Reconnecting River and Region: Blueway Network Design Guidelines for Socio-Ecological Resilience along the James River Corridor in Virginia

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Abstract

This thesis investigates the foundational principles that inform the strategic planning of blueways and examines their practical application within the James River corridor in Virginia. By positioning the corridor from Richmond to Williamsburg as a case study, the research articulates a replicable framework for blueway development aimed at enhancing recreational access, connectivity, and socio-ecological resilience. In contrast to the well-established network of greenways across the United States, blueways remain underdeveloped and lack a cohesive design methodology. This absence of standardized frameworks inhibits the integration of river systems into the cultural and ecological fabric of adjacent communities, perpetuating a historical disconnection from waterways that once functioned as vital community arteries.

The project proposes a reimagined narrative for the James River corridor, guided by research-based and experimental design strategies that cultivate dynamic interactions between human and non-human systems. Through a series of design interventions and policy-driven recommendations, this study outlines how a strategically implemented blueway can activate the river as both a recreational resource and a socio-ecological catalyst. Ultimately, the thesis contributes a set of transferable design guidelines and planning insights that address a significant gap in the discourse and practice of blueway development, offering a model for other riverine landscapes looking to foster resilience, access, and connectivity.

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General Audience Abstract

This paper explores and cultivates guidelines needed for strategically planned blueways, then how they can be specifically applied to the James River corridor through Richmond to Williamsburg, Virginia. Through precedent projects and a variety of trailway guidelines, new guidelines were created to address barriers in recreational accessibility, connectivity of beyond-humans and humans to the river, and socio-ecological benefits that are not present without intentional connection. The project aimed to use, test, and refine the new guidelines by applying them to the development of a blueway trail on the James River. One that highlights the unique natural and cultural characteristics of this area while increasing recreational opportunities that have been hindered by various factors, such as private development along the riverine coast, erosional conditions, inaccessibility, and lack of public space, among others. This project uses existing research and a design experimentation process through the use of guidelines to implement a blueway masterplan that will create a new way of approaching blueway and trail design in the field of landscape architecture.

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The completion of this thesis has been full of trials and tribulations, to say the least. I could not have done it without any of my people, pushing me through my academic burnout, inspiring confidence, and giving the best support (even when I did not feel deserving of it). This body of work truly did take a village, and I had the best one.

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Love Letter to My City

Richmond, oh Richmond. I am not sure who I would be if it were not for you. You have taught me all I know and loved me through it all. This entire thesis is for you, RVA, and for your beautiful people who have helped mold me into me. I am not sure I know much love deeper than the love I have for you. From little Sarah just learning to love playing outdoors, you provided a space for me to explore and learn to care about the environment. To teenage Sarah, driving to the city, you provided places where I could see art that inspired me, places to see the natural beauty of the world, and restaurants where I could spend time together with my friends and feel a little bit more like an adult. To undergraduate Sarah, living in the city to go to VCU- you taught me some of my hardest lessons, gave me some of my most fond memories, bonded me with some of the best people in my life, and gave me so many things to look back on and reminisce. You showed me that living in RVA was one of the best decisions of my life. Finally, to now graduate Sarah, living 3.5 hours away- you've made me miss you and your people (on more than one occasion), you've kept me involved in various Richmond groups because I felt I needed to be close to you and help you, and you have shown me that even when I am not there, my heart always is. Future adult Sarah is thrilled that she gets to work to change and better the landscapes in Richmond that may inspire another kid to love the Earth just as you did me. Richmond, you are so vibrant, you are resilient (even in the hardest of times), you are fun, you are beautiful, and most importantly, you are important. Your beauty along the James (even when there is a heavy rainfall) makes life feel a little bit more peaceful. Your ability to get people outside (though it has a long way to go to be equitable), highlights your parks and spaces that are an adventurer's dreams. You inspire me, you make me care about the world, about nature's ecosystems, about humans and beyond-humans, and you teach me every day how to be optimistically curious. I hope to make even a fraction of a positive influence on you, as you have on me. I love you, RVA!

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*All images created by author, unless otherwise specified. All aerial and base map imagery was provided by Google Earth, Bing, and ArcGIS, unless otherwise specified.

I. Introduction

Throughout history, rivers have sustained civilizations and offered spaces for rest and reflection (Macklin & Lewin, 2020). When access to these waterways is restricted, communities risk losing meaningful ties to both the natural environment and one another. A series of barriers that hinders this recreational access to the river exists, including, but not limited to, private landowners inhibiting the land for public use, physically inaccessible spaces, and minimal integration of historic sites.

In response, some communities are turning to blueways, a relatively new approach that creates a recreational corridor along waterways with vital connections to the water and the communities along it. This is done through multi-modal services and educational moments that inform users of the ecological and cultural history along the site. They are designed for a variety of users, including but not limited to paddlers/non-motorized vessels (e.g. kayaks, stand-up paddleboards, canoes, rafts, tubes, etc.), boaters/motorized vessels (e.g.boats, jet-skis, sightseers, etc.), human groups (e.g. fisherman, swimmers, tourists, individuals, families, sightseers, and wildlife viewers), and beyond-human groups (e.g. fish, wildlife, and birds). Blueways provide a strategic framework for restoring access, allowing rivers and communities to reconnect and rebuild the social, cultural, and ecological relationships that once flowed freely between them.

The James River is one of Virginia's most cherished natural resources, but its ties to Virginia's historical and cultural heritage are underrepresented, and its potential for community recreation is still largely untapped through fragmented pathways from Richmond to Williamsburg. This landscape corridor currently has a greenway, the Capital Trail, loosely connecting these areas together, but the need for accessible points along the river is not addressed and often overlooked. Integrating a blueway in the James River corridor would expand

access, enhance recreational opportunities, and strengthen connections between people and the river across all user-groups. Ultimately serving as a model for how strategic, place-based design can restore social, cultural, and ecological relationships within a historically significant landscape through a set of policy-based design guidelines.

Project Statement, Goals, and Objectives

As a society that depends on water, leaning on its transportive, economic, natural, and recreational properties, we have now made the river a private amenity, stripping away the exact thing that made it crucial in the first place. The James River has always been vital to the history of the United States of America and has allowed many communities to thrive and express their identities. In recent years, rivers have been transformed into a place that only some can go to due to a lack of public access points, availability of knowledge, and privatized amenities. Additionally, anthropogenic changes and increasing climate change have allowed for dramatic changes to river ecosystems, fundamentally altering the way that humans and non-humans can interact with them. All of these issues have led to a plethora of problems for rivers to face, including, degraded habitats and water quality issues, a lack of intentional connections between communities and their natural systems, lessened socio-ecological resiliency, increasingly eroded edge conditions, limited recreational access, habitat restoration, and educational engagement opportunities, as well as rapid tidal and flash flooding (Wantzen, 2022).

Physical access to the James River is challenging with steep slopes, a lack of public land around the water, and privatized shoreline ownership all limiting public access to the shoreline and water access. As seen in Figure 1., the disconnection to the river can be a physical barrier. Many of the edge conditions along the James River follow the pattern in the section below; first there is a wooded area that creates a sense of enclosure and privacy obstructing the view to the

river, next there is a rocky edge with grasses along a steep slope which makes the water very difficult to get into, then finally there is the water which can have varied conditions dependent on the actual weather. Figures 2. and 3. display what different areas along the corridor currently look like from a few publicly accessible locations, both locations, though, have a monetary contribution associated with visiting the property. With obstructed views and challenging terrain, the water is not a resource able to be heavily used for rest, relaxation, and recreation. Additionally, this makes it difficult for residents of communities to understand their relationship with the water and the impact that their choices have on the environment around them. These barriers are not only physical, but also there is a lack of public locations where people can directly access and get into the water without having to pay. This creates a fragmented pathway along the James River corridor for recreation users and casual visitors of the river. Of the 20 put-in locations around the James River corridor, only seven of these are directly found on the river's edge (the others are located within creeks and streams that eventually make their way to the river), making it around eight miles on average of distance between each put-in spot. This makes it difficult for people to comfortably traverse the site and explore more, like they would be able to if there were more designated locations. These barriers, both physical and systemic, have transformed the James River into a largely inaccessible space for public recreation. The James River reflects the broader issues of limited access and weakened connections to a vital public resource.

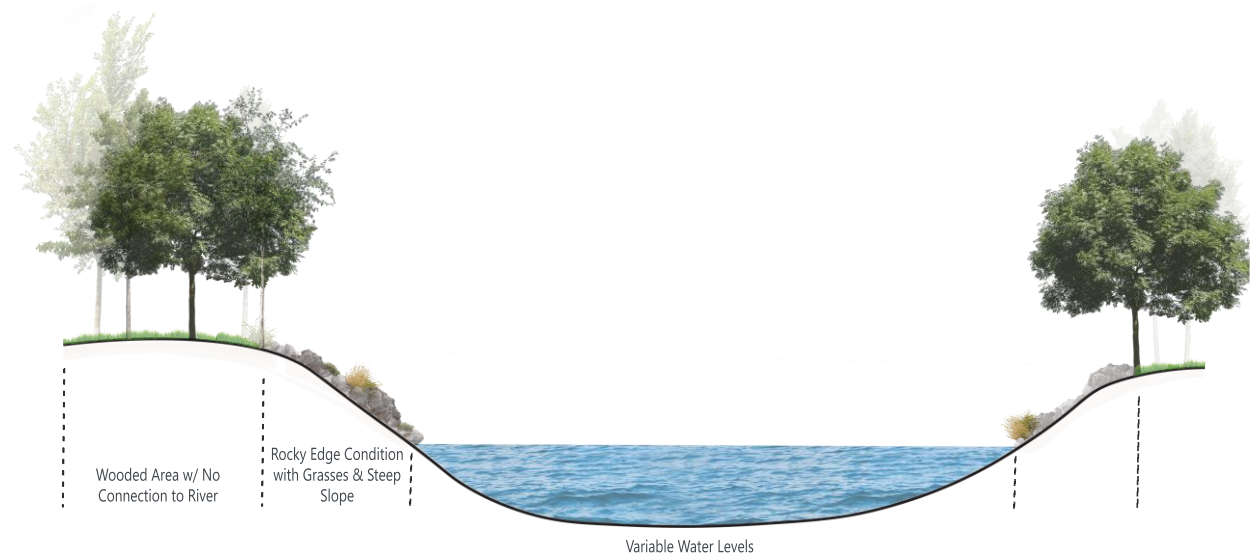

Figure 1. Existing conditions along much of the James River. Not to scale.

Figures 2 and 3. Existing edge condition of the James River at Upper Shirley Vineyards. Existing edge conditions of the James River and direct division from the water at Berkeley Plantations.

After identifying the problems of access and how they reflect the chosen site, the next step was to explore relevant information that could help address these challenges. This led to the development of topical issues (see Figure 4.) that combined information from the project statement and information derived from the literature review, as well as identified gaps in the

research. These questions then informed the goals and objectives of the project, which can be defined further in the graphics below.

- How can we integrate blueway design into communities?
- How does engagement with wildlife make people care?
- How do we reconnect people with water?
- How does integrating these networks improve socio-ecological wellbeing?

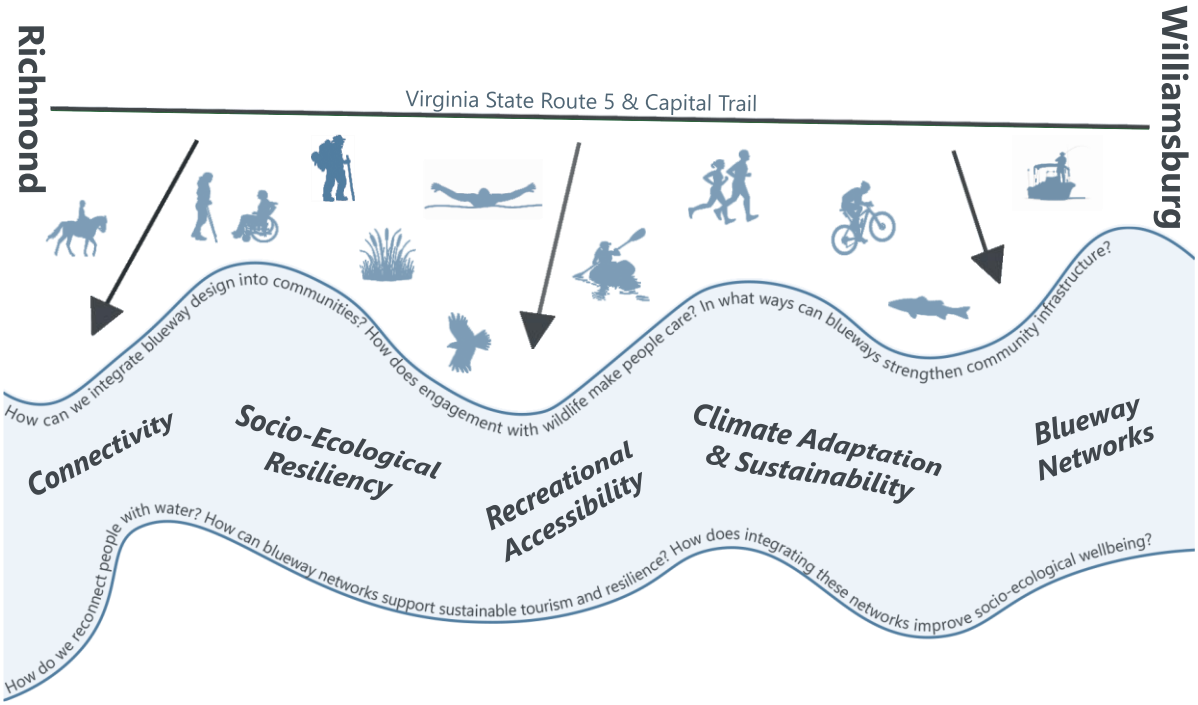

Figure 4. Flow chart of user groups, key principles, and guiding questions that lead to effective blueway networks.

Goal: Develop a strategic and resilient set of guidelines and masterplan for a blueway that enhances recreation (Figure 5.), connectivity (Figure 6.), and socio-ecological benefits (Figure 7.) as applied to a new James River blueway along the river corridor.

Figure 5. Recreation definition in reference to the development of guidelines for blueways.

Figure 6. Connectivity definition in reference to the development of guidelines for blueways.

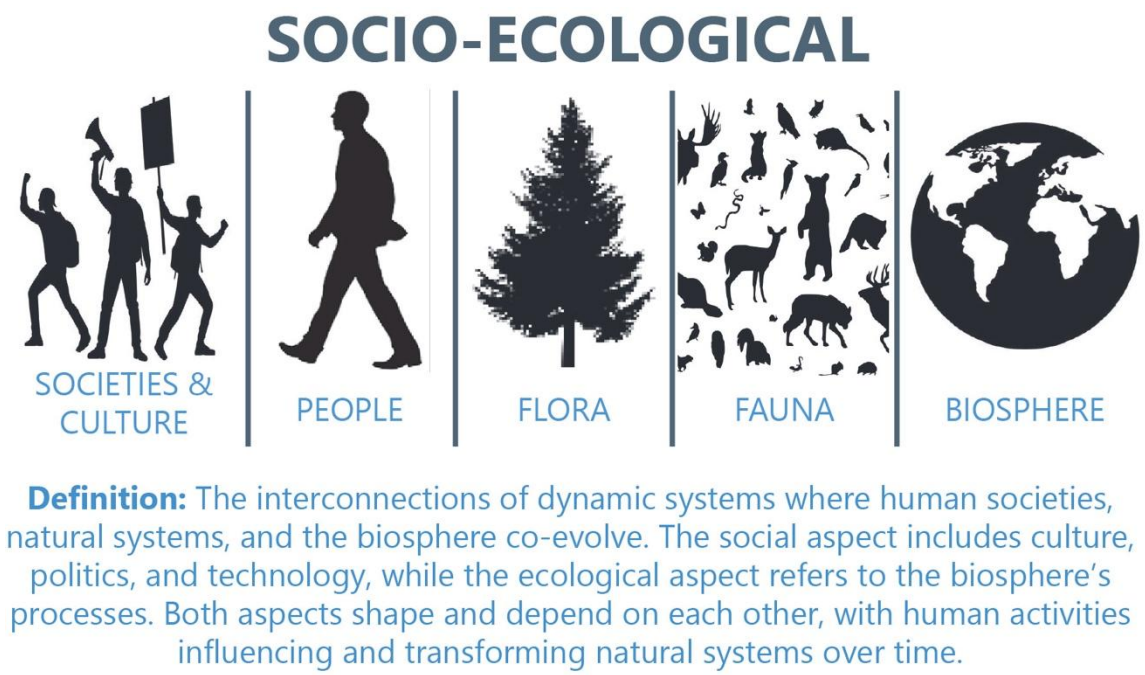

Figure 7. Socio-ecological definition in reference to the development of guidelines for blueways.

Objective 1: Enhance opportunities for water-based recreation by thoughtfully designing a blueway network that expands access to paddlers and boaters through strategically placed launches, landings, and ramps. The design will establish a clear trail hierarchy- green, blue, and black routes- ensuring safe, enjoyable experiences with regulated distances between stops to accommodate varying skill levels and water conditions.

Objective 2: Promote socio-ecological benefits of human and beyond-human communities through habitat restoration of the Atlantic Sturgeon and interactive experiences including- wildlife engagement, flooding and sea-level rise (SLR) awareness, wayfinding, significant historical and cultural ties, and educational moments that cultivate "cues to care."

Project Selection

The motivation for choosing the Richmond to Williamsburg section of the James River stems from the author's deep connection to the Richmond, Virginia community and passion for

connecting all communities back to the river, a beautiful resource that has been hidden away. It also stems from the author's love of water sports as a mode of recreation and exploration. The lack of places for recreation to occur on this site has hindered the ability to enjoy water sports in an easy and accessible way. This project combines both a landscape architecture and urban planning background to create policy-driven designs for enhanced recreation and highlights how the two disciplines are strengthened when they work together.

The original intention of the project was to design a successfully integrated blueway and greenway (with the Capital Trail) along this corridor with multiple site-specific designs. This evolved when further research was done on blueways, and it was determined that there is not a cohesive set of guidelines that addresses designing a blueway. Meaning that before a blueway could successfully be integrated with the greenway on this particular site, a framework for developing a blueway needed to be defined. It was essential that this project evolve through research instead of trying to just fit research into the actual design.

II. Literature Review

Rivers have always been the lifeblood of all living beings, with the world's first settlements being found along the water to use resources and provide a substantial form of commerce. These vital systems are constantly in flux due to human and beyond-human pressures being placed on them over centuries- such as anthropogenic climate change, industrialization, resource-dependence, agriculture, and development which creates a balance that needs to be met to protect riverways for generations to come (Macklin & Lewin, 2020). The connection of waterways to their people and their environments is vital to understand for the continued thriving of all landscapes. Through a targeted literature review, key themes emerged, leading to the creation of a literature map (Figure 8.) that illustrates how these topics are intricately interconnected, like a spider web, and highlights the abundance of research linking them together.

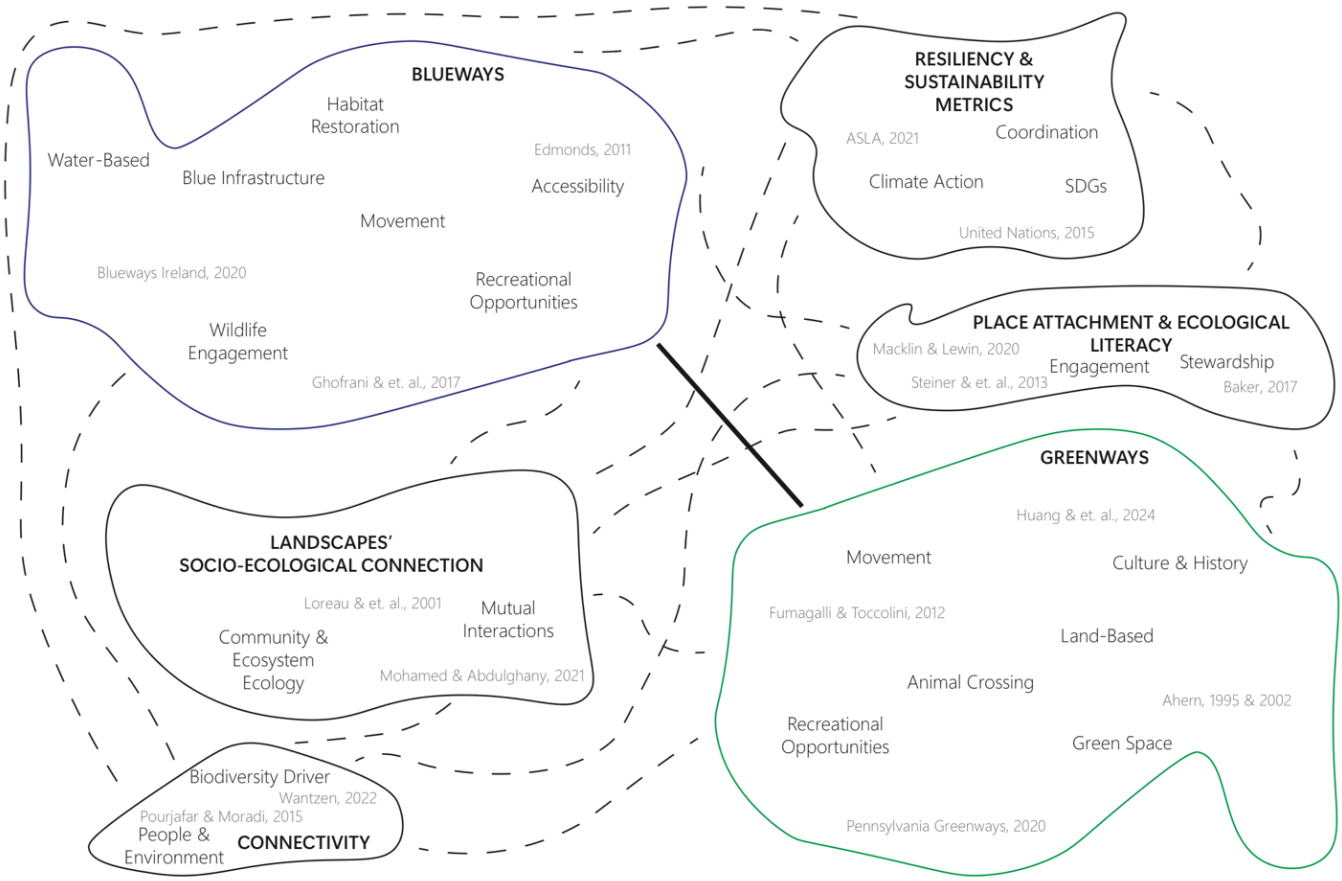

Figure 8. Literature map showcasing each of the studied topics' connections to each other.

Landscapes' Socio-Ecological Connection

Landscapes facilitate socio-ecological connections and give greater purpose to people's understanding of the world around them, so it is essential that designers design to cultivate these connections in every aspect of their work. Through landscape ecology, it is found that the intricate interdependence between biodiversity and ecosystem functions helps to highlight how various species underpin landscape resilience (Loreau et. al., 2001). Recently, other studies have shown that restorative landscape interventions succeed when ecological integrity is balanced with local community engagement, economic benefit, and adaptive governance (Mohamed & Abdulghany, 2021). These studies together reinforce the premise that riverfront design must

recognize landscapes as socio-ecological systems because resilience emerges through human-nature interactions that maintain biodiversity, ecosystem services, and cultural values across spatial scales. For this thesis, this research suggests that strategies such as native landscape corridors and ecological stewardship interventions are necessary to support both ecological stability and sustained public engagement with the river.

Blueways & their Framework

Blueways are strategically defined as, "a network of approved and branded multi-activity recreational trails and sites, based on, and closely linked with the water, together with providers facilitating access to activities and experiences (Blueways Ireland, 2020)." The framework established by Blueways Ireland prioritizes equitable access, user-friendly infrastructure, and integrated land-water trail systems to show the ultimate goals of developing a blueway system. Their model also emphasizes consistent launch typologies, standardized trail difficulty levels, and interpretative elements that blend cultural storytelling with ecological awareness (Blueways Ireland, 2020); all core strategies that are embedded in the James River project. This structure is further supported by blueways being identified as socio-ecological systems that require governance, community participation, and coordinated land-use planning to succeed (Edmonds, 2011). Edmonds' analysis stresses the need for clearly defined trail hierarchies, distributed access, and interpretative frameworks that generate both recreational and ecological value. This directly echoes the guidelines' focus on strategic launch, landing, and ramp site placement, socio-ecological signage, and flood adaptive infrastructure (Edmonds, 2011). Both sources validate the James River blueway methodology as both functionally grounded and informed, ensuring that design decisions reflect tested models of access, resiliency, and cultural integration.

Greenways & their Framework

In addition to understanding how blueways function, it is important to understand their land-based counterparts, greenways. Greenways are strategically defined as "a linear open space established along a corridor converted to recreational use, a canal, scenic road, or other route (Tennessee Greenways & Trails, 2025)." Charles Little, one of the first to define greenways, describes five general types of greenways, including urban riversides, recreational greenways, ecologically significant natural corridors, scenic and historic routes, and compressive greenway systems or networks. All of these systems have three distinguishing features that influence the design of them, which are linearity, connectivity, and resource protection (Tennessee Greenways & Trails, 2025). Through research, it is found that greenways function as multifunctional corridors that combine ecological, recreational, cultural, and aesthetic objectives. Their successes are also heavily reliant on user-friendly design with integrated network planning (Fumagalli & Toccolini, 2012). This research is further cemented by earlier work done by Ahern that emphasized the importance of greenways as linear infrastructure linking fragmented habitats while providing health and social benefits through alternative mobility routes (Ahern, 1995). Collectively, these studies support a systems-based greenway model that integrates spatial design, governance, and performance outcomes in a replicable way for other trailway designs, including blueways.

Problems for Urban Waterways

Urban waterways have different elements that may affect them in detrimental ways. Some common problems for the health of urban waterways come from combined sewer outflow, agricultural runoff, non-point source polluted runoff, contamination, excess wastewater, pesticides/herbicides, stormwater runoff, and more. These problems contribute to the browning

of water, which makes bluespaces more aptly named brownspaces. Each of these problems can come from various places along a waterway and eventually make their way to the entirety of the watershed, which poses serious anthropogenic disturbances for the quality of the watershed and all who use it. This has prompted the emergence of the 'watershed epidemiology' field which studies how humans have altered watersheds and will do so for the foreseeable future. However, it is difficult to properly find the linkages of human health problems to environmental triggers because the evidence is correlational instead of being a causation (Jordan & Benson, 2015). A series of ways to characterize some correlations that scientists believe could be evidence for this case highlights how watershed sustainability conceptually affects ecological public health. To use these concepts, we must work to communicate relationships to bring awareness for human and ecological well-being (Jordan & Benson, 2015). While the project is not specifically centered around only urban water spaces, the research presented provides evidence for the connection between the health of waterscapes and how they play a role in the socio-ecological vitality of a community. Proving that cultivating spaces for one directly enhances the other and that landscapes do affect all elements of the world around us.

Blue-Green Infrastructure

Blue-green infrastructure (BGI) is defined as, "an interconnected network of natural and designed landscape components, including water bodies and green and open spaces, which provide multiple functions such as: water storage for irrigation and industry use, flood control, and wetland areas for wildlife habitat or water purification (Ghofrani & et. al, 2017)." Blue-green infrastructure is also the cohesive use of blue and green infrastructure as a solution for environmental impacts, such as, natural disasters, human-induce climate change, biodiversity loss, and overall degradation. Within Ghofrani's review of BGI, the core functions are revealed

as water storage, flood control, habitat provision, pollution filtration, and recreational amenities that all emphasize the importance of interconnectivity of BGI for maximizing multi-functionality. Ghofrani et. al. proposes decision-supported framework to assess BGI through two different scales: practice/site feasibility and policy-related land potential. This multi-criteria evaluation approach underscores the need for holistic planning processes that integrate ecological data with spatial analysis and governance (Ghofrani & et. al., 2017). In the context of the thesis' guidelines, Ghofrani's review provides a methodological foundation for selecting and prioritizing design interventions. All of the proposed design interventions can be evaluated using the BGI feasibility criteria. Moreover, the emphasis on network connectivity supports the guideline's multi-scale trail hierarchy and spatial layout. By applying this BGI framework, the project gains both the technical rigor and strategic coherence needed to ensure socio-ecological resilient across jurisdictional boundaries, aligning design with systemic performance goals. Figure 9. showcases the informational framework found through the individual research on blueways and greenways, as well as the research found through the BGI section. Figure 9. looks at how the elements of blueways and greenways can be interconnected, as well as showing the differences and similarities between their frameworks and relevant components.

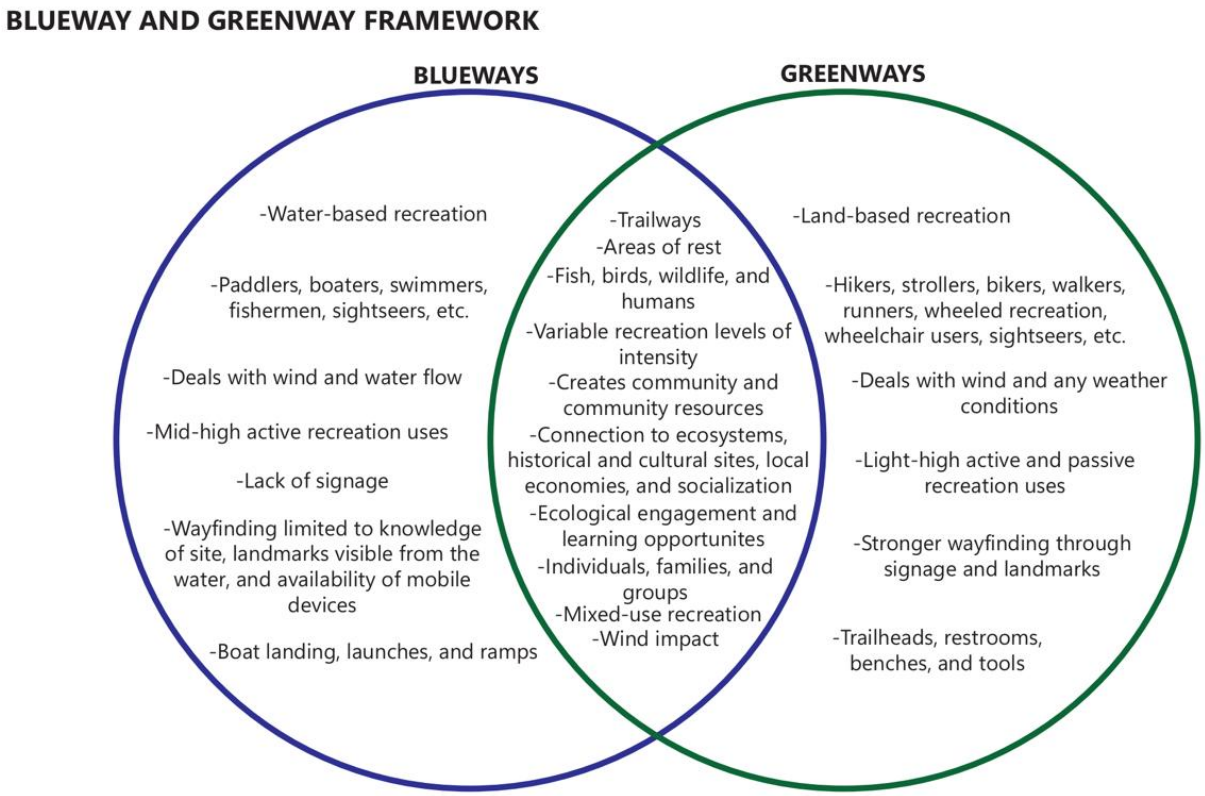

Figure 9. Comparison and contrast of blueway and greenway networks. Elements were derived from literature, case studies, and personal interactions to show the standard components and how they are either similar or different than the other form of infrastructure.

Virginia's Recreational & Trail System Plans

The State of Virginia believes that all trail systems play an influential role in preserving and enhancing the state's landscapes. Virginia's recreational and trail system reflects a statewide commitment to sustainable and culturally rich development through the emphasis on public access and scenic value. It also highlights the impacts of recreational landscapes as socio-ecological, recreational, and connectivity benefits. These benefits range from conservation of natural resources, preservation of historic structures, flood control, increased recreation, increased multi-modal transportation, and economic growth. The Department of Conservation

and Recreation (DCR) specifically distinguishes between water trails (blueways) and scenic river corridors by stating that water trails require a level of coordinated landuse planning to preserve viewsheds and maintain recreational access (VA DCR, 2025). Scenic rivers are designated corridors that are deemed vital to Virginia's history, recreation, and natural functions that should be protected for generations to come through various protection methods (VA DCR, 2025). that are Additionally, Virginia's Statewide Trails Plan outlines a vision for a connected system of trails that includes the Capital Trail, Eastern Shore Rail Trail, and the Fall Line Trail. All of which prioritize non-motorized transportation, equitable access, and scenic integration into the state's cultural and ecological fabric. These planning efforts emphasize the role of trails, not only as transportation and recreation corridors, but also as tools for landscape preservation and public education. Trail alignment along riparian corridors, historic sites, and natural overlooks is intended to support ecological awareness and natural tourism (VDOT, 2022). Collectively, Virginia's planning framework underlines the state's recognition that recreational trail systems are critical infrastructure for fostering socio-ecological resilience and connecting residents and visitors alike to the landscapes that define Virginia's regional identity. In the blueway guidelines, Virginia's statewide recreational and trail planning principles are directly operationalized through a focus on public access and connectivity, scenic continuity, multi-modal activities, and ecological engagement. This extends the state's goals of ecological stewardship and public education into a localized, actionable design toolkit.

Resiliency & Sustainability Metrics

Resiliency and sustainability metrics can be measured in a variety of ways, but some of the most applicable metrics for landscape, planning, and infrastructural projects are Landscape Architecture Foundation's (LAF) *Evaluating Landscape Performance*, American Society of

Landscape Architect's (ASLA) *Climate Action Field Guide*, and the United Nation's (UN) *Sustainability Development Goals (SDGs).* LAF's guide provides foundational methodology for evaluating landscape performance with over 100 metrics under environmental, social, and economic benefit categories. These include stormwater retention, habitat restoration, carbon sequestration, and public health measures that become a framework for aligning the successes or failures of landscape architectural projects with broader environmental performance disciplines. The metrics from this guide come from data transparency, post-occupancy evaluations, and replicability (LAF, 2018). This creates a relevant framework for interdisciplinary methods and assessments that generate actionable data, which are relevant in ensuring blueway systems, like the James River blueway, function adequately.

ASLA's *Climate Action Field Guide* compliments LAF's guide but shifts more inwardly towards climate-specific impacts of landscape interventions. The metrics in the guide provide various action pathways through practice (carbon drawdown and climate resilience), equity (cultural empowerment and climate agency), and advocacy (global alliance and climate leadership) actions. Each of these actions has specific strategies that can be employed during design phases like protecting, conserving, and enhancing biodiversity as well as guiding policies. The guide strategically links design action to climate adaptation policy, an alignment issue between site-scale design and planning that has persisted for years (ASLA, 2025). This framework displays the employable strategies for design work as well as setting the stage for socio-ecological benefits that will come out of each strategy. These strategies were directly used in the blueway guidelines.

On an even larger scale, the United Nations has developed their *Sustainable Development Goals* that offer normative framework to align with project ambitions and international

development standards. Specific goals relevant to river corridor projects include goal six (clean water and sanitation), goal eleven (sustainable cities and communities), and goal thirteen (climate action); all of which are addressed in the guidelines. Within the goals there are specific indicators and targets that provide metrics for environmental and institutional resilience (United Nations General Assembly, 2015).

Collectively, these frameworks help to integrate measurable sustainability and resiliency strategies into the blueway guidelines. Many of the access-oriented design guidelines, such as multi-use landings, trail hierarchies, and ADA-compliant land-water transitions can be evaluated through LAF's guide. These evaluations can be through public access equity, number of access points per mileage, and user comfort infrastructure. Guidelines for floating infrastructure and flood-adaptive design directly correspond to ASLA's guide recommendations, with those specifically targeting coastal resilience, adaptable public space design, and nature-based flood mitigation. Including habitat enhancements and biodiversity goals fulfills many of the SDG's targets for the betterment of riverine ecosystems. It is essential to have design intent structured around measurable social and ecological performance indicators, so that the developed framework is compatible with international and local development goals, as well as landscape architecture disciplinary standards.

Literature Findings and Reflections

The collected literature confirms a growing interdisciplinary concussive that river-based trail systems, such as blueways, are critical nexuses where ecological function, cultural memory, public health, and infrastructural resilience converge. A key finding is the recognition of waterways not merely as natural features, but socio-ecological systems whose design and stewardship must account for ecological inter gritty and human experience (Loreau et. al., 2001;

Mohamed & Abdulghany, 2021). Another critical insight is the way that greenways and blueways, while often treated separately, operate through shared logics of linear connectivity, multi-functionality, and resiliency (Fumagalli & Toccolini, 2012). Finally, Virginia's recreational and trail planning documents reveal a clear public mandate for trails to preserve scenic viewsheds, foster historical awareness, and support multimodal access. These priorities are echoed in the guidelines, suggesting the localized interventions should also reflect regional planning goals while adapting to site specific constraints.

Together the review literature offers more than theoretical validation, but provides practical frameworks, metrics, and design philosophies for the thesis to synthesize into a context-aware set of guidelines. Most importantly, the findings reinforce that well-designed blueway systems are not static paths but dynamic interfaces for restoring, connecting, and empowering landscapes and their communities. Figure 10. demonstrates the framework of the creation of blueways that was derived from the literature as well as the performance-based specifications and system impacts that blueways typically have.

GOALS OF FORMING A BLUEWAY	SPECIFICATIONS OF BLUEWAYS	SYSTEM IMPACTS
• Connection to nature • Recreational promotion and opportunities • Improving water and air quality • Environmental engagement • Ecosystem improvements • Bettering health & well-being of humans and beyond-humans • Scenic views • Cues to care • Increasing biodiversity • Movement	• Recreational function • Water corridor • Ecosystem enhancing infrastructure • Provide diverse access • Interaction with nature	• Physical & environmental • Socio-ecological • Humans • Beyond-humans • Economic • Tourism • Mental

Figure 10. Blueway framework found through literature.

III. The Project

Case Studies

Formative case studies for this project informed the way that the blueway design guidelines were developed and how to properly implement a blueway design into the James River corridor through a series of design interventions. Each of the case studies was chosen for its relevance to the design of multi-modal recreation, the development of typologies for design interventions, and site selection for the implementation of these design interventions.

Tom Lee Park

Tom Lee Park in Memphis, Tennessee, USA (designed by SCAPE) spans 31-acres along the Mississippi River and connects a historically disconnected community back to its riverfront historic bluff. The design focuses on displaying the fluvial patterns of the Mississippi riverine ecosystems through intentionality, incorporating extensive community engagement, and restoring native habitats that had been destroyed when the US Army Corps of Engineers turned this site into dike wall meant to protect the bluffs. The design has four vital components built into the design- civic gateways, active cores, community battures, and habitat terraces. SCAPE utilized riffles, pools, micro-deltas, and tailouts as a means of manipulating the landscape back to the natural patterns of the Mississippi River. This created a terrain that can naturally support stormwater management, flood resiliency, and native riparian planting. While manipulating the landscape, they also decompacted and restored the underlying soil, which allowed over 1,000 trees to be planted and habitats for migratory birds and pollinators to be recreated (SCAPE, 2025). Additionally, these new plantings contribute to the park's vitality by handling climate stressors like heat, humidity, and flooding; further enhancing the socio-ecological health of the

Memphis community. The landscape includes many elements that filter the stormwater before it heads into the river, like floodable swales and lifted terraces serving as buffers for flooding and stormwater runoff (Hope, 2019). This resilience strategy is characterized by floodable swales, stormwater microswales, permeable lawns, permeable planting and paving, and enhanced layered edges to strengthen the park's ability to withstand strong weather conditions and events (Hope, 2019). The design also integrates the community of Memphis into the park by naming structures after them and paying attention to what they identified as needs for the area. The design highlights the newfound rebirth of Memphis out of poverty and its spatial consequence of racism, proving how design plays a pivotal role in shaping the socio-ecological connectivity of spaces (Murphy, 2023).

Through the design of Tom Lee Park, it is clear that extreme care went into reforming some of the landscapes back to their natural landforms while also ensuring that the planting material used was strategically targeted for natural stormwater management. Tom Lee Park offers key design implications for this thesis, by demonstrating how landscape architecture integrates ecological restoration with inclusive public spaces. By mimicking natural river processes and using a variation of native plantings, the park enhances flood resiliency and biodiversity; strategies that can be adapted to the James River's hydrology. Additionally, the emphasis on reverting landscape functions back to their natural state and community mixed-use spaces shows how civic landscapes can foster community connectivity while supporting environmental goals. This holistic approach suggests that the James River project can successfully balance ecological function with cultural and recreational value for the communities between Richmond and Williamsburg.

Los Angeles (LA) River Masterplan

The LA River Masterplan in Los Angeles, California, USA (designed by StudioGang & OLIN) follows 51-miles through the urban core of Los Angeles reconnecting once fragmented communities back to the highly altered and channelized river. This masterplan offers various design solutions and interventions through a series of a kit of parts that can be transferred into other similar landscapes. Their kit of parts consists of six different typologies that are strategically tailored to environmental, infrastructural, recreational, and social needs that are then tied to masterplanning goals (DPW LA County, 2023). The six different typologies are trails and access gateways, channel modifications, crossings and platforms, diversions, floodplain reclamation, and off-channel assets. The plan is rooted in equity and access with each "kit of parts" component designed to be deployable in both affluent and underserved communities, ensuring that the river revitalization benefits are enjoyed by all. The design allows for hybrid infrastructural spaces that serve as functional for public parks, stormwater filters, and ecological corridors. These interventions are layered with unified visual landscapes that connect the entirety of the river as a resilient waterscape. The masterplan offers a pathway for implementation of ecological integrity combined with culturally rooted public spaces (LA River Masterplan, 2022).

The LA River Masterplan's "kit of parts" typologies provided valuable framework for shaping the user typologies and guidelines for the James River blueway design. By organizing interventions into replicable typologies, such as- wayfinding, launches, landings, ramps, and educational nodes, the project can gain flexibility and cohesiveness. This strategy allows for scalable, site-specific designs while maintaining alignment with overarching goals like socio-ecological resiliency, connectivity, and recreational access. Drawing from OLIN's approach, the guidelines ensure that each intervention along the James River contributes to a unified, resilient,

and inclusive riverfront vision. Additionally, their approach helps to reinforce the identity of the river and contributes to a holistic experience.

Pailao River Blueway

Pailao River Blueway in Shenzhen, China (designed by VenhoevenCS) is less than an acre's worth of riverfront property reconceptualized into a dynamic waterfront. The project aims to move away from typical gray infrastructure and towards blue-green infrastructure like sponge banks, wetland ponds, and resilient landscape terraces that absorb stormwater and reduce flood risk during heavy subtropical rain events. It embeds ecological zones into adjacent neighborhoods through cultural spaces (under the viaduct) and raised pavilions with green roofs. Each designed with a multitude of uses like recreation, local economic ventures, ecological education, and community gatherings. This nature-inclusive design attempts to integrate strategies for a cohesive identity of the area that enhances resilience, social vibrancy, and economic potential (LILA, 2022).

The Pailao River blueway offers many lessons for the James River corridor that help achieve the project goals of connectivity, recreational access, and socio-ecological resiliency. One of the most important takeaways is the unified identity through design; by creating a consistent design language and simple ecological zones with native plantings and educational moments, the various river sites can be tied into a cohesive riverfront vision. Additionally, by incorporating strategies like inclusive programming, active mobility, and community support with the unified design strategy, the James River guidelines can foster a resilient, accessible, and vibrant riverfront anchored in both ecological and social value.

Tennessee Riverline

The Tennessee Riverline from Knoxville, Tennessee to Paducah, Kentucky, USA (designed by the University of Tennessee and the National Park Service) spans 652 miles and 1.2 million acres while traveling through four different states. Its main goal is to recreate a river park for "exploration, health, learning, and connection, while welcoming everyone to experience the beauty and richness of the Tennessee River Valley (Tennessee Riverline, 2025)." The idea is that this series of site designs and overall masterplans creates a cohesive network of land and water multi-modal recreation that reinvigorates a powerful sense of place. This redefines the site from a fragmented industrial artery into a vibrant regional greenway with a series of planning initiatives and informed conceptual designs of riverfront parks, boat launches, trails, and community gathering spaces (ASLA, 2020). The project merges ecological stewardship, like stormwater filtration, habitat restoration, and erosion control, with equitable outdoor recreation and access (UTK, 2021).

The Tennessee RiverLine offers a valuable model for shaping the James River blueway and its guidelines, especially in how it balances regional connectivity, community engagement, and ecological resilience. Like the RiverLine's vision, the James River blueway can benefit from a unified identity of interventions such as launches, park infrastructure, green corridors, and riparian access zones that are tailored to local context but tied together by the shared design standards in the guidelines. These lessons reinforce that the James River corridor is not just a recreational path, but a socio-ecological framework that connects communities, restores riverfronts, and promotes stewardship at a regional scale.

Design Guidelines

Three core principles (Figure 11.) were derived from the project's goals and objectives, which shaped the respective key design guidelines- connectivity, recreational access, and socio-ecological benefits. These core principles are intermixed into all the design guidelines and provide a supporting framework that highlights the identified needs, as well as strengths in blueways.

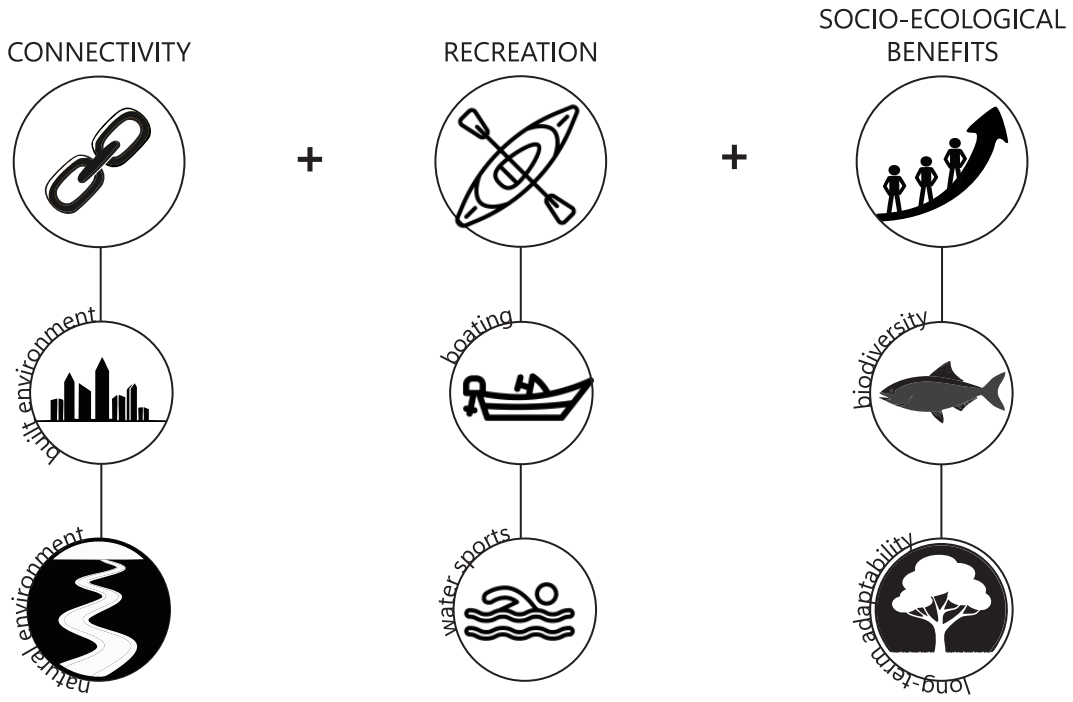

Figure 11. Interconnections of core principles for design guidelines.

Connectivity: Blue networks should form continuous, multi-modal corridors that link urban, suburban, and rural landscapes directly to waterscapes inclusively.

Recreational Access: All users should be able to traverse space with safe, inclusive access to multi-modal outdoor recreation, educational opportunities, and cultural experiences.

Socio-Ecological Benefits: Designs should prioritize habitat restoration, biodiversity, and water quality improvement, while fostering dynamic, vibrant spaces that promote safety, engagement, well-being, and long-term adaptability.

NOTE: Guidelines are adapted loosely from ASLA's Climate Action Field Guide, ASLA's Climate Action Plan, United Nation's Sustainable Development Goals, and LAF's Evaluating Landscape Performance Guidebook through refined framework categories.

Key Design Guidelines:

Connectivity:

1. Ensure seamless land-water integration by designing multi-use launches, landings, and ramp sites.
    a. Launches are defined as spaces for vessels to begin and end their journey in the water, while landings are spaces where vessels can dock and access the land or partake in resting sites. Ramps are defined as spaces for vessels (typically motorized) to enter and exit the water, with a direct connection to the water via a vehicle.
2. Populate river access with a series of strategic multi-use landing sites where recreational users can adequately rest with comfortable intervals for stopping.
3. Establish a clear trail hierarchy that accommodates all skill levels.
    a. Green trails show easy trails (with 2 miles or less between stopping points), blue trails show moderate trails (2-4 miles), and black trails show difficult trails (4 or more miles). Green trails are intended for families and those that may be new to paddling, blue trails are intended for people who may have some experience

paddling but not extensively, and black trails are intended for people who are highly skilled in paddling and want a more intense form of exercise.

4. Strategically place boat launches in areas that are found suitable due to a multitude of factors.
    a. Including, but not limited to, areas that have visibility to the river, current public lands, optimal conditions (both water and wind), opportunities to connect to cultural sites, and the need for recreational opportunities.
        i. Visibility to the river allows users to be able to directly see the breadth of the river and feel connected to it.
        ii. Current public lands are any lands owned or managed by the US Government, the State of Virginia, a public-private partnership that has donated the land, or the local municipality.
        iii. Optimal conditions in the river are secluded spots that are blocked by heavy wind (below 10 mph or 8.6 knots), low boat traffic areas with no wake zones, proximity to community resources, and perceived safety in the water. This may look like locating the entrance within a creek that then leads to the river.
        iv. Opportunities to connect to cultural sites may look like having launches, landings, and ramps beside a property that is on the National Register of Historic Places or on a similarly designated list, in order to bring awareness to the cultural history along the blueway for users that may not typically seek this education out.

v. The need for recreation is in an area with a far distance of a park; this may look like one mile or more of a park radius from neighborhoods and communities. Ultimately, the need for recreation is best defined by the municipality it is in and what their recreational goals may be.

5. Use wayfinding elements including signage, interpretative markers, mileage markers, floating buoys, and digital tools/apps to guide users.
    a. Create a comprehensive system of safety signage that informs users of how to navigate tricky situations.
        i. Including, but not limited to, extreme weather conditions, preventative actions for flooding conditions, obstacles that may arise, tips in case of a wildlife encounter, and how to understand wind and tidal flow through site conditions.

Recreational Access:

6. Offer diverse recreation opportunities to meet the specific needs of each user group of all abilities.
    a. Water-users may need floating infrastructure in the form of launches, landings, and ramps that move with the water levels and provide ease for independently getting into any watercraft. Additionally, there needs to be places to moor the watercraft during moments of rest, oversized vehicle parking spots, proper turning radii, and ADA docking.
    b. Upon mooring, the needs of the site users change to land-users who have a differing set of needs, including- gentle slopes for ease of movement, a series of facilities and amenities (bathrooms, showering spaces, locker rooms, and tools for

maintenance of recreation materials), and elevated pathways that traverse waterways or low zones that may potentially flood.

7. Design community gathering spaces and educational opportunities at key nodes along the corridors, such as river overlooks, interactive learning stations, and innovative rest spaces.

Socio-Ecological Benefits:

8. Incorporate interpretative elements that highlight the cultural and ecological narratives of a space and promote "cues to care" through the usage of signage, exhibits, lookout points for natural sightseeing, and educational opportunities (ecological stewardship).
    a. Signage that promotes the total history of the area (Virginia) and accurately depicts what happened on the land that spans the corridor, including but not limited to- plantations, enslaved laborers, indigenous communities, settlements, battles, and cultural history.
    b. Exhibits that allow viewers to contribute to natural sightseeing like birding, water observation, and plant identification.
9. Implement green infrastructure practices that enhance biodiversity, uplift vital keystone species, and the overall health of the river.
    a. Design spaces for spawning and laying eggs of the keystone species, Atlantic Sturgeon through the use of rocky beds within the center of the river along curves and oxbows, along with other optimal spawning conditions. This may look like ensuring habitats are out of commercial zones and are placed strategically in deep water where good current flows through.

    b. Utilize native plantings along the river edges to create tidal wetland zones and strengthen the coastal edge without the usage of reinforced gray infrastructure to revitalize the natural ecosystems along the river corridor and bring populations back to the river.

10. Elevate boardwalks along the water accommodate 6ft of sea level rise (2100 scenario) while providing floating infrastructure for docks/launches/landings in flood-prone areas with changing tidal conditions.
11. Design flood-adaptative landscapes with resilient materials and native plantings to mitigate excessive water impacts and support ecological functions.
    a. Resilient materials may include permeable pavements, fiberglass reinforced polymer grating, and tropical hardwoods that are able to withstand coastal inundation and conditions.
12. Develop design-driven policy strategies to protect ecologically sensitive areas from heavy development pressures and ensure that development is designed strategically with socio-ecological benefits in mind.
    a. Strategies should be specific to the area, provide actionable solutions for lessening harmful development, and work with local constituents and stakeholder groups to create the most beneficial solutions.
    b. Strategies should formalize community engagement as a step in blueway planning and position community-driven design as a model for regional policy adaptation.
    c. Strategies should adopt local policies to protect riparian communities from harmful development.

d. Strategies should support design-led policymaking through interdisciplinary collaboration while encouraging municipal codes that reflect ecological performance standards (like LAF's Evaluating Landscape Performance).
e. Communities can utilize blueway development to pursue Virginia's Scenic Waterways designation (or other state equivalent), to leverage the recognition to access resources that support ecological restoration, public access, and community-driven improvements.
f. States and municipalities without widespread public understanding of water rights, such as Virginia, should clearly define who owns the water and work towards a total or high percentage of water ownership for public usage.
    i. In the State of Virginia, riparian water rights are followed, meaning that property owners immediately adjacent to waterways are entitled to water usage. With this being said, all bottomlands are strictly owned by the Commonwealth of Virginia, with a few exceptions in the case of private ponds and lakes (Reavis, 1986). These two policies have created confusion and murkiness around who can use waterways in Virginia and who the water belongs to, as opposed to other states who use the Public Trust Doctrine method where all waterways are owned by the state for public use.

Site Inventory & Analysis

This blueway project spans 52 miles along the James River corridor in Virginia and passes through five different municipalities- City of Richmond, Henrico County, Charles City County, James City County, and City of Williamsburg. The throughway that loosely follows the

James River to connect these municipalities is Virginia's Scenic Byway Route 5, though the most preferred route of driving from Richmond to Williamsburg is the longer route, US Interstate 64, due to the higher speed limits and overall efficiency in travel time (VDOT, 1991). Along Route 5 runs the Capital Trail, a 52-mile public-private greenway aimed at connecting two historic American locales and expanding the availability of multi-modal recreation in this corridor (Virginia Capital Trail Foundation, 2025). Many historic plantations and sites are situated along this corridor, which are all open to the public, but many are privately owned and have a monetary cost associated with visiting. These are Shirley Plantation, Berkeley and Westover Plantations, North Bend Plantation, Kittiewan Plantation, Upper Weyanoke Plantation, Jamestown, and Colonial Williamsburg- all of which are privately owned except Jamestown and Colonial Williamsburg, which are owned by the National Park Service (NPS) and cost money to visit. This hinders the public's ability to understand and experience history on a large scale, while providing a buffer to what should be public knowledge between disadvantaged groups and those who have the resources to afford visiting. Additionally, much of the land along the waterway is privately owned, making it difficult for visitors to be able to interact with the water because there is limited public access to it.

The site's greenway sufficiently connects the land to its historic and cultural resources, but as a resource that follows the river, it does not connect the land to the water in many different sites. The only points of the Capital Trail that are in direct conversation with the water are the two termini of the trail in Richmond and James City County. Some of the trail is found as far as six miles away from the river, and a majority of the trail is found over one mile away from the river, which makes it difficult to easily access the views of the water (see Figure 12.).

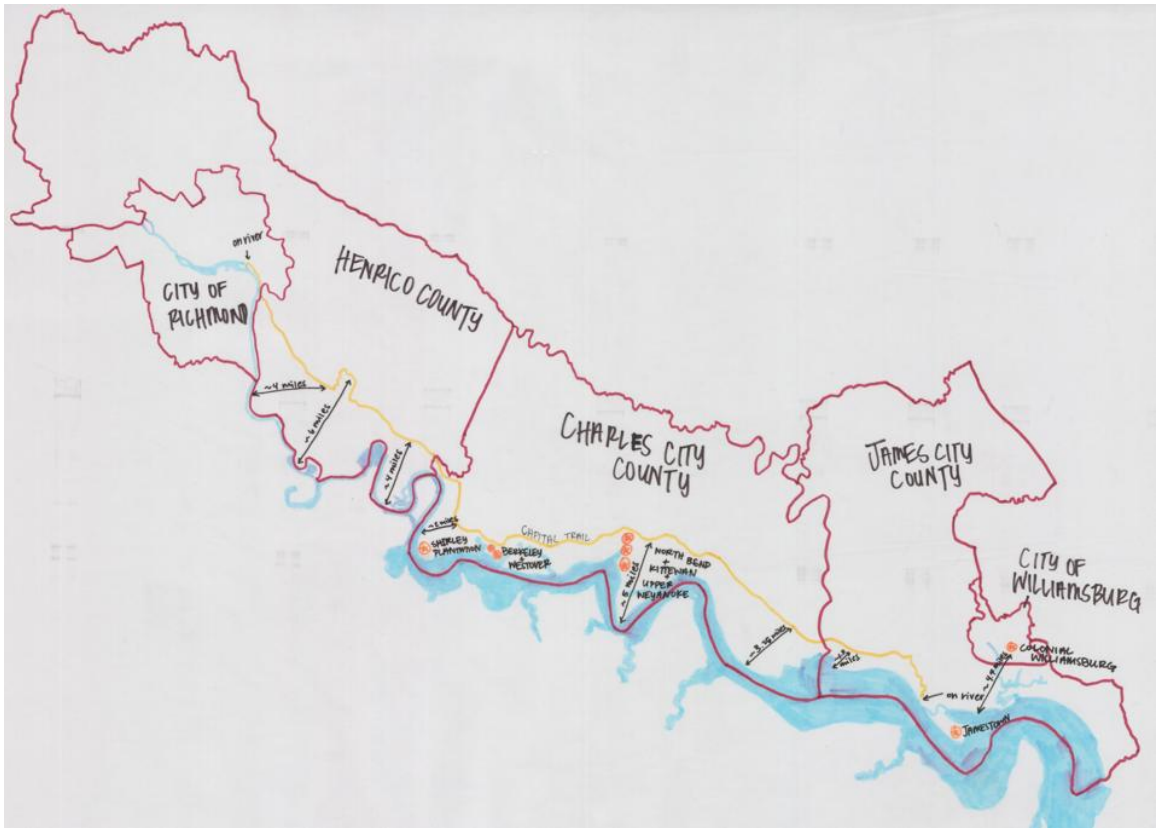

Figure 12. Distance of the Capital Trail from the James River with each of the historical plantations.

IV. The Design

Each blueway trail development guideline developed for the project was strategically applied along the James River corridor, resulting in a site-responsive design grounded in regional context and planning rationale. While the site is roughly 52 miles, there is a rough series of 74 miles worth of trails proposed within the blueway design. The guidelines are expanded upon here as site-specific interventions for the James River blueway integration with their design rationales. The design rationales and locations of each site design are further explained in Figures 13-15. The conceptual masterplan with these elements in mind is then explored in Figure 16 with the trail hierarchy and proposed mileage.

Connectivity:

1. *Ensure seamless land-water integration by designing multi-use launches, landings, and ramp sites.*
2. *Populate river access with a series of strategic multi-use landing sites where recreational users can adequately rest with comfortable intervals for stopping.*

The first major intervention proposed the creation of 20 new designated access points-including launch, landing, and ramp sites distributed throughout the corridor based on optimal conditions outlined in the planning guidelines. With an average spacing of approximately 2.6 miles between sites, the network aligns with the transition from green (easy) to blue (moderate) trail classifications, based on recreational trail standards set up (USDA Forest Service, 2016). This spatial rhythm enhances continuity and accessibility across the blueway, ensuring that each municipality along the river has at least one point of access. In many underserved communities, current access is nonexistent, creating a barrier to water-based recreation. By equitably

distributing access, the intervention promotes inclusive engagement, reinforcing the river's role as a shared public resource and catalyst for community identity.

3. *Establish a clear trail hierarchy that accommodates all skill levels.*

To further promote inclusive and safe recreational use, the proposed trail system adopts a modified ski-trail hierarchy, requiring that a minimum of 40% of routes fall within the green (easy) or blue (moderate) categories. This framework ensures accessibility for a broad demographic (families, novice paddlers, and casual users) aligning with best practices in recreational landscape design. Such inclusivity is vital to cultivating long-term stewardship and encouraging frequent, low-barrier use of the river corridor.

4. *Strategically place boat launches in areas that are found suitable due to a multitude of factors.*
5. *Use wayfinding elements including signage, interpretative markers, mileage markers, floating buoys, and digital tools/apps to guide users.*

Within this network, site-specific programmatic elements are introduced to enhance user experience and meet the unique recreational and infrastructural needs of the James River. Given the river's strong appeal to families and multi-generational visitors, key amenities including restrooms, locker rooms, and essential recreational tools (e.g., screwdrivers, personal flotation devices, distress kits, toolboxes, and fuel stations) are proposed at every landing site and every other launch and ramp site. These amenities are especially critical at landing sites, which serve as pause points for non-motorized users expending greater physical effort. Providing opportunities to rest, change, and replenish enhances both comfort and safety, aligning with human-centered design principles. This same logic is applied when providing users with important site

information like what to do in extreme weather conditions, how to deal with a wildlife encounter, and how to understand site conditions like wind and tidal flow.

Recreational Access:

6. *Offer diverse recreation opportunities to meet the specific needs of each user group of all abilities.*
7. *Design community gathering spaces and educational opportunities at key nodes along the corridors, such as river overlooks, interactive learning stations, and innovative rest spaces.*

To support sustained engagement and improve usability in more rural or suburban segments of the corridor, the plan introduces food access points (such as small cafés, vending infrastructure, or food truck-ready spaces) at six sites. This supports user health and comfort while acknowledging the limited availability of nearby commercial amenities. Additionally, every site is designed with shaded dining areas, picnic tables, and designated rest zones. These elements promote respite, social interaction, and incremental use of the blueway, accommodating both casual and extended recreational experiences. At each site, kiosk signage is proposed so that users can geolocate and learn more about the site. Mileage markers and floating buoys with the mileage stated clearly on them are then proposed every mile, to create an easy-to-follow wayfinding system. This allows users to always be within a sight line of a mileage marker, decreasing the amount visitors may get lost.

The distinction between launch/ramp and landing sites is also addressed through infrastructural support. While launch and ramp sites typically include vehicular access and parking, landing sites often do not. As such, greater emphasis is placed on embedding essential services directly into landing sites, ensuring that users' needs are met regardless of access mode

or trip duration. This means that landing sites can become destination resting points for people to be able to recoup some of their energy and continue their journey. Frequent paddlers and non-motorized boaters typically reference the inability to do this as the reason that they do not explore more waterways, because it is difficult to be able to find moments to rest when they are feeling sore or places to use the restroom during longer journeys. All sites should be equipped with ADA and universal design standards on land and in the water. Specifically, 100% ADA-compliant paths (5% slope and stable surfacing) from the parking to the entrance of the water. All docks should be floating docks, not only to keep up with the tidal flow, but also to accommodate all users. These docks should have vertical guideposts to self-adjust to water levels, handrails, ramps, and transfer benches. Designing for all abilities increases inclusivity and long-term engagement with the James River corridor. The goal is to have the river accessible to anyone who wants to use it, instead of only having a few spaces to do such.

Socio-Ecological Benefits:

8. *Incorporate interpretative elements that highlight the cultural and ecological narratives of a space and promote "cues to care" through the usage of signage, exhibits, lookout points for natural sightseeing, and educational opportunities (ecological stewardship).*

Twelve cultural history markers should be installed (one every ~ four miles), along with an ecological lookout point (elevated OWLs) at each landing and exhibits at each launch and existing public land on the water. A cultural history marker around every four miles aligns with the black trail mileage, ensuring that the site is not saturated with too many markers but still highlights this important corridor of Virginia's history. This gives a unique experience to visitors who travel further distances and provides them with incentives to rest at a landing area. An ecological lookout at each landing creates an engaging experience for those who may be resting

but want to engage with wildlife and ecological processes before heading back into the water. Exhibits at each launch and existing public land give visitors an activity to do and promote public interaction with natural systems. This implementation creates a layered experience-honoring complex histories while actively engaging the public in caring for the land and water systems of this corridor.

9. *Implement green infrastructure practices that enhance biodiversity, uplift vital keystone species, and the overall health of the river.*

Six new spawning habitats for the Atlantic Sturgeon (~1,200 sqft each, 7,200 sqft total) should be installed and placed in the deepest part of the water, in areas with high water current and low sediment pollutants. This helps to allow these keystone species to continue spawning with ample space after the James River was designated as a critical habitat for them under the Endangered Species Act in 2017 (NOAA Fisheries, 2023). These sites should be located in the deepest part of the water to protect spawning habitats from destruction by boat propellers and limit direct human interaction. Additionally, 15% of the public sites should be restored to promote biodiversity, through the use of native plantings and have interpretative signage at every launch and landing to educate users about Atlantic Sturgeon and native plants. The 15% biodiversity goal through native plantings aligns with the UN's Decade on Ecosystem Restoration for coastlines. Signage at every launch and landing site ensures that no matter where users stop, they are educated about these two vital populations along the James River and provides more cues to care.

10. *Elevate boardwalks along the water accommodate 6ft of sea level rise (2100 scenario) while providing floating infrastructure for docks/launches/landings in flood-prone areas with changing tidal conditions.*

It is proposed that 100% of boardwalks along the water should accommodate for 6ft of sea level rise (the 2100 scenario) by being elevated with ADA-accessible gangways to connect to the floating infrastructure. Additionally, 100% of docks, launches, and landings should be designed as floating infrastructure to change with the tidal flows of the river. This ensures that boardwalks are not frequently inundated with water and needing to be repaired. Elevated boardwalks also enable the users to traverse the site, even when the water is high. The floating infrastructure ensures that the user can consistently safely access the water without compromising ecological function or excessive landform change. Floating infrastructure also mitigates flood damage while enhancing aquatic habitat health because of its ability to protect shorelines from erosion, allow natural water flow, and provide new habitats for aquatic life.

11. Design flood-adaptative landscapes with resilient materials and native plantings to mitigate excessive water impacts and support ecological functions.

The proposed implementation for this guideline is to utilize resilient materials for 100% of docks and sites, as well as wherever else possible in the corridor. Resilient materials may look like using tropical hardwoods and fiberglass reinforced polymer grating, due to their ability to resist warping, rotting, and constant inundation, all of which are essential for coastal exposure. Permeable pavement can drastically reduce surface runoff, which maintains trail use and ecological flow, making it ideal for paving parking lots. By using these materials, maintenance costs will be significantly decreased due to their ability to withstand poor conditions while maintaining user access. This also looks like planting native plants along the coastal edges of every site. Native plantings will ensure that biodiversity increases, while enabling the site to become more flood-adaptive due to their drawdown capacity.

12. *Develop design-driven policy strategies to protect ecologically sensitive areas from heavy development pressures and ensure that development is designed strategically with socio-ecological benefits in mind.*

As with most masterplanning-related efforts, there is an element of policy implications that need to be addressed. Within the James River corridor, there are many implications that are essential within this project. First, community engagement needs to be formalized as a step in blueway planning for the most equitable trailway possible that reaches all user groups, including those not typically involved in the conversation. This may include hosting design workshops and charrettes in the heart of communities that may not have otherwise been able to reach the workshops or utilizing surveys/townhalls to get important feedback. This can also lead to supporting design-led policy making through interdisciplinary collaboration. Policymakers must seek the advice of others who shape the environment before creating policy. Having collaboration from activist groups, non-governmental organizations, urban planners, architects, landscape architects, designers, scientists, horticulturalists, and economists etc. can make for the most well-informed and effective policies. These guidelines could also be used to shape future zoning and land-use planning, involving more designers in the conversation of strategic planning for waterscapes. All of these strategies would be beneficial in positioning community-driven design as a model for regional policy adaptation. Another tactic could be adopting local policies that protect riparian communities from harmful development to continue to uphold the vitality of the river. This may look like creating a policy where developers located near the river must plant 30% or more of the landscape on site with native plants that are proven to be beneficial for riverine health. Another policy implication could be encouraging municipal codes that reflect ecological performance standards, such as LAF's *Evaluating Landscape Performance*.

Encouraging these codes would ensure that landscape and waterscape best practices are actually implemented into design work and that they can thrive more than they would if developers were left to their company standards. Next, blueway development should be used as a way to pursue Scenic Waterway designations (specifically in Virginia or other state equivalents of the program), which unlock future resources for restoration and access. Finally, communities without comprehensive water rights should work towards a higher or total percentage of water belonging to the state for public usage, thus opening an avenue for accessibility to waterways. It is also essential to note that various communities have different policies, so this is by no means a comprehensive list of how to address policy, but rather a starting point.

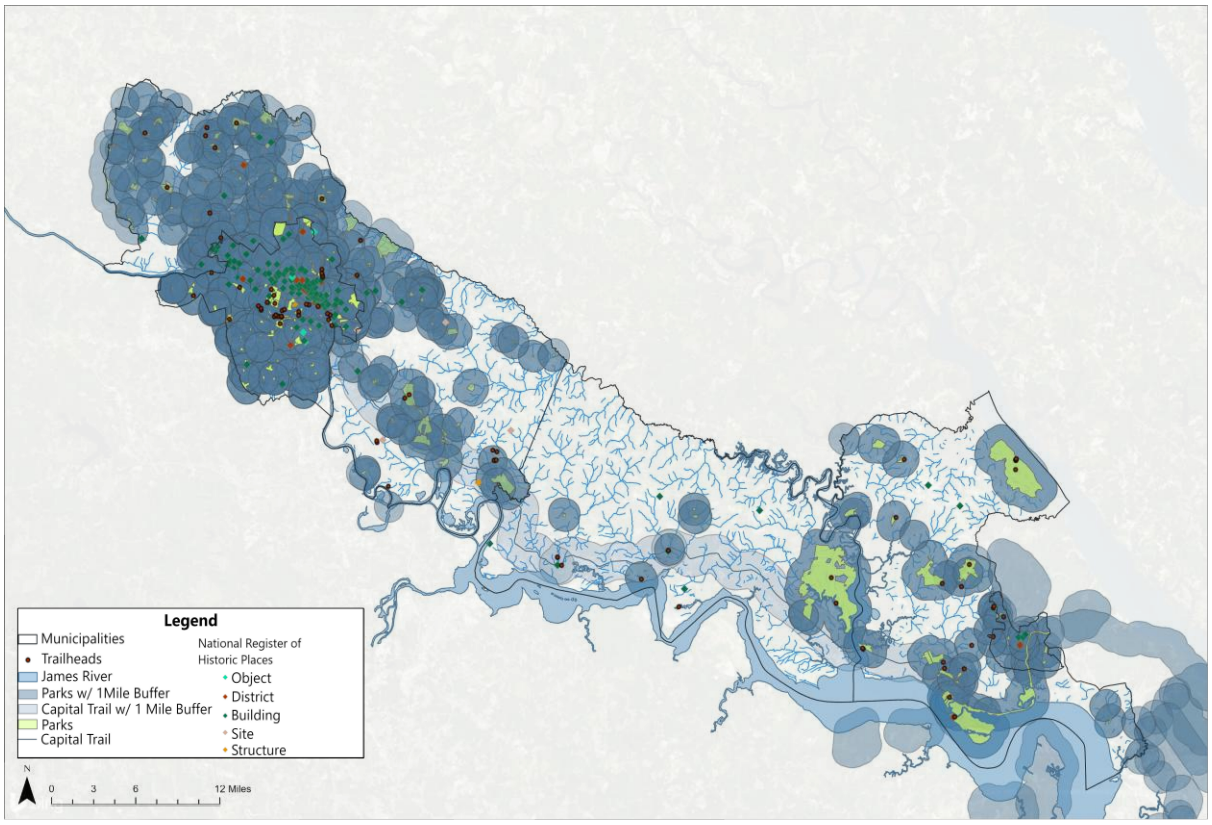

Figure 13. Public lands map along the James River with one-mile buffers around their locations.

The public lands in each of the municipalities needed to be mapped to fully understand and identify where there were gaps in public lands and areas that may be lacking this direct water connection. The map (Figure 13.) was plotted with one-mile buffers around each of the public lands, as one mile is chosen as the measurement of proximity in physical accessibility to park infrastructure. In the map above, viewers can see how the City of Richmond, Henrico County, and the City of Williamsburg are amply covered with parks and public lands, with most of the area having at least a one-mile radius to parks. The map shows how Charles City County and James City County are largely lacking park infrastructure, meaning that site designs and implementations would greatly improve this area and contribute to the overall goals of the project.

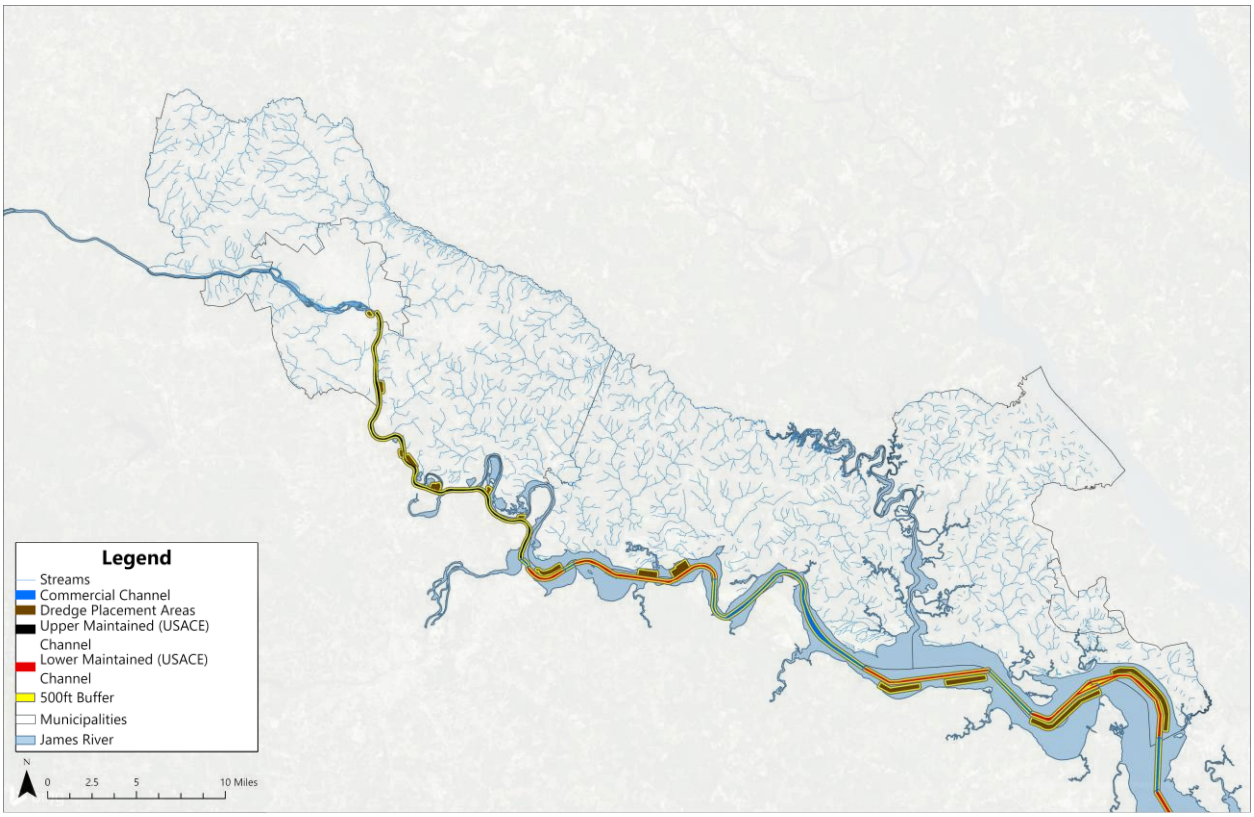

Figure 14. Commercial zones' map along the James River indicating areas where sturgeon spawning habitats cannot be located.

It was also essential to map out the commercial shipping areas in the James River corridor (Figure 14.), so that the areas where work was being done and dredge was being placed could be better understood. This is specifically essential for the indications of where the vital species, Atlantic Sturgeon spawning habitats, cannot be placed, since they will be interrupted by ship passages and could possibly be damaged. The map informs designers of where propellers and human interactions will not disrupt the species as significantly. This also informs designers of where the working waterway may change the experience of the users or hinder their ability to use all of the water.

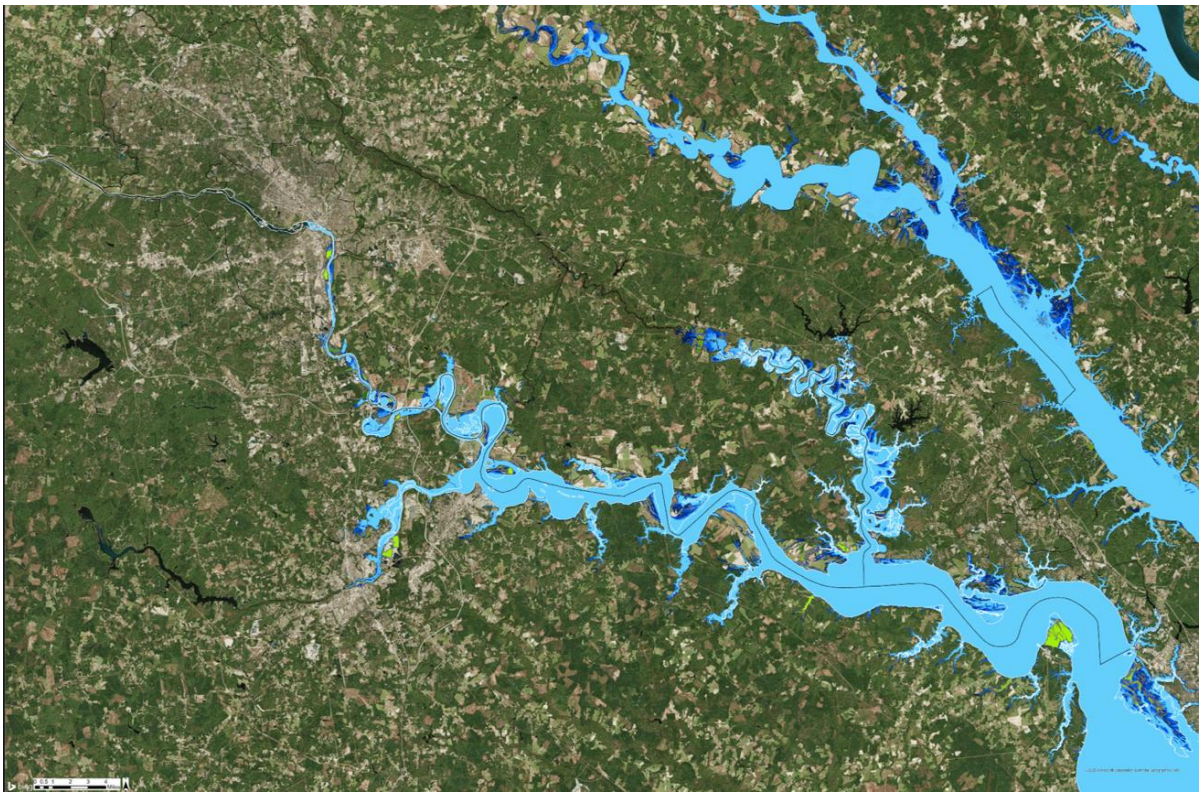

Figure 15. Sea-level rise map in 2100 along the James River. Light blue indicates the highly likely scenario of 1-3ft, while the dark blue indicates the possible scenario of 3-6ft. Green showcases low-lying land that will flood.

Additionally, it was essential to map out the sea level rise conditions for the area (Figure 15.). It was decided that looking at a 2100 median sea level rise scenario was ideal because it focused on the future trends of water inundation and flooding on land. The map shows how the James River is predicted to expand greatly outwards onto many coastlines, emphasizing the need for flood-resilient infrastructure as well as native plantings that help to clean and slow the floodwater before drastically affecting too many natural systems.

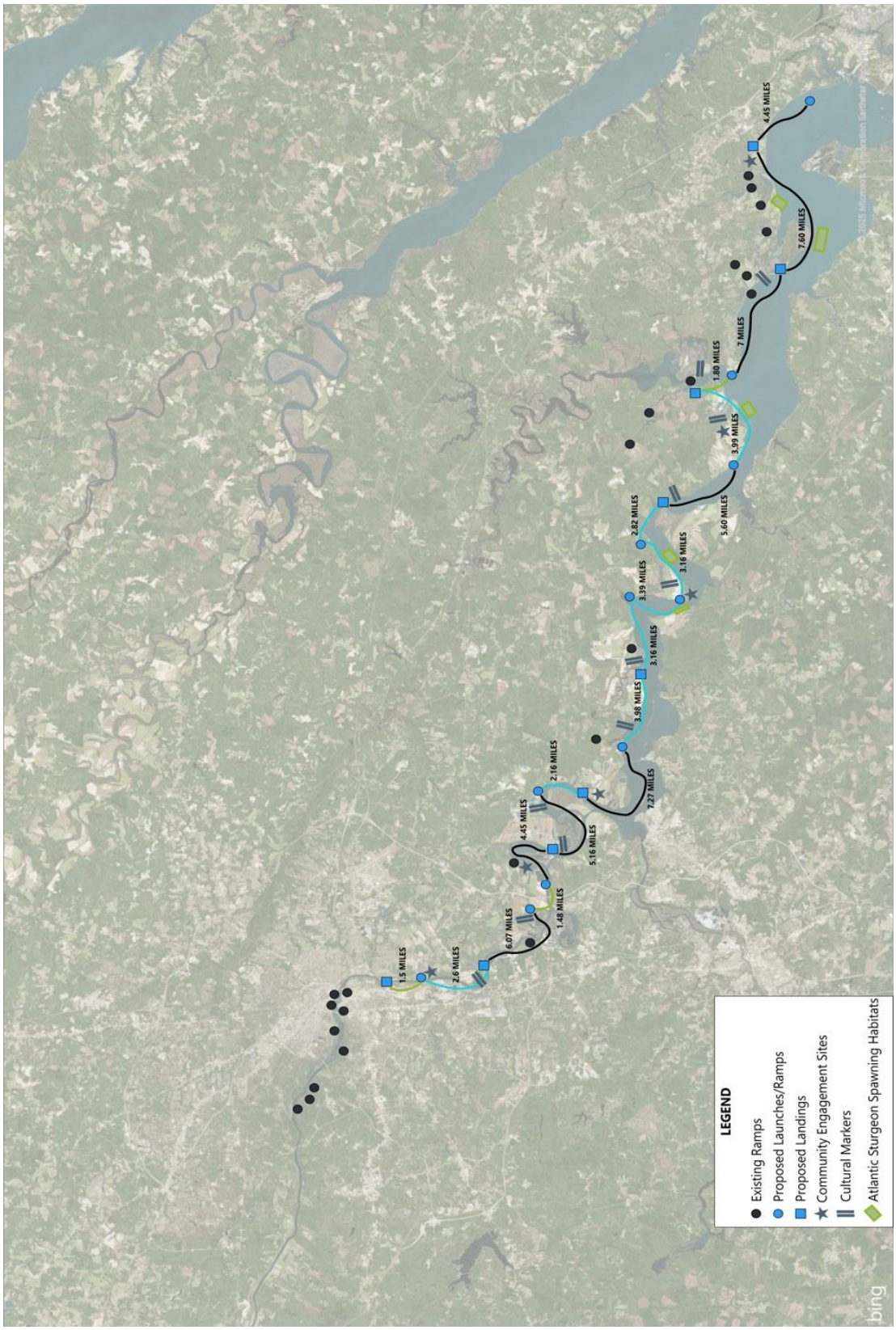

Figure 16. Trailhead and site interventions masterplan. Not to scale.

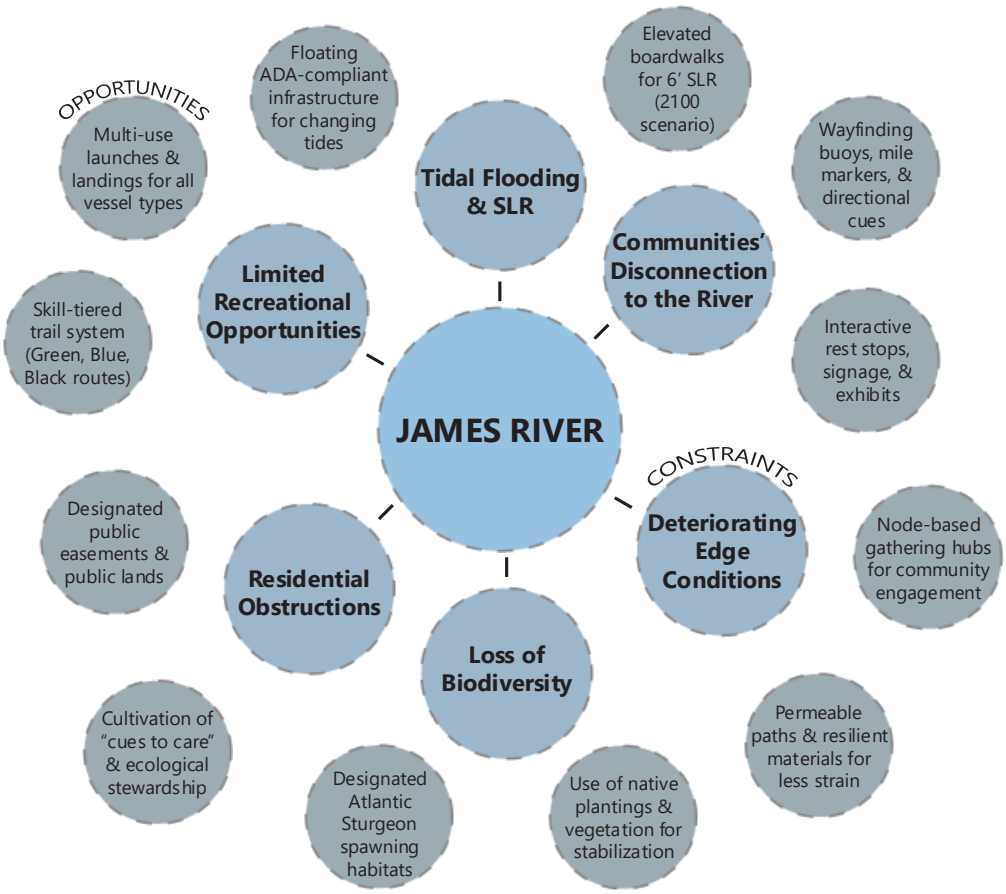

Figure 17. Constraints of current James River conditions and opportunities through design interventions.

Figure 17. examines the constraints that were identified throughout the site analysis on the James River, then how they manifested themselves into opportunities through the design portion. This shows the direct relationship between constraints specific to the James River and how they are addressed in the design, as well as strategies that can be carried forward for other locations that may run into similar constraints. For example, if a location is experiencing a loss of biodiversity, one way they can combat that is by employing native plantings and vegetation for shoreline stabilization and the creation of new habitats for important species. It defines each design action and the motivation behind that tactic for the cohesiveness of the guidelines.

User Experiences and Typologies

Within understanding the way that a user moves through space, it must first be understood what their needs are and how they can best be addressed. This project has two major user groups that its design is accounting for, paddlers and non-motorized boaters, as well as motorized boaters. Motorized boaters have an advantage because they do not have to exert as much energy when traversing through space, while non-motorized boaters need to be able to have moments along the blueway to recoup some of their energy. This makes it essential to pay attention to the vast needs that each user group must have for a successful and enjoyable trip down the blueway. The specific needs for each user group are explained through a general need and then specific site interventions that are utilized in the design, in Figures 18 and 19.

User Needs- Paddlers & Non Motorized Boats	Wayfinding elements- on land and in the water	Directional signage, floating buoys with mileage markers, mobile and physical water trail maps, visible landmarks, and hazard warning signs
	Adequate stopping points	Emergency take-out points, designated access points, safe landing areas, proper facilities, shade/shelter, and ample rest spaces
	User experience & programming	Signage, floating buoys, mobile maps, visible landmarks, intuitive wayfinding, interpretative signage, place-naming and identity, and community
	Safety & accessibility	Accessible landings (designed with ADA and universal design standards), emergency info access, non-slip surfaces, and preparedness measures
	Interpretative elements	Cultural and natural signage, reflectivity, connection to historical locations, riverine programming, lookout points, and nature engagement
	Viable environmental interaction	Wildlife observation zones, environmental stewardship cues and educational moments, designated shoreline landings, and native plantings
	Amenities & comfort	Rest and shelter, clean facilities, ample trash and recycling bins, storage, seating and benches, locker rooms, and shower facilities
	Connectivity	Integrated maps, digital connectivity, trail network integration to existing community, linkage to town and visitor amenities, and points of interest
	Parking infrastructure	ADA parking spaces, sufficient vehicle storage, proper ramps, oversized vehicle spaces, and lighting
	Variety of routes and skill levels	Predictable stopping points, first-time user support (printed and digital), route variety, rated difficulty system, maps highlighting hazards, trip planning aids, and flexibility within route distances

Figure 18. Typical needs of paddlers and non-motorized boaters that informed design decisions.

User Needs- Motorized Boats	Wayfinding elements- on land and in the water	Directional signage, floating buoys with mileage markers, mobile and physical water trail maps, visible landmarks, and hazard warning signs
	Wake management	Clearly marked "no wake" signage, wake awareness signage, buffer zones between shorelines and waterways, and channel markers
	User experience & programming	Lauch area signage with protocols, trailhead kiosks, wayfinding for destinations, docking and mooring infrastructure, and marina services
	Safety & accessibility	Accessible landings (designed with ADA and universal design standards), emergency info access, non-slip surfaces, and preparedness measures
	Interpretative elements	Boat ramp etiquette signage and education, adaptive boarding assistance, dockside interactive kiosks, channel edge signage, and marine radio
	Viable environmental interaction	Sensitive area campaigns, seasonal wildlife alert areas, habitat-friendly mooring areas, invasive species removal, and volunteer opportunities
	Amenities & comfort	Rest and shelter, clean facilities, ample trash and recycling bins, boat cleaning, storage, seating and benches, locker rooms, and shower facilities
	Connectivity	Integrated maps, digital connectivity, trail network integration to existing community, linkage to town and visitor amenities, and points of interest
	Oversized parking infrastructure	ADA parking spaces, sufficient vehicle storage, pull through stalls, turnaround spaces, ample lighting, and appropriate ramps
	Fuel and maintenance access	Designated fueling stations on land and signage on how to get to additional locations, fuel docks, spill prevention equipment, nearby boat repair facilities, pump out stations, and waste disposal stations

Figure 19. Typical needs of motorized boaters that informed design decisions.

Within these blueways, there are a series of typologies that were designed to accommodate the user needs. Figure 20. demonstrates what a plan view of a launch, landing, and ramp may look like. In this project, launches are sites where non-motorized boaters can enter and exit the water and have ample room to unload/reload their gear. Landings are sites designed for moments of resting and recharging before continuing the journey in the water. Ramps are for both non-motorized and motorized boaters to be able to access the water, while having the parking infrastructure for leaving their car there while journeying through the water. It is important to also note that launches and ramps can both have landings attached, and that ramps can be a form of launches. Launches are normally characterized by floating infrastructure for ease of access, a gentle slope ramp in order to gradually wade into the water, and a parking area for storing vehicles. Landings are typically characterized by some sort of rest area to allow users

to recharge, trail and boardwalk infrastructure to give them a break from the water, a beach transition area to get into and out of the water more easily, and a dock landing with mooring for the ability to store a boat as user venture onto the land. Ramps have a parking area for oversized vehicles that may be carrying large equipment, a boat ramp for motorized boaters to drop their boats off in the water, and a dock landing with mooring so that users can tie up their boats while getting everything situated. Blueway typologies are extremely important because they shape the entrance, exit, and resting experiences of users on the blueway. They play a pivotal role in getting people in and out of the river, therefore they must be designed strategically.

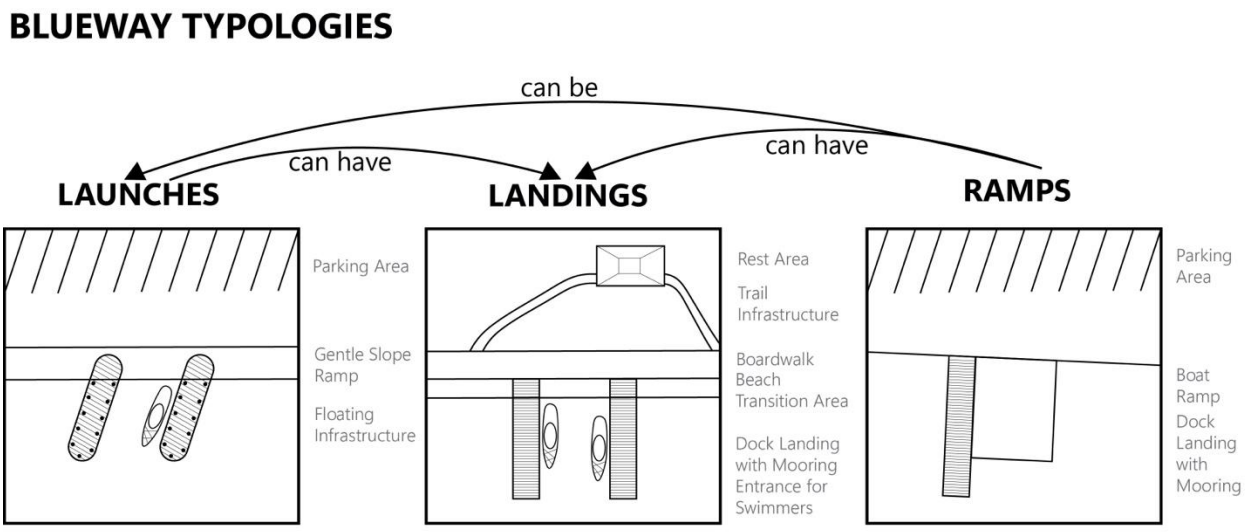

Figure 20. Plan view of components of each blueway typology.

The wayfinding typologies in Figure 21. demonstrate the possibilities of what wayfinding may look like on site, in order to create a cohesive theme and provide ample, clear information to the site users. Through case study research, it was found that signage is extremely relevant in the design of wayfinding and that signage needs to be clear and all-inclusive. This informed the design of the wayfinding typologies for the James River project. Floating buoys were proposed because of the lack of wayfinding available in the water for users. These may have mileage

numbers visible on both sides for visibility from farther distances, a small map with location indicator for people to be able to understand where they are in relation to the river, and a structure that is anchored to floats and bobs with the tide, so it is always near the user. Kiosk signage was proposed because there needed to be a cohesive way for users along the land side of the blueway to know where they were, gain insight into the site, and learn something. The signs should all follow a consistent theme with a map that has a location indicator on it and boxes that have may have informative drawings, variable information (safety, history, and warnings), and interpretative elements (including information on Atlantic Sturgeon and native plantings). Finally, landmarks that can be visible from the water are tools for wayfinding. There is not a standard typology for this, just the idea that maps can locate where visible landmarks are and then users can associate that with how far they have traversed in the site.

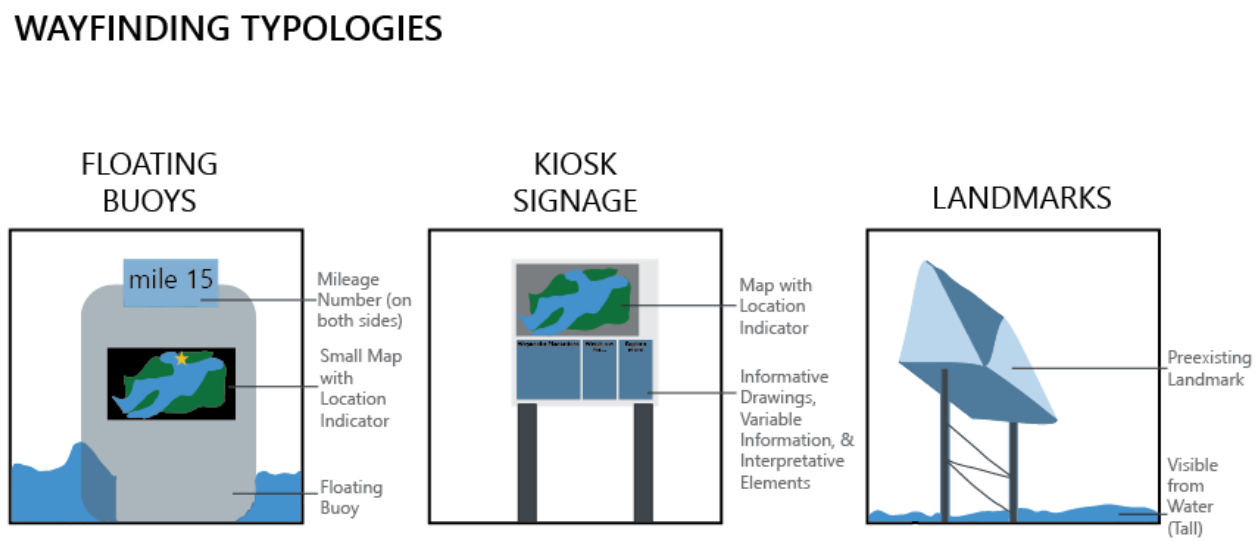

Figure 21. Perspective view of components of each wayfinding typology.

Reflection on the Design Process

Due to the length of this segment of the James River, while applying the blueway development guidelines, it was extremely difficult to capture all the components needed for a thoughtfully designed blueway because, like many masterplanning efforts, so many pieces need to be addressed to be fully inclusive of all users' needs and wants. For example, no cohesive way was found to capture the safety and best conditions as in the guidelines. This is because safety and best conditions are not static; they are dynamic, ever changing. It is also difficult to measure and quantify the best conditions, like wind and water speed and direction, as people have different comfortability levels with them. In order to design a strategic blueway, a more holistic set of guidelines may need to be developed to accommodate all the components that these guidelines were not able to capture (e.g., utility conflicts, water quality, water quantity, all elements of biodiversity, shoreline stabilization, etc.).These guidelines are just a starting point for employing a cohesive blueway network along a historic corridor.

To accommodate everyone, an element of community engagement must be employed, which the timing constraints of this project did not allow to happen. With time allowing, design workshops and charrettes in various communities along the James River would have been conducted to figure out the specific community wants and needs. This would have also had an element of design included, where community members could show what they wanted their future riverine parks to look like and what elements would encourage them to use the river more. These would have been held at a variety of locations to accommodate the largest number of community members' input. Additionally, it may have been helpful to gather more community input (from those who did not attend the workshops) through some surveys with open-ended

questions. This process may also be used to identify key site locations for future publicly accessible points and the expansion of water-based parks.

About 75% of the project consisted of gathering information (literature review, case studies, and design exploration) for developing the concise guidelines of blueways, while the other 25% was spent on the actual implementation and design reasonings on the James River as a case study for future implementation of the blueway guidelines in other landscapes. This was not how the project was originally intended, but as more information was revealed through research, it became clear that the blueway guidelines and design policy were an influential contribution to the broader discourse of landscape architecture because of blueways' important role in transforming a water-based recreation corridor.

As the guidelines are applied in different locations, it is important to remember to modify them to make sure they are site-specific. While the guidelines are general in nature, they were also somewhat influenced by the characteristics of the James River and issues that are specific to its needs. This allowed the design solutions to be tailored specifically to the James River and tied to the vitality of this corridor. To ensure that guidelines are site-specific, extensive site analysis and visits must be part of the overall process before being applied to site design along different river corridors. This is an extremely vital step because guidelines are just that, guidelines, and should not be the final word in any design since each site can be vastly different.

V. Conclusions

This thesis sets out to examine how blueway systems tied to riverfront corridors can be designed as multifunctional infrastructure that supports socio-ecological resilience, community connectivity, and increased recreational access. Through the comprehensive review of literature, planning documents, and existing trail models (through case studies), it became clear that blueways are not simply recreational amenities but deeply integrated socio-ecological systems. They operate at the intersection of many different disciplines (e.g., landscape architecture, planning, science, engineering, etc.) and bring together natural and human communities. The guidelines developed in this thesis translate these insights into a grounded, design and policy-forward toolkit that can be used in riverine corridors that are looking to cultivate deep connections with the water. These guidelines reflect evidence-based principles found in blue-green infrastructure frameworks, socio-ecological theory, and statewide recreational planning initiatives. By emphasizing adaptable launch points, culturally interpretative signage, and biodiversity-enhancing design interventions, the guidelines propose a resilient blueprint for how further blueways can be designed.

Ultimately, this work argues that designing blueways is not only about connecting people to water but also about connecting systems in a way that anticipates long-term sustainability. The design of these spaces must balance flood resiliency with daily functionality, cultural history with modern access, and conservation with recreation. The guidelines proposed for the James River blueway represent a step towards a more interconnected future where our rivers are not overlooked but carefully woven back into the landscapes and communities they have always shaped.

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