Restoring the Rivanna Trail through Stream Restoration

Examining Racial and Political Injustice in the Flint Water Crisis

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

In Charlottesville, Virginia, nestled just behind the University of Virginia's North Grounds Recreation Center and stretching along a portion of U.S. Route 29, a small tributary meanders its course into the Rivanna River. Over the years, the Rivanna Trail, which runs alongside the tributary as well as throughout Charlottesville, has woven itself into the fabric of the community, uniting people from various backgrounds, and contributing to the city's unique connectivity and diversity. The Rivanna waterways have drawn some concerns as this tributary and others like it have suffered severe degradation over the years. Consequently, this particular segment of the Rivanna Trail sees fewer visitors, exacerbating a disconnect in the community. Moreover, this tributary eventually merges with the Rivanna River, renowned for its offerings of kayaking, tubing, fishing, and paddleboarding. Beneath its pristine exterior, a hidden issue looms the possibility of polluted waters seeping in from smaller tributaries, often with limited hydrological flow, leading to concentrated pollution (Frisbee, 2022).

The heart of the problem lies in engineering design. Often, engineers fixate on the technical aspects of a project, sidelining the broader impact on the community. In the case of the Flint water crisis, the engineers involved completely disregarded the community impact in route to a cheaper solution to drinking water access (Denchak, 2018). With the Flint Water crisis as our guide, our mission is to craft and implement a river restoration design that encourages the use of the Rivanna Trail by the entire Charlottesville community as opposed to just those who happen to live nearby.

The interplay between social and technical factors often dictates engineering project success or failure. Drawing from the STS framework of Technological Politics, this paper will delve into how technology affects power relations among different social groups, in turn, privileging some while marginalizing others, using real-world examples like the Flint Water Crisis to illustrate the influence of societal and political factors on engineering projects (Winner, 1980). It is important to assess how engineering projects can marginalize communities from both a technical and social point of view so that engineers may provide the most functional and equitable solution to every project. In the paper that follow, I draw on the ideas of two research proposals. The technical proposal describes an improved approach to river restoration in a community while the STS proposal will examine how an engineering failure in the Flint Water Crisis led to the marginalization of a community, through the lens of Technological Politics (Winner, 1980). Insights from my STS research will be implemented into our technical project, thus giving way to a more informed and inclusive river restoration design.

Technical Proposal

Large, prominent rivers are usually well-known, but often overshadowed are the small tributaries that contribute water to them and play a critical role in maintaining the overall quality of water in these larger systems. One such tributary runs behind the North Grounds recreation center at the University of Virginia, feeding into the Rivanna River. This stream, however, is in a state of degradation, with steep banks, high sediment loads, and diminished hydrologic flows except during significant storm events. The objective of our technical project is to restore this tributary by introducing natural elements such as rocks and native vegetation to mitigate the impact of the toxic runoff originating from the adjacent highway and to reduce the erosion of its banks. We also hope to beautify the river in general hoping to revamp the nearby Rivanna Trail.

River restoration initiatives have been underway across the globe for decades, often pursuing diverse goals but sharing common elements. In various regions, projects like the Teanaway River restoration in Washington State or the removal of dams in Tennessee, Washington, and Maine have sought to rejuvenate rivers and their associated ecosystems. For example, the Teanaway River, a tributary to the Yakima River, faced a decline in water quantities due to drought and reduced snowfall (Holappa et al., 2023). Designers proposed a solution by placing approximately 1,000 strategically located pieces of wood to reroute flood and drainage waters, replenishing the Teanaway River and its surrounding forested areas. The removal of dams, mostly in larger rivers, is also a common practice in many cases where dams tend to negatively effect the ecosystems around them. Dams have been known to restrict organic matter, fish, and sediments from moving naturally through rivers (Lindsay, 2015).

Nonetheless, many common solutions to river restoration projects often fail to address all types and sizes of water bodies and tend to disregard effects on nearby trails, communities, and wildlife. To overcome these limitations, our project aims to design an approach that can be universally applied to rivers and streams of varying dimensions while incorporating strategies for monitoring and treating water quality. In a similar vein, our project will focus on enhancing the stream's aesthetics with the goal of revitalizing and rejuvenating this segment of the Rivanna Trail.

Our innovative technical design includes deploying large boulders along the degraded sections of the tributary, which will confine and redirect water within the stream to maintain a swift flow. Additionally, we plan to modify the grades of the river by cutting and filling, ensuring efficient water movement throughout the river and into the Rivanna River. By enhancing the flow within the tributary, we anticipate an improvement in stream quality as toxins are carried downstream. Furthermore, we intend to implement semi-permanent water quality monitoring equipment to continuously assess water quality throughout the project, even as we stir up existing water and sediment.

Our project will follow a structured framework, utilizing classical engineering methods consisting of six phases: Idea, Concept, Planning, Design, Development, and Launch. Although these stages may appear straightforward, we anticipate revisiting them as necessary to ensure the success of our project.

To assess the impact of our efforts, we plan to conduct comprehensive water quality testing before, during, and after the project to ensure substantial improvements in the stream's condition. This testing will encompass an examination of key parameters such as Phosphate, Nitrogen, and Total Suspended Solids (TSS). Moreover, we will measure stream flows at various cross-sections throughout the river and at the point where the tributary converges with the Rivanna River. We also plan to assess success by analyzing the effects on the community and determining what political factors will come into play as the river restoration gets underway.

River restoration projects are pivotal for the well-being of ecosystems and the communities they serve (Bardeen, 2023). Small tributaries often play an underappreciated role in maintaining water quality and quantity in larger river systems. Our project seeks to restore a degraded tributary to the Rivanna River by deploying innovative techniques such as boulders and grade modifications. We intend to employ rigorous water quality monitoring and adhere to a structured project framework to ensure long-lasting positive impacts on the environment. By recognizing the significance of these smaller water bodies and addressing their unique challenges, we can contribute to the broader goal of preserving the health and vitality of our rivers and streams.

STS Proposal

In 2014, Flint, a small town in Michigan, became the epicenter of a major environmental and water injustice crisis (Denchak, 2018). This crisis stemmed from a cost-saving decision made by the city to switch its water source from the Detroit system to an older system that drew water directly from the Flint River (Denchak, 2018). Unfortunately, what the city officials and residents did not know was that the water in the Flint River was highly corrosive, posing a significant risk to the aging and rusty pipes that connected the river to the town's water supply (Parmet, 2020).

Shortly after the switch, residents of Flint began to experience a slew of problems. They complained about foul-smelling, discolored water flowing from their taps. Concerned individuals took matters into their own hands by collecting water samples from their homes, which consistently revealed dangerously high levels of lead, far exceeding the standards set by the United States EPA (Denchak, 2018). It was later discovered that, unlike the Detroit water supply, the local government had failed to add corrosion inhibitors to the Flint River water, leading to the widespread corrosion of pipes and subsequent lead contamination (Parmet, 2020). Many other cities have gone through the process of replacing older lead pipes or adding corrosion inhibitors and were able to avoid lead contamination (Catalini, 2020).

The consequences of increased lead and other contaminants in the city's water supply were severe. Residents fell ill, with some experiencing mild illnesses, while others were diagnosed with Legionnaires' Disease, directly linked to the elevated lead levels in Flint's water (Denchak, 2018). As the crisis unfolded, the city faced significant backlash from both its residents and the broader public. When the crisis initially emerged, Flint was grappling with an economic downturn (Parmet, 2020). The city had been steadily shrinking for decades, and by 2011, an "emergency manager" had been appointed by the governor to address the city's financial woes (Parmet, 2020). One of the manager's cost-saving measures was the ill-fated decision to change the city's water source. This decision, driven by a misguided belief that it would save money, ultimately had devastating consequences for the residents of Flint (Parmet, 2020).

However, looking at cases like the Flint water crisis purely from a functional perspective can obscure the social and political factors at play. Water, despite its essential function, has always been a highly political issue. Questions about water rights and the provision of safe water to underserved communities are deeply intertwined with politics (Edmond, 2023). In the case of Flint, the decision to switch back to the pipes gathering water from the Flint River without treating it adequately became political, possibly influenced by the fact that the marginalized community was predominantly African American (Trounstine, 2016). Failure to recognize the political dimensions of technology can blind us to the power dynamics and social divisions that shape its impact.

By applying Langdon Winner's Technological Politics Framework, it becomes evident that technology is not just a neutral tool; it performs political and social work by favoring certain communities while marginalizing others. This framework addresses issues of power, justice, and care in technological design, illustrating how technology intersects with our personal beliefs and biases, particularly in the context of power relations among different social groups. The Flint water crisis serves as a clear reminder of the interconnectedness of technology, politics, and society. Removes Sentence Here (Not pure research)

Conclusion

In summary, the river restoration project in Charlottesville will improve on existing designs by combining advanced technical design with a holistic integration of social, economic, and political elements. This project seeks to foster community cohesion through the principles of sociotechnical engineering. It also endeavors to establish a standardized approach to stream restoration for Biohabitats, promising increased project efficiency and overall quality.

Our analysis of the Flint Water Crisis from a technological politics perspective has enriched our knowledge of how societal factors have considerable influence over the success and caliber of engineering projects. This case serves as an invaluable lesson as we begin working on the technical design for the Rivanna River Tributary. Through this project, we intend to illustrate how an inclusive, socially oriented engineering approach not only elevates the probability of project success but also fosters unity within communities, offering substantial benefits to all stakeholders. By assessing the Flint Water Crisis, we aim to learn from past missteps and forge a path toward a more connected and equitable future for the Rivanna River Tributary project.

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