Flooding in Charleston, SC: Spring-Fishburne Drainage Improvement Project

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Rising sea levels, geographic location, and extreme weather have made the largest city in South Carolina, Charleston, vulnerable to intense flooding (see Figure 1). Dated infrastructure has worsened this issue. The Charleston Flooding and Sea Level Rise Strategy seeks to address this growing problem by setting objectives related to the human, economic, and environmental issues caused by increasing sea levels. Within this strategy is a specific initiative, the Spring-Fishburne Drainage Improvement Project, which is currently improving local drainage systems by constructing tunnels and vertical shafts throughout the city of over 150,000 inhabitants. The objectives of this construction project are to reduce the "duration, frequency, and severity of flooding caused by moderate to heavy rainstorms" (Spring/Fishburne Project Team, n.d.) by the summer of 2025. The Spring-Fishburne basins are located in essential areas of the Charleston Peninsula, including residential neighborhoods, part of the Charleston medical district, and schools.

The Spring-Fishburne Drainage Improvement Project will be able to move 360,000 gallons of water per minute from the Charleston Peninsula to the neighboring Ashley River (Spring/Fishburne Project Team, n.d.). This speed is necessary for the volume of water that collects on properties and roads after storms. The project consists of a series of surface collection pipes, vertical drop shafts, and tunnels that lead to a pump station where the water is deposited into the Ashley River. Figure 2 demonstrates the area of the peninsula that the Spring-Fishburne project will affect and shows how the geographical location highlighted in orange makes it vulnerable to intense flooding. An outfall constructed below low tide on the Ashley River will use surface pumps throughout the city to funnel millions of gallons of water from streets into the local waterway, creating a viable solution to the city's centuries-long struggle recently worsened by a deteriorating shoreline and rising sea levels.

Benefits

Decreasing the amount of flooding in Charleston benefits multiple aspects of society, especially the environment. By improving drainage systems through the Spring-Fishburne project, there will be a reduction in stormwater runoff, which presents a serious environmental concern. Stormwater runoff pollutes natural waterways by transporting garbage, agricultural chemicals, or other contaminants to natural bodies of water. In turn, this polluted runoff water could harm the ecosystems and wildlife of the Ashley River. Marine species could disappear, and others, like shellfish, could be contaminated by toxins, jeopardizing the health of the humans and animals who consume them. Rising sea levels worsen the possibility of runoff caused by flooding and demand a solution.

In addition to the citizens of Charleston benefitting from decreased flooding, the drainage project offers other advantages. 75 million dollars has been allocated to local contractors, boosting the Charleston economy. The city relies on tourism, generating almost $13 billion from the industry in 2022 (Charleston Regional Development Alliance). Supporting local businesses and protecting them from flood damage will further promote the economy. Also, the project will improve access to highways across the Charleston Peninsula (see Figure 3). Conti Civil states that the Spring-Fishburne development will “offer a solution to alleviate frequent flooding that causes property damage and heavy traffic along this critical corridor” (Conti Civil, n.d.). US 17 is an essential highway connecting Charleston and must be improved to facilitate driving onto the peninsula, efficient emergency responses, and evacuation when necessary. By addressing two significant concerns, flooding and traffic, and supporting local businesses, the Spring-Fishburne Drainage Improvement Project benefits the environment and economy. It also improves the quality of life of inhabitants and visitors of the historic city of Charleston.

Costs

The project will cost $198 million, which the city of Charleston will fund. Multiple environmental costs are associated with developing these drainage systems due to the water not being treated before it is released. This counteracts the benefit from reduced runoff in local waterways that ecosystems and wildlife would experience with the implementation of this project. There are also significant opportunity costs to the Spring-Fishburne project, considering this project involves the provision of a public good. Spending funds for drainage improvement on other public goods, like education and healthcare, would benefit the specific area of Charleston where the basins are located due to the prevalence of schools and medical offices there.

Sediment loss from constructing these drainage systems is another cost of implementing this development, which could further pollute the river and degrade the land around the drain. This also jeopardizes local marine wildlife and could destroy their natural habitats in an area already heavily impacted by flooding and shoreline erosion. Sediment loss from construction can cause the surrounding land to become unstable, which is a significant issue for a city constantly developing local infrastructure. Marine ecosystems are not the only wildlife that suffers from sediment loss, considering this exhausts topsoil, a necessary element for plant growth. This causes a ripple effect of problems affecting many Charleston ecosystems.

While there are no specific values for the compliance costs incurred, Charleston recognizes the fragility of the shoreline around the Ashley River and ensures that the construction of the Spring-Fishburne project follows city regulations. While the construction company Conti Civil was working on Phase 4 of the project, the installation of culverts

extending into the Ashley River, they were expected to comply with local standards to protect the environment. The value of this phase of the project was estimated to be $52 million.

Enforcement costs are included in the Stormwater Design Standards Manual (SDSM), which addresses how projects could affect stormwater in Charleston. An enforcement cost of the SDSM would be the cost of paying inspectors to visit construction sites and ensure construction companies are acting per city regulations. The city of Charleston will enforce the policies stated in the SDSM through inspections and will fee companies that do not follow these regulations. One of the purposes of the SDSM is to "provide general information to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts" (City of Charleston, 2020), the most relevant objectives regarding the Spring-Fishburne project. While it is unclear if companies contracted by the city to work on the drainage improvement, like Conti Civil, are held to the same standards as independent construction companies, the SDSM still serves as a framework for construction regulations and demonstrates Charleston's commitment to reducing negative impacts on the local environment.

Policy Efficiency

Striving for less abatement would not produce a greater net benefit because of the need for a complex drainage system in this area of the Charleston Peninsula. Figure 4 shows multiple drainage pumps, tunnels, and a pump station that must be constructed to ensure the project successfully deposits runoff water into the Ashley River. Because of a fragile and deteriorating shoreline, significant measures must be taken to reduce flooding. For this reason, the goal of decreasing flooding and stormwater runoff in Charleston could not be achieved at a lower cost. Historically, the city has suffered from intense flooding. More recent environmental factors like rising sea levels and shoreline deterioration are increasing the need to develop an efficient

solution to a dangerous problem. Currently, the Spring-Fishburne project only addresses 20% of Charleston, although the issue of flooding is a citywide concern. By increasing abatement and extending the drainage tunnel system to other areas on the peninsula, Charleston could experience greater net benefits.

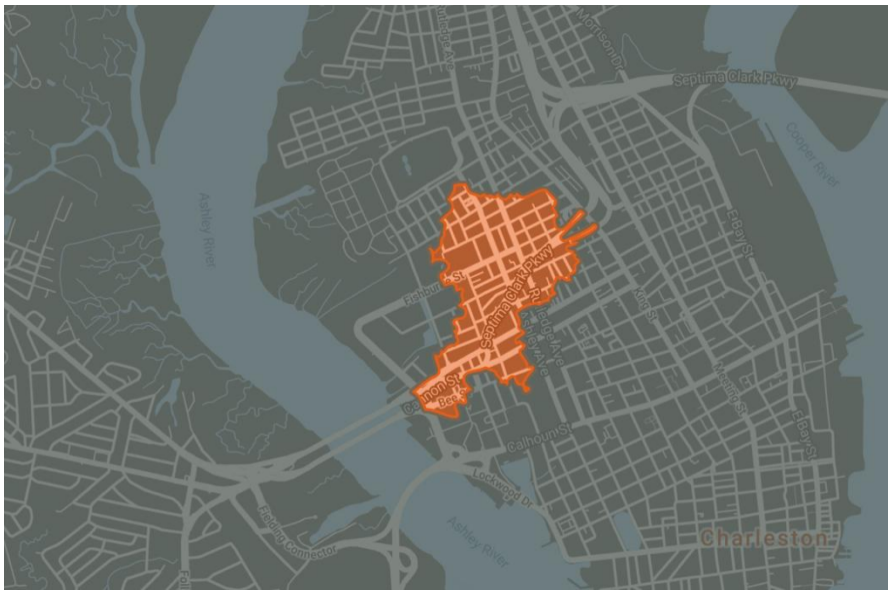
The Spring-Fishburne project seems to increase net benefits overall by reducing the damage caused by flooding, among other benefits. The $75 million contract for local businesses improves the economy, and the reduction of flood-related damage further supports Charleston's infrastructure. Also, the project aims to serve as a long-term solution rather than a temporary response to flooding. This is essential to the city because it will continue to suffer from worsening flood effects without developing resilience through the Spring-Fishburne project. The project seeks to have a minimal impact on the environment, but there are still concerns related to soil erosion and the transportation of pollutants into the Ashley River.

Currently, another approach would not provide greater net benefits to the city of Charleston because of the necessary magnitude of the project. There was no information about treating the water before releasing it in the Ashley River, so a project implementing this necessary step could further add to the environmental benefits of the Spring-Fishburne project. While this is a more permanent solution to a familiar problem, the project adds to water pollution without the purification of the 360,000 gallons of water moved through the drainage system per minute. It is evident that the city of Charleston is considering the possible impacts of this large development because of the placement of the Ashley River outfall. The outfall has been constructed below low tide to ensure the flow of runoff water does not contribute to shoreline erosion.

The Charleston Flooding and Sea Level Rise Strategy and one of their infrastructure projects, the Spring-Fishburne Drainage Improvement Project, promote environmentally conscious solutions and policies for the escalating issue of flooding in Charleston. The drainage project supports multiple aspects of society by promoting the local economy, protecting the city from shoreline erosion, and decreasing damages caused by excessive flooding. These benefits outweigh the costs of the 198-million-dollar project, but sediment loss and potentially polluted runoff water disposed of in the Ashley River pose reasonable concerns for local ecosystems that are already at risk. Overall, the scale of the Spring-Fishburne project is justified, and a smaller scale project would not produce a greater net benefit. Considering this development is a large undertaking by Charleston, it is not feasible that the same results and extensive systems of tunnels, surface collection pipes and an outfall in the Ashley River could be constructed for a lower cost. This project also addresses traffic congestion caused by flooding by improving the US 17 highway. The completion of the Spring-Fishburne Drainage Improvement Project will provide essential protection from flood related damages in the city of Charleston.

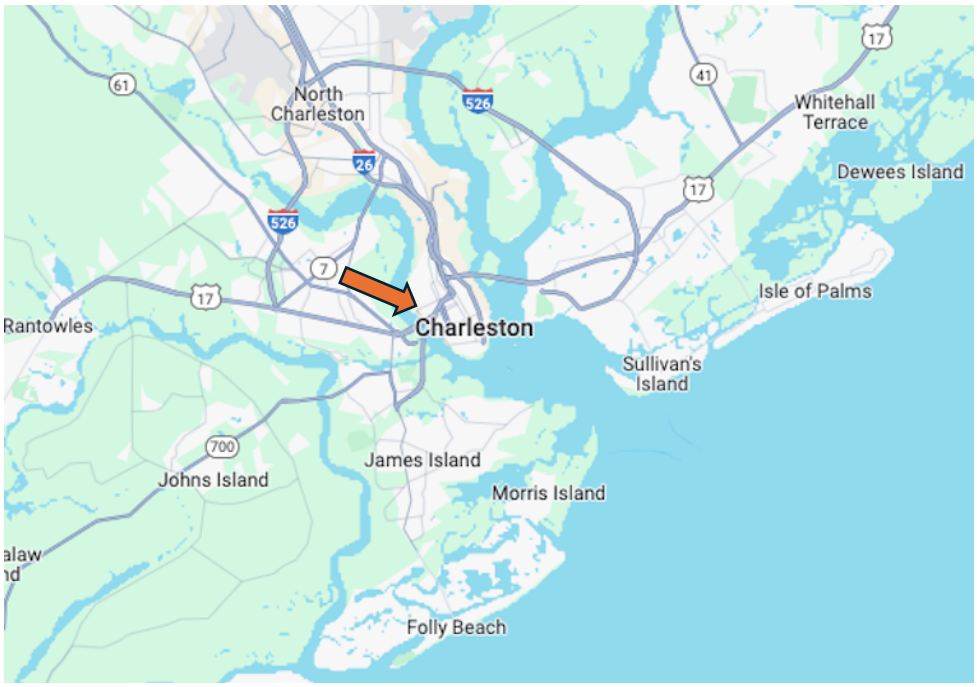
Figure 1: Charleston on a map of South Carolina

Figure 2: Spring-Fishburne Drainage Project



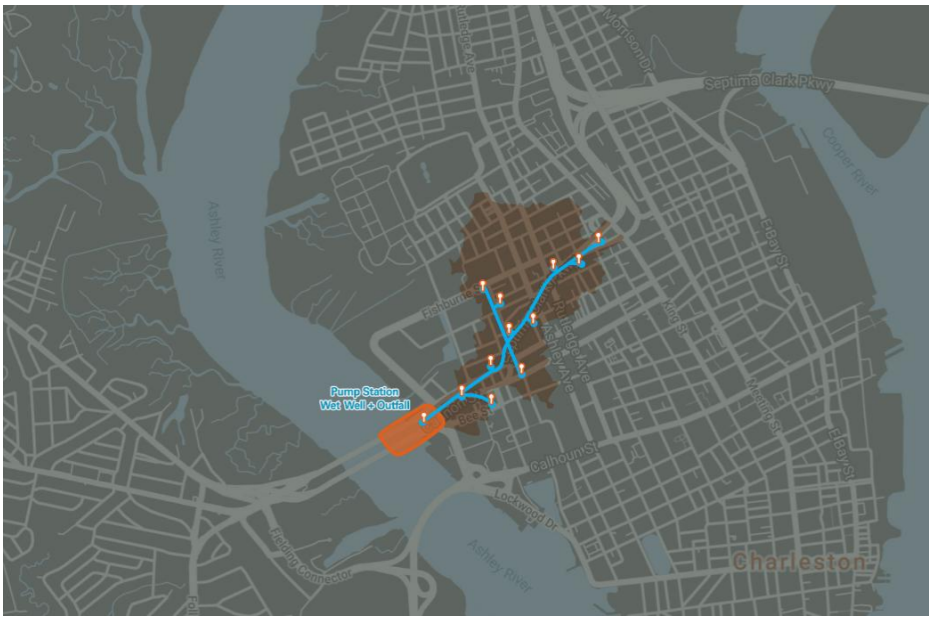
This 198-million-dollar initiative will be focused on essential elements of Charleston including part of the medical district, neighborhoods, and multiple schools (*Spring Fishburne*).

Figure 3: The Charleston area on a map



The orange arrow in the map above demonstrates the location of the Spring-Fishburne Drainage Project on the Charleston Peninsula, an area vulnerable to flooding due to its geographic location (*Google Maps*).

Figure 4: Pump Station and Surface Drainage Locations



The final phase of this project involves the installment of the pump station, highlighted in bright orange above. The pins on the city map represent where tunnels connected to surface drainage have been established (*Flooding and Sea Level Rise Strategy Update).*

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