

Using a combination of research and personal communications, it was determined that the cultural and ecological history of the RAD area were both of vital importance to the community. Both cultural and environmental perspectives were woven into a historical narrative of the RAD watershed using a combination of graphics, illustrations, and text to be featured on signs in the RAD.

3.2 Signs

The goal of this project was to complete the design and installation of three interpretive signs for the River Arts District (see Figure 1 for sign locations). One sign, for Bacoate Branch, was fully designed and installed within the duration of this project. The two remaining signs were drafted, with one draft serving as the inspiration for a sign created by the environmental consulting organization, Equinox Environmental.

The Bacoate Branch sign was installed in August 2018 (Figure 6). The sign features information on the naming of Bacoate Branch, hidden tributaries within the watershed, and the historical use of the building where the sign was installed. Bacoate Branch flows directly under the building, which created an ideal opportunity to highlight subterranean stream systems. The industrial theme of the RAD can be interpreted from font and graphics choices.

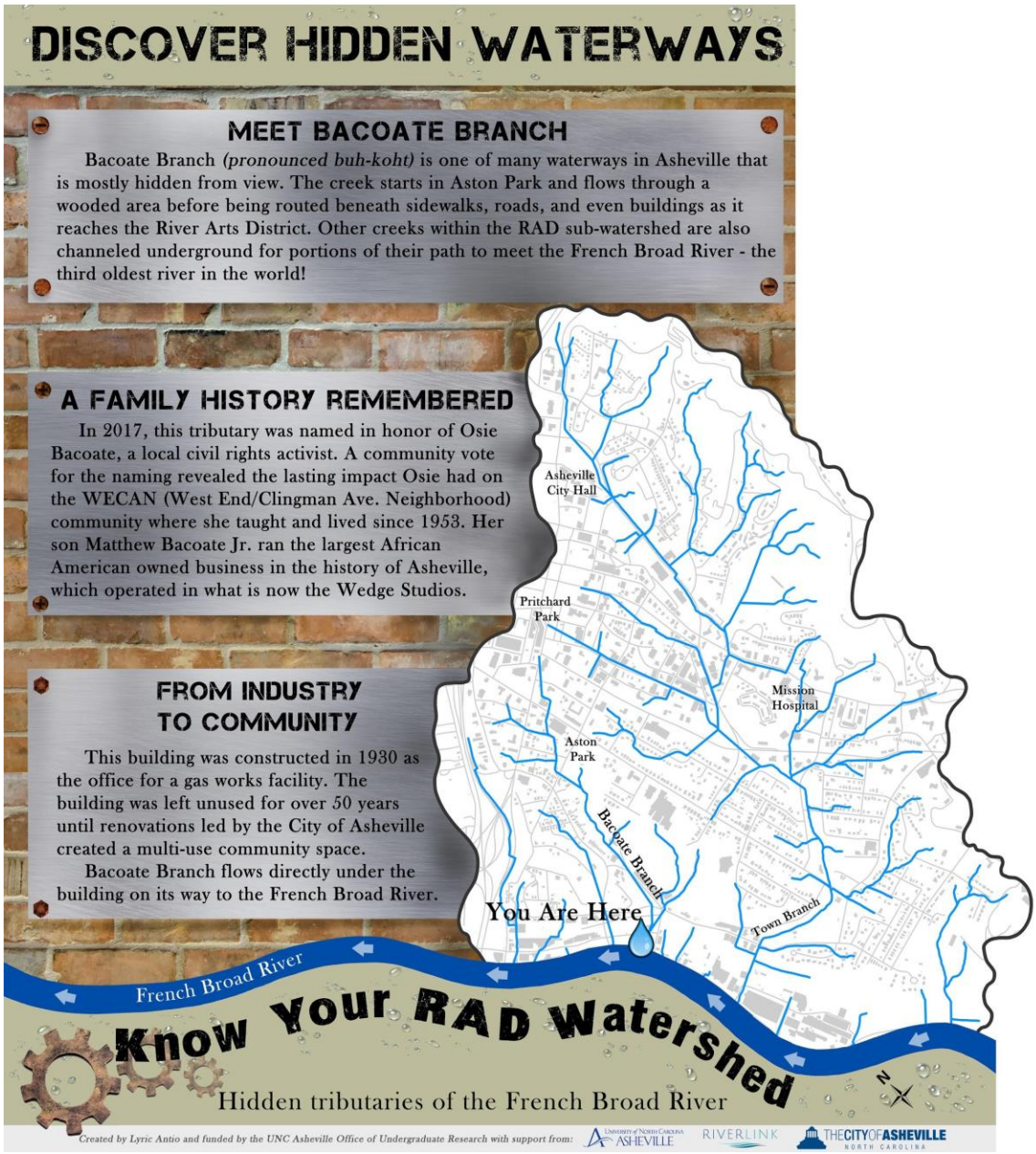

Figure 6. Completed sign graphic for Bacoate Branch. Designed by Lyric Antio.

Bacoate Branch was named after the late Osie Bacoate, a local civil rights activist who resided in the adjacent West End Clingman Avenue Neighborhood since 1953[22]. Osie was described by her son, Matthew Bacoate Jr., as a strong community leader working in a time of racial injustice. Bacoate Jr. owned the largest African-American owned business in the history of Asheville, AFRAM, which operated in what is currently the Wedge Studios[23]. The creek was named to honor the lasting impact the Bacoate family had on the River Arts District.

A concept draft was created for the unnamed tributary sign (Figure 7). Three native riparian plant species were chosen to be featured on the sign as recommended by ecologists and horticulturalists at UNC Asheville. Three species were chosen: common elderberry, swamp milkweed, and sycamore.

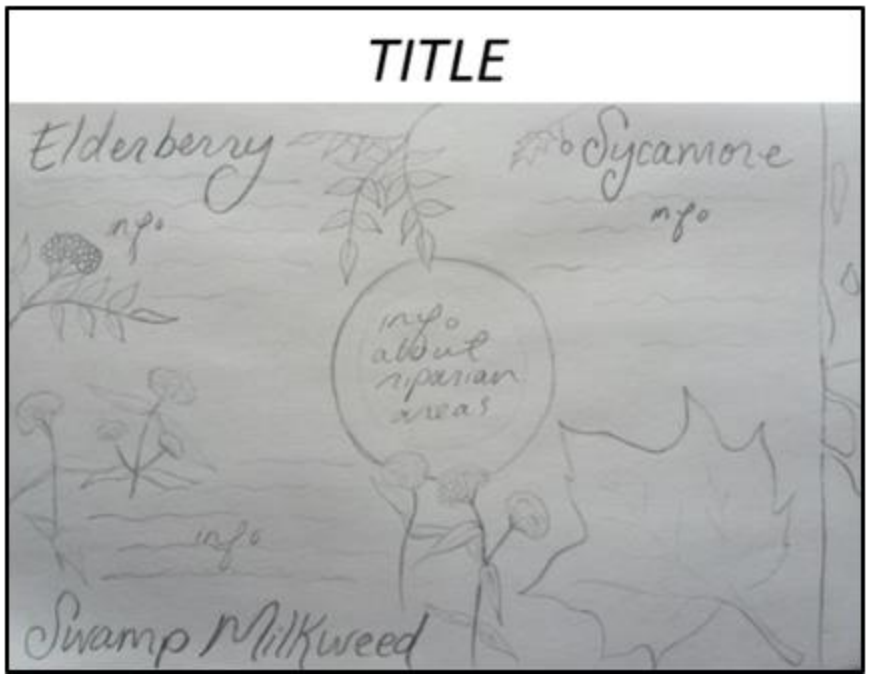

Figure 7. Concept draft for unnamed tributary sign, featuring local riparian flora.

Common Elderberry (*Sambucus canadensis*) is a flowering shrub native to North Carolina. It is particularly known for flowers that attract a variety of pollinators and berries that provide food to many species of birds[24]. The shrub can commonly be found growing along small streams or in wider riparian areas, as it prefers moist soil with deciduous associates[24]. Elderberry has a variety of historical uses by Native Americans across its range. The berries mainly provided a food source, with additional medicinal values for which other portions of the plant were also used[25]. This includes parasite removal (bark) and kidney pain relief (roots)[26]. Tools and dyes were also crafted from the plant[25].

Swamp Milkweed (*Asclepias incarnata)* is a flowering herbaceous plant requiring moist habitat, such as stream banks, where it gained its Cherokee name of *guhí* meaning "it stays green in the water"[25]. The plant produces a showy flower in late summer which attracts many pollinators, particularly butterflies[27].

Sycamore (*Platanus oxydentalis)* is a large single-trunked tree, primarily inhabiting and reaching fullest height in riparian areas along large rivers[28]. The sycamore provides food to seed-eating birds and its strong root systems anchor soil along stream banks[28]. The tree also held medicinal and folklore value to the Cherokee. The inner bark was commonly decocted for topical application on skin conditions which resembled the flaking, scaly bark of the tree. The roots that were submerged in water were believed to have special significance and were used in a variety of ways[26].

The sign draft was not completed because, prior to completion, the concept and original map graphic were used by local organization Equinox Environmental for a separate grant project (Figure 8).

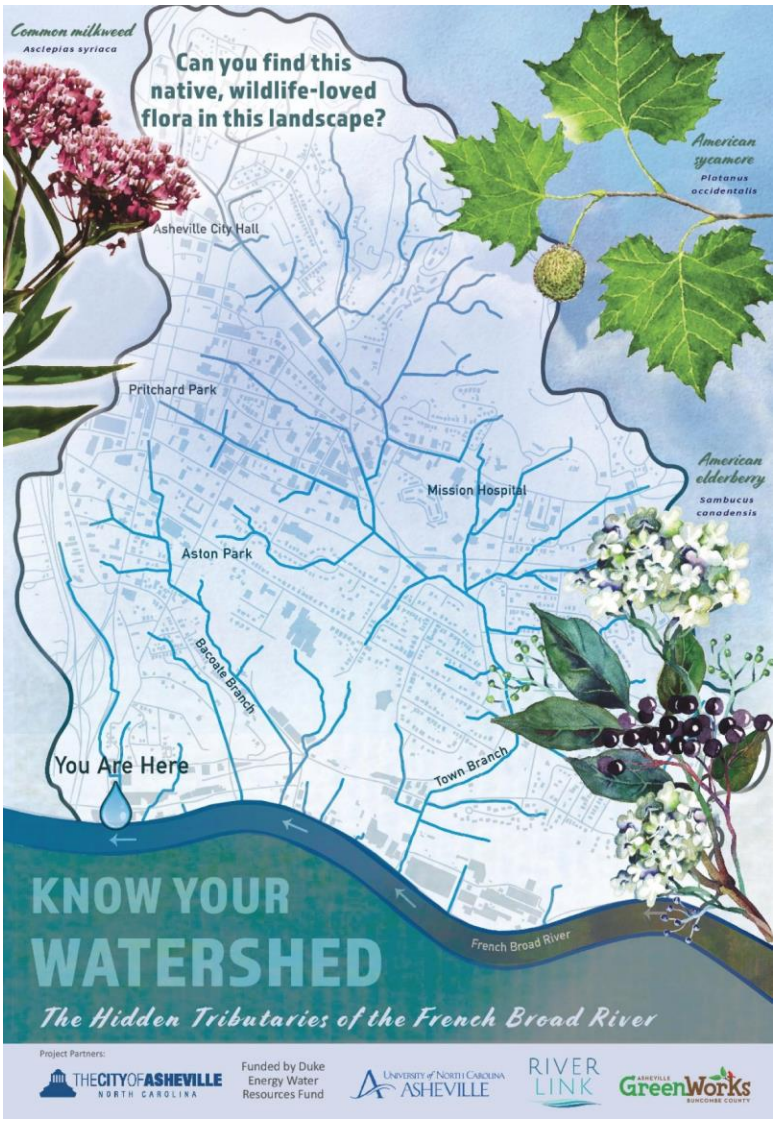

Figure 8. Sign created by Equinox Environmental using concept and graphic created by Lyric Antio.

A sign was drafted for the Town Branch outfall, with emphasis on the ecology of the river basin (Figure 9). The draft features key aquatic species native to the area which are facing a variety of challenges due to problems afflicting the French Broad River. Three species were chosen to be featured on the sign, driven by a literature review and personal communication with ecologists at UNC Asheville.

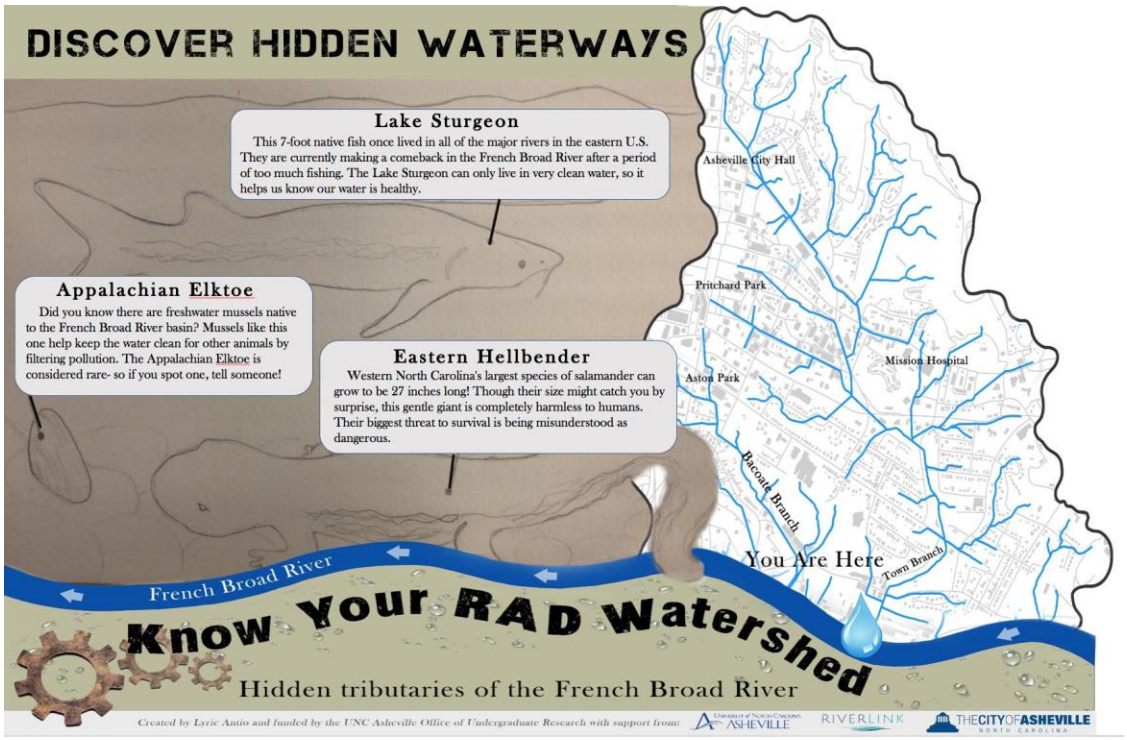

Figure 9. Draft sign for Town Branch, featuring local fauna.

The Appalachian Elktoe *(Alasmidonta raveneliana)* is a freshwater mussel native to the French Broad River basin and upper Tennessee River basin, inhabiting small mountain tributaries that feed the rivers. The mussel has been federally endangered since 1994[29]. Freshwater mussels are facing endangerment and extinction at rates much higher than other groups of organisms, with 67% of North American native mussels believed to be extinct[30]. Freshwater mussels such as the Appalachian Elktoe provide multiple benefits to ecosystems where they occur, including particle filtration and habitat preservation for benthic insects[30].

The Eastern Hellbender (*Cryptobranchus a. alleganiensis*) is one of the largest salamanders in North Carolina, reaching lengths up to 70 cm[31]. The species requires the specific habitat features of fairly shallow, highly oxygenated riffle areas where large flat rocks and debris are present[31]. These conditions are imperative for feeding behavior, as the primary prey of the hellbender is crayfish. Additionally, hellbenders require high water quality as they uptake oxygen through their skin[32].

The hellbender was historically abundant in shallow rivers and tributaries throughout the mid-eastern United States, but has been steadily declining in population due to reduction in water quality and encroachment of development[32]. It is now ranked a species of special concern in North Carolina[31]. One of the most common threats to the population is an under-informed public, as the animal is often misperceived as dangerous and subsequently killed[32]. Thus, increasing public awareness through successful environmental interpretation may play an integral role in conserving the hellbender.

Lake Sturgeon *(Acipenser fulvescens)* historically had a wide range across eastern north America, through major lake, bay, and river systems east of the Mississippi. As sturgeon require upstream migration to spawn, excessive damming throughout the 20th century imperiled the fish, and populations became endangered[33]. Other factors contributing to this decline include overfishing and increase in water pollution[34]. The Lake Sturgeon has recently been reintroduced to the French Broad River basin as 7000 fish were released into the French Broad River in Hot Springs, North Carolina in 2015[35]. The species is currently surviving and reproducing for the first time since the 1940s[33]. As the fish is intolerant to pollution, its reintroduction can provide biomonitoring of water quality in the river basin.

4. Discussion and Conclusion

4.1 Interpretive Signs and Greenways

The three signs are intended to be installed along a new greenway through the RAD. Greenways are increasing in popularity in the United States, bringing forth concerns about and opportunities for environmental education[36]. Asheville currently maintains four greenways (Glenn's Creek, Reed Creek, French Broad River, and River Bench Park) totalling less than 5 miles in length[37]. There are currently seven additional greenways in the planning stages or pending funding, which would increase the overall mileage of greenways within the city to over 15 miles (Figure 10). This includes the Bacoate Branch Greenway and Town Branch Greenway that adjoin sign installation sites for this project[37]. Though the RADTIP project, which includes additional construction beyond greenways, is set to be completed by the end of 2020, the other greenway-specific projects are without timelines but are "shovel-ready and pending funding"[37].

Figure 10. Map of current and proposed greenways in Asheville and greater Buncombe County. Source: https://mountainx.com/news/community-news/062012the-path-ahead-county-greenways-plan-faces-major-hurdles/

Creating new public access spaces along the French Broad River and forested areas includes the responsibility of instilling a sense of place and appreciation in visitors, so as to reduce disruptive behavior. The installation of interpretive signs in the River Arts District allows for voluntary engagement of visitors in these spaces. Engagement with the signs will provide a heightened community knowledge of the ecological and cultural history of the region. Interpretive signs along paths are statistically more likely to provide retained information to more visitors than established kiosks or direct interaction with a guide[21].

4.2 Challenges and Recommendations

The original intention for this project was to research, design, and fabricate three interpretive signs to be installed in the River Arts District. Multiple factors prevented this goal from being reached. One issue was lack of adequate funding. An additional issue encompassed unclear communication and misinformation from various stakeholders involved in the project. Discrepancies in communication caused deadlines to shift and altered the scope of the project

from the original agreement. These factors compounded to influence the decision to design and fabricate a single sign for Bacoate Branch, while completing a draft of a secondary sign for Town Branch and allowing original graphics and ideas to be used on a sign designed by Equinox Environmental for an unnamed tributary. This prevented overall style and content cohesiveness of interpretive signs being installed and caused internal deadlines to change multiple times.

The Damon workshop provided insight into specific community concerns and priorities within the RADTIP project as a whole, but this input came prior to the establishment of this sign design endeavor. Following the decision to create signs, a comprehensive surveying of community needs through formal written and verbal response would have provided a more inclusive and thorough reference for sign subject prioritization. Due to time restrictions, this could not be completed prior to sign design. The selected community members who provided input may have included personal bias and did not quantify a large sample size.

Due also to the brief duration of this project, the effectiveness of the Bacoate Branch sign in educating the public on historical aspects of the RAD is difficult to determine. Levels of success regarding the interpretive design cannot be evaluated without sufficient surveying and evaluations of site-specific interactions with the sign. It is recommended that this be done in the future.

Based on the challenges listed above, there are several recommendations for future projects of similar scope. Though not deemed appropriate for the scope of this project, it is recommended that for future endeavors to create installations involving multiple parties/municipalities, a detailed and binding contract be signed by all involved. This would ensure that the original agreed upon terms are upheld, which encourages timeliness and communication across all parties.

For practices such as interpretive information conveyance through signage, the effectiveness of the communication is critical in assessing successes and failures of the project. Thus, it is recommended to include a survey method that analyzes interactions between signs and viewers to ensure the desired outcome is achieved. Additionally, more comprehensive analysis of existing signs and cultural preferences within the area designated for installation is necessary for preserving heritage and authenticity.

4.3 Implications

Research findings described within this study may influence restoration actions of local organizations regarding future daylighting and public education projects in the FBR basin. The addition of interpretive signs at Bacoate Branch and the unnamed tributary within the RADTIP project will serve the public for many years to come. The additional drafted sign for the Town Branch outfall has the potential to be fabricated in the future or act as a template for other future signs. Evaluating the efficacy of the Bacoate Branch sign offers a potential for future research.

Through the collaboration of diverse stakeholders, the RADTIP signs aim to illustrate the rich narrative of southern Appalachian culture and ecology centering around the French Broad River. This research is of great value to the community in providing a synthesis overview of the RAD watershed and establishing educational signs to inform the public on the uniqueness of the watershed. The project paired the historical narratives with an understanding of watershed restoration techniques and the importance of public place-based education through interpretive signage.

5. Acknowledgements

The author would like to express their gratitude towards their research advisor Alison Ormsby, for supreme support within the project and ongoing endeavors. Additionally, the resources provided by Asheville organization RiverLink were invaluable to the completion of the RAD watershed map graphic. Feedback from Renee Fortner of RiverLink aided in the preservation of accurate ecological and historical knowledge regarding Bacoate Branch. Various affiliates of the City of Asheville allowed for the sign to be installed on public property in the River Arts District.

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