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BUSINESS PLAN

2022



R I V E R E

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Table of Contents

COMPANY DESCRIPTION AND LOGO.....	4
EXECUTIVE SUMMARY	5
INTRODUCTION	7
THE RAPPAHANNOCK AS A MODEL SYSTEM FOR WATERSHED RESEARCH	8
THE RAPPAHANNOCK AS AN ECONOMIC ENGINE	9
CURRENT AND PROJECTED THREATS TO THE RAPPAHANNOCK RIVER	10
WHAT WE DO: FACILITATE, PROMOTE, SUPPORT.....	11
SUPPORTING WATERSHED RESEARCH	12
SUPPORTING USE OF EMERGING TECHNOLOGIES TO CREATE VIRGINIA’S FIRST SMART RIVER	12
SUPPORTING ENVIRONMENTAL EDUCATION	14
SUPPORTING OUTREACH, ECOTOURISM, AND ECOCULTURE.....	14
SHOWCASING SUSTAINABILITY	15
ENVIRONMENTAL SUSTAINABILITY	15
ECONOMIC SUSTAINABILITY.....	16
SOCIAL AND CULTURAL SUSTAINABILITY	16
LOCATION ANALYSIS.....	16
JUSTIFICATION	17
ALIGNMENT WITH REGIONAL STRATEGIC PLANS	17
BENEFITS TO THE CITY OF FREDERICKSBURG.....	18
COLLABORATORS, PARTNERS, AND STAKEHOLDERS.....	20
COMPARATIVE ANALYSIS OF COMMENSURATE FACILITIES.....	24
CENTER DESIGN CONCEPT	25
ARCHITECTURAL DESIGN	25
GREEN BUILDING DESIGN AND MANAGEMENT.....	28
ACCESSIBILITY	29
DESIGN OF NATURAL ENVIRONMENTS	29
LANDSCAPE DESIGN CONCEPT.....	29
EXHIBIT DESIGN CONCEPTS.....	32
AN ONLINE RETAIL VENUE FOR THE RIVERE SM CENTER	35
ORGANIZATIONAL STRUCTURE.....	35
NONDISCRIMINATION POLICY.....	35
EXECUTIVE TEAM.....	36
RIVERE SM BOARD OF DIRECTORS	36
ADVISORY BOARDS	40
INTERNSHIPS AND INDEPENDENT STUDY.....	40
PHASES OF DEVELOPMENT	41
PHASE I - PLANNING AND FUNDRAISING.....	41
PHASE II - BUILDING DESIGN	42
PHASE III - BUILDING CONSTRUCTION AND MEMBERSHIP RECRUITMENT	43
PHASE IV - MOVE-IN AND TRAINING.....	45
PHASE V - OPERATIONAL CENTER	46
COMMUNICATIONS, MARKETING, AND ADVERTISING	47
FINANCIAL MODEL FOR ECONOMIZING SPACE IN THE RIVERESM ECOLOGICAL CENTER	49
THE ECOLOGICAL CENTER’S PROJECTED COWORKING MODEL FOR MEMBERSHIP SPACE	49

CONFIGURING THE SPACE TO MAXIMIZE PROFIT AND COLLABORATION	49
PRICING PER SEAT	51
SYSTEMS	51
PROJECTIONS OF CENTER COST AND ENDOWMENT NEEDS	53
FIRST FULL YEAR PROFIT/LOSS PROJECTIONS	54
FUNDRAISING.....	57
RISK ASSESSMENT	57
ACKNOWLEDGMENTS.....	61
REFERENCES	64

Company Description and Logo

The Rappahannock River Ecological Park LLC is operating as RIVERESM, a 501(c)(3) not for profit corporation, aiming to help mitigate effects of human population growth and global climate variability on freshwater systems by supporting water research, education, technology and ecoculture for the Rappahannock region. RIVERESM, with a location on the Rappahannock River in Fredericksburg, VA, will serve as a living laboratory for water researchers, management agencies and environmental educators. RIVERESM will be a game changing future forward Center with multi-faceted and far-reaching benefits for the City of Fredericksburg and the surrounding region.



The RIVERESM logo is the artistic version of leaves derived from Liquidambar, a genus of trees, commonly referred to as Sweetgum. This native tree is an ancient source of beneficial compounds that offer modern benefits. The logo stands for 'river reverence', and all that it connects. It depicts the connection of a flowing river, interaction of plants with the water way, and four dots that stand for research, education, technology and ecoculture. The logo colors show an ombre effect of how blues and greens are ever present in ecosystem services from the air we breathe, the water we drink, and abundant plant life. The RIVERESM Tagline is ~Revere the River~.

Executive Summary

The need to enhance and increase access to emerging technologies is one of the top national water challenge priorities for the next 25 years. Scientific research using automated sensors, machine learning, and big data integration will play a critical role in water research and intelligent water management decisions. The Rappahannock, the longest free-flowing river in Virginia and the Chesapeake Bay watershed, is an ideal watershed for supporting this national water priority.

Best Management Practices (BMPs) are the engineered or natural based solutions to capture and filter polluted stormwater runoff before it enters waterways. The Rappahannock River is big enough to provide meaningful challenges to test watershed Best Management Practices but is small enough to demonstrate successful BMPs. In addition, unprecedented environmental pressures projected for the Rappahannock provide an opportunity to proactively detect and mitigate changes over time through deployment of a watershed-level wireless sensor network to pilot emerging technologies. The region's population containing Stafford, Spotsylvania, King George and Caroline counties, and the City of Fredericksburg is projected to increase up to 60% in the next 20 years, making it the fastest growing area within Virginia. Projected intensification of urban and suburban development in the watershed will accelerate nutrient and sediment loading and ecological habitat decline. There is an urgent need to proactively address this challenge.

RIVERESM is a 501(c)(3) nonprofit corporation that will take a lead role in supporting this effort by building a world-class ecological center designed in form and function to attract, support, and integrate technology-enhanced scientific research into conservation, education, and outreach in the Rappahannock River watershed.

- **Location:** The RIVERESM Center will be located on 4-acres at the historic Embrey Power Plant site, as part of a revitalization of Fredericksburg's Creative Maker District. The Center will be within walking distance to vibrant downtown Fredericksburg, a high tourism area, local hotels, a walking/biking trail, and a train station that connects to Richmond and Washington D.C.
- **An Entrepreneurial Approach:** RIVERESM will serve as a host and a facilitator that provides a centralized location and support resources for water researchers, government agencies, nonprofits, environmental educators, and technology entrepreneurs. RIVERESM will support and enhance their work by offering:
 - **Indoor & Outdoor Space:** A high tech facility with laboratories, conference and education space, direct river access, and urban native landscaping to demonstrate watershed BMPs.
 - **Coworking Membership Model:** A modern alternative to office rentals that provides flexibility and cost savings, as conceptualized and proven successful by Gather Workspaces, LLC (Gather®). RIVERESM is seeking the talents of Gather® to manage the physical facilities of the Center in alignment with their existing facilities in Richmond and Hampton Roads.
 - **Exhibits:** A destination to showcase scientific research and Native American traditional ecological knowledge through exhibits that attract regional ecotourism and connect the public with science and ecoculture.

- Commitment to **economic, environmental, and social sustainability**, with Living Building design guidance from prestigious SmithGroup architects and Commonwealth Architecture.
- **Supporting Research and Technology**: RIVERESM will coordinate the Rappahannock SmartRiver initiative to serve as a focal point for collaboration involving emerging technologies designed to enhance water quality monitoring and research.
 - **Goal**: Support the development of technologies and BMPs that scale up to larger river systems. Combine artificial intelligence and wireless sensors to generate real time “big data” to inform rapid response and predictive modeling of water quality and quantity.
 - **Advisory Board**: Experts from Virginia Cooperative Extension, Virginia Tech, Virginia Innovation Partnership Corporation, Friends of the Rappahannock, Chesapeake Bay Foundation, USGS Next Generation Water Observing System, Rappahannock River Basin Commission, and University of Mary Washington.
 - **Key Collaborators**: Through a partnership with Virginia Innovation Partnership Corporation (VIPC), RIVERESM will facilitate research on the Rappahannock in the areas of wireless water quality sensor acquisition and deployment, data integration, and cloud-based computing by engaging the Virginia Smart Community Testbed (a partnership between VIPC and Stafford County EDA). RIVERESM will complement Smart Stafford’s Integrated Water Management initiative while benefiting from three ecosystems that confluence at the Testbed: 1) Verizon Innovation Hub ecosystem, 2) RIoT ecosystem, and 3) VIPC Living Laboratories ecosystem to identify technology and entrepreneurs.
- **Supporting Education, Outreach & Ecoculture**: RIVERESM will offer indoor and outdoor space to support and enhance environmental education, outreach and ecoculture initiatives.
 - **Goal**: Provide adaptable, technology-enhanced classroom, meeting, and exhibit space to host educational events and conferences. Leverage the power of virtual/augmented reality technology to enhance accessibility and reach of environmental education through virtual field trips and immersive learning experiences related to Rappahannock River ecology and regional Native American Tribes.
 - **Key Collaborators**: Educational initiatives at the RIVERESM Center will be led by Friends of the Rappahannock, a non-profit organization that provides nationally recognized environmental education programs to over 15,000 students annually. Outreach and ecoculture initiatives will be conducted in partnership with Virginia Cooperative Extension and the Patowomeck Native American Tribe.
- **Impact**: Combined, the Rappahannock SmartRiver and technology-enhanced educational initiatives at RIVERESM form an exciting opportunity to leverage ecotourism to connect the public with cutting-edge science, promote research and education, and demonstrate urban BMP landscaping to protect water quality in the Rappahannock watershed and beyond. Ecotourism from RIVERESM can result in significant financial benefits for the City of Fredericksburg and the region.

Introduction

“The provision of adequate fresh-water resources for people and ecosystems will be one of the most critical and potentially contentious issues facing society and governments at all levels during the 21st century.”

-- (American Meteorological Society, 2017)

According to the world’s leading climate experts, unequivocal evidence shows that anthropogenic influenced climate change is responsible for unprecedented increases in extreme weather noted in the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2021). Extreme variability in climate, resulting in increased droughts and floods, is projected to rise as the global temperature moves closer to the critical threshold established by the Paris Accord. The global temperature is currently 0.4 degrees Celsius shy of this critical threshold (IPCC, 2021). Rapid growth in human population and associated increases in land use will further exacerbate impacts on natural systems that support human life. Of particular concern is the dwindling global availability of clean water due to increased human consumption and contamination. By 2050, the projected total human population will reach ten billion with 65% of humans living in the global urban areas of the world (World Health Organization, 2019). By 2025, half of the world’s population will be living in water-stressed areas (World Health Organization, 2019). Over the next three decades, projected food production needs and increasing water effluents associated with increasing populations, suggest a 10-15% increase in river input by nitrogen loads into coastal ecosystems (United Nations, 2020). Finally, global water demand in water withdrawals is projected to increase by 55% by 2050, due to growing demands from a 400% increase in manufacturing (Organization for Economic Co-operation and Development, 2012). Current and projected impacts on environmental systems point to an unavoidable conclusion -- *the future of human existence is inextricably embedded in the health of Earth’s natural systems, particularly water.*

Adequate safe water provides the foundation of a nation’s health, economy, security, and ecology. Coming decades will present unequaled challenges in managing competing demands for freshwater (drinking water, energy, agricultural and industrial demands, and ecosystem requirements), given projections of more frequent and severe droughts and flooding (National Research Council, 2004). In 2018, the National Academies of Sciences, Engineering and Medicine identified the top strategic opportunities for water science and research to address the highest priority national water challenges over the next 25 years. The need to enhance and make emerging technologies more accessible is at the top of this list. Current barriers to water research include limitations in data collection, monitoring, sharing, and processing, and coordination of research between government and research institutions. These barriers make it difficult to support efficient water resource planning (Brown et al., 2015).

To address emerging water resource problems, government decision makers need to make intelligent choices informed by scientific research and analysis. Emerging and innovative technologies such as automated sensors, machine learning and big data integration will play a key role in water research. The Commonwealth of Virginia is well-positioned to contribute to these efforts. Virginia is taking a proactive approach to projecting future water availability and needs through state-wide conservation planning and prioritization models (Hazler et al., 2018). Virginia’s river network model incorporates all water withdrawals & releases (e.g., energy, industry, agriculture, water supply) including projected population growth and changing climate to develop simulations that help management agencies make intelligent decisions for future

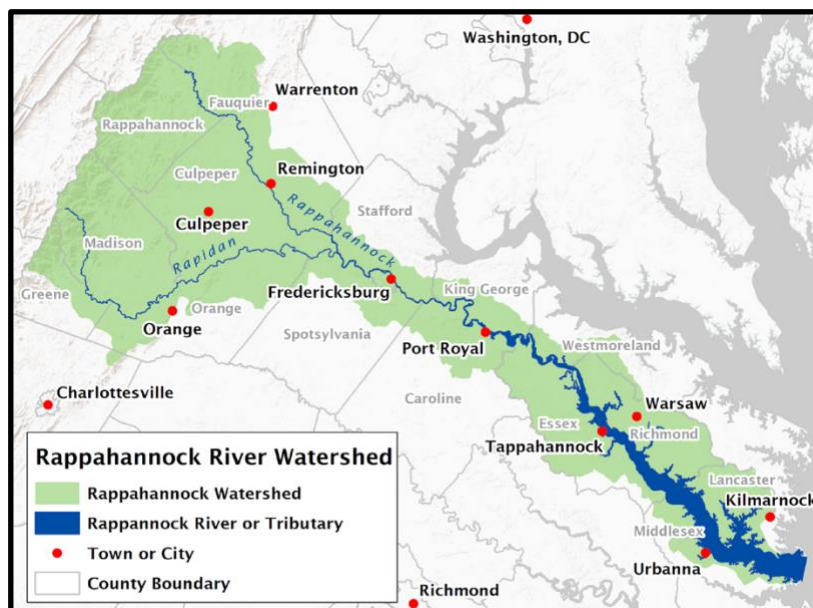
water management needs (Hazler et al., 2018; Virginia Department of Environmental Quality, 2021). Virginia's forward-looking approach is uncommon for the eastern United States, which is generally considered to be water rich. Of particular interest in Virginia is the Rappahannock River Watershed.

The Rappahannock as a Model System for Watershed Research

The Rappahannock River is a promising focal point for water resources conservation, restoration, and proactive management solutions that meet competing demands. With headwaters that originate in Chester Gap in the Blue Ridge Mountains, the Rappahannock carves a 185-mile free flowing path through Virginia's three distinct geographical regions, ultimately joining more than 100,000 interconnected streams and rivers flowing into the Chesapeake Bay (Figure 1).

Figure 1

The Rappahannock River Watershed



Note. The Rappahannock is the longest free-flowing river in Virginia and the Chesapeake Bay watershed, encompassing 7000 km² with headwaters in the Shenandoah National Park. Image Credit: Friends of the Rappahannock.

The Rappahannock River is representative of many other rivers on the East Coast of the United States. It flows through low-intensity agricultural lands (e.g., hay) and forests in its upper reaches, flanked by sprawling suburbia and high-intensity agricultural lands at and below the fall line. Like most rivers, the Rappahannock is experiencing significant environmental pressures from intense population growth, increased climate variability, and lingering effects of deforestation during America's early history. At the same time, the Rappahannock River Watershed is free from an over-abundance of complex industry and municipal effluent discharges. In 2006, 4,232 forested acres along 32 miles of the Rappahannock and Rapidan Rivers above Fredericksburg, were placed into conservation easement, to be managed by The Nature Conservancy (City of Fredericksburg, 2011). An additional 30 plus miles of tributaries

and streams flow in the river along the easement. Ten water quality monitoring stations exist within this easement. The river also has a relatively low degree of runoff associated with impervious surfaces because of the relatively small number of large cities located within the watershed. In addition, its percentage of agricultural runoff is lower than other watersheds, given the dominance of low-intensity agriculture in upper reaches of the watershed. The Rappahannock flows, unimpeded from its source in the Blue Ridge Mountains, to the fall line at Fredericksburg where it becomes tidal and increasingly brackish as it continues to the Chesapeake Bay.

As a high-quality resource with a wide spectrum of activities occurring within its watershed, the Rappahannock River is virtually tailor-made for a broad-based approach to identifying the challenges and developing and implementing solutions. First, the Rappahannock watershed is small and compact relative to other river systems, which makes the full watershed more accessible to researchers than other larger river systems. The entire river's stretch offers significant research opportunities all within a day's travel from beginning to end. The compact size of this watershed also makes it possible to demonstrate success with Best Management Practices (BMP). A BMP is an engineering practice or nature based solution to capture and filter stormwater runoff pollutants and sediments before they enter our local waterways. At the same time, the Rappahannock is still large enough that it can significantly impact the Chesapeake Bay and provide realistic challenges for testing the ability of BMP concepts to mitigate sediment and nutrient loads. Combined, these features position the Rappahannock to serve in proactive watershed solutions and management well-beyond the mid-Atlantic region -- a potential model study system for water research and management questions that can be scaled up to larger river systems. Given its just-right set of conditions, the Rappahannock is colloquially referred to as the 'Goldilocks River'. The Goldilocks principle, inspired by the children's story 'Goldilocks and the Three Bears', states that something must fall somewhere within the middle of extremes to be 'just right'. With its Goldilocks just-right qualities, RIVERESM aims to position the Rappahannock River as Virginia's first SmartRiver from its headwaters to the Chesapeake Bay, utilizing smart sensor technology that is ideally suited for the development of globally relevant research, demonstrable modeling, and mitigation strategies.

The Rappahannock as an Economic Engine

In addition to providing habitat for wild mammals, birds, freshwater mussels and fish, the Rappahannock River is a quiet economic engine for the entire watershed. The river provides potable drinking water and recreational value, and supports economically valuable species such as Oysters, Blue Crabs, Menhaden, Herring, Shad, Striped Bass and Atlantic Sturgeon. The river's collective 'natural capital' is significant to local and regional economies. The Rappahannock also has great potential for ecotourism. The Rappahannock provides fishing, canoeing, kayaking, tubing, swimming, camping, hiking, and biking opportunities for visitors. Combined, these key features of the Rappahannock offer great potential to bolster the regional economy through ecotourism. Virginia had a revenue stream of \$25 billion in the tourism industry in 2019, and according to the local Tourism Advisory Council, Fredericksburg and surrounding Stafford and Spotsylvania counties may reach an economic impact of a billion dollars by 2028. Local governments continue to seek novel ways to increase tourism opportunities in recreation, culture, and art.

The Rappahannock River offers an excellent opportunity for ecotourism development, particularly within the greater Fredericksburg region where the river passes through 32 miles of environmentally protected acreage owned by the City of Fredericksburg. This entire protected expanse of the river above the fall line is minimally affected by environmental stresses associated with human encroachment. This is a rare attribute shared by only a few remaining rivers across the U.S.

Current and Projected Threats to the Rappahannock River

As of 2021, well-documented and compelling data places the Rappahannock River at the precipice of extreme environmental pressure that will degrade water quality and jeopardize river health and economic stability. While declines in Chesapeake water quality and associated habitat have resulted from centuries of land use change, more recent intensification in both agriculture and urban/suburban development throughout the watershed have accelerated nutrient and sediment loading and habitat decline (National Fish and Wildlife Foundation, 2018). Projected population growth rates upstream, for Stafford and Spotsylvania County, show some of the fastest rates of population growth in the country. For example, the Fredericksburg population was 27,982 in 2020, and is projected to rise to 38,094 by 2040, an astounding 36% increase (Weldon Cooper Center for Public Service, 2019). Stafford County's current population of 256,927 is projected to increase to 183,161 by 2030, and 209,250 by 2040, a 33.4% increase (Weldon Cooper Center for Public Service, 2019). The region containing Stafford, Spotsylvania, King George and Caroline counties and the City of Fredericksburg is projected to increase 60% from 350,380 in 2025, to 562,598 in 2045, with the largest concentrations of employment per square mile occurring in Fredericksburg and the Dahlgren area of King George County (George Washington Regional Commission, 2018). This rapid growth will bring a surge in potential pollutants and sediments entering the river over a short period of time.

Currently, the Rappahannock River and Chesapeake Bay watersheds are considered impaired due to excess levels of nitrogen, phosphorus, and sediment. These pollutants largely come from non-point source pollution in stormwater runoff. Approximately 291,000 metric tons of nitrogen and phosphorus enter the Rappahannock River via stormwater each year (Dauer et al., 2005). Reports on nitrogen, phosphorus, and sediment loads in the Rappahannock (Figure 2) indicate a degrading situation for nutrient and sediment loading (Mason et al., 2021). A significant percentage of land in the area is in low-intensity agricultural use, which historically may have provided a source of bioaccumulative pesticides (now banned) to the land and the river (Dauer et al., 2005). In addition, the City of Fredericksburg has the lowest percentage of wetlands and shoreline with a riparian buffer of all the Virginia river tributaries of the Chesapeake Bay (Berman et al., 2017). Segments of the Rush, Thornton, Hughes, Hazel, and Rappahannock Rivers in Rappahannock County have been designated "303(d) Impaired" for fecal coliform or E. coli bacteria (RappFLOW, 2005). More recently, Friends of the Rappahannock assessed 11 river tributaries to obtain a representative sample of streams in the middle river section of the Rappahannock River. Streams were graded on human health, land use, stream ecology and community engagement. In the resulting 'Report Card', the middle Rappahannock was graded a "C" (FOR, 2018).

Figure 2

Reports on Nitrogen, Phosphorus and Sediment Loads in the Chesapeake Bay.

RIVER INPUT MONITORING STATION	TOTAL NITROGEN LOAD		TOTAL PHOSPHORUS LOAD		SUSPENDED- SEDIMENT LOAD	
	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term
SUSQUEHANNA RIVER AT CONOWINGO, MD	Improving	Improving	Improving	Improving	Degrading	Improving
POTOMAC RIVER AT CHAIN BRIDGE, MD	Improving	Improving	Improving	No Trend	Improving	No Trend
JAMES RIVER AT CARTERSVILLE, VA	Improving	Improving	Improving	Improving	Degrading	Improving
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	Improving	Degrading	Degrading	No Trend	Degrading	Degrading

There is an urgent need to take steps to protect the Rappahannock River. RIVERESM is a 501(c)(3), not for profit corporation that will take a lead role in supporting this effort. RIVERESM aims to promote and enhance the ecological and economic umbrella for the region by building a world-class ecological center on the banks of the Rappahannock. The RIVERESM Ecological Center will be a facilitator of water conservation efforts by offering flexible office, laboratory, and outdoor rental space for organizations helping to mitigate environmental pressures on the Rappahannock and the Chesapeake Bay watershed. The Center's outdoor landscape design will further enhance natural habitat by incorporating small scale best management practices with meandering trails that draw visitors to experience an adventure in research, education, technology and ecoculture.

What We Do: Facilitate, Promote, Support

RIVERESM aims to join and complement the great environmental centers of the world that share a similar mission to mitigate the impacts of human population growth and global climate change on freshwater systems. Due to its unique location and associated pressing environmental concerns, RIVERESM is in an excellent position to serve as a regional and global magnet for watershed research and conservation. The RIVERESM Ecological Center will support, promote and facilitate collaboration among water researchers, conservationists, environmental educators, and management agencies by bringing them into a shared space. RIVERESM will accomplish this goal by providing a state-of-the-art facility that offers flexible memberships with access to coworking, laboratory, education, auditorium, and event space. RIVERESM will support the use of emerging technologies by collaborating with the Virginia Innovation Partnership Corporation and water researchers to create the Rappahannock SmartRiver Initiative. RIVERESM will support ecoculture and ecotourism through the creation of rotating exhibits that integrate watershed research, sustainable agriculture, and indigenous knowledge into the surrounding landscape, providing visitors with meaningful learning opportunities. The Center will follow a phased approach for construction of the building and grounds that will continue to develop over time (see Phases of Development section). Each phase of research, education, technology and ecoculture will be developed incrementally for the interior and exterior of RIVERESM to ensure economic sustainability.

Supporting Watershed Research

RIVERESM will support water research and conservation in several ways. First, the high-tech design of the Center will help researchers align with national water research priorities involving emerging technologies such as automated sensors, machine learning, predictive modeling, and big data. These national research priorities include (1) enhancing data collection, citizen science, and development of Web-based analytical tools, and (2) coordinating with agencies and organizations on data delivery (National Academies of Sciences, Engineering and Medicine, 2018). To accomplish this first goal, RIVERESM has formed a Research Advisory Board to inform the integration of emerging technologies into the Center and provide guidance on the research focal point at RIVERESM, the Rappahannock SmartRiver Initiative (see next section). Second, the physical location and structure will provide researchers with ample indoor and outdoor resources to support research. The RIVERESM Center interior will include a flexible office, coworking and collaboration space, wet and dry laboratories, a greenhouse, flexible educational, auditorium and event space. The Center will integrate high-bandwidth technology and audio/visual resources, copy/print resources, and a kitchen. Surrounding the Center, RIVERESM will offer direct access to the Rappahannock River, as well as on-site Best Management Practice landscaping and testing grounds, walking trails, a canoe livery, and 24/7 secure access and parking. Finally, RIVERESM will provide scientists a venue to conduct imperative environmental research with concentrated access to a network of potential collaborators who share local, regional, and global-level watershed expertise. Combined, these features will support scientists' efforts to develop novel and replicable mitigation strategies for dissemination to watersheds around the globe. RIVERESM has already taken initial steps to kickstart research efforts and academic engagement with the Rappahannock by funding programs at the University of Mary Washington, Virginia Tech, and Virginia Cooperative Extension (see Important Collaborators, Partners, and Stakeholders, section for more details).

Supporting Use of Emerging Technologies to Create Virginia's First SmartRiver

Emerging technologies will play a critical role in addressing water research challenges over the next 25 years (National Academies of Sciences, Engineering, and Medicine, 2018). The wide adoption of new technologies will require development of systems (e.g., hardware, software, management frameworks, protocols) that can rapidly collect data from disparate sources, assess, store and process, and share data in formats that are informative and accessible in near real time. Consequently, developments in managing big data and integrating data from multiple sources and of different types will be critical to supporting scientific research involving predictive modeling and decision-making under uncertainty.

RIVERESM will support water research involving emerging sensor technologies, applied machine learning and predictive modeling by bringing the Rappahannock SmartRiver Initiative to Virginia. Recent advances in wireless sensors and communication technologies have led to the emergence of next generation water quality monitoring systems that are changing bodies of water can be monitored and managed (Adu-Manu et al., 2017; Burke & Allenby, 2013; Chen et al., 2018; Dong et al., 2015). The Rappahannock SmartRiver Initiative is a smart water quality monitoring system with a network of wireless sensors collecting real-time data on chemical, biological and physical aspects of the river, and transmits data through a centralized server to be processed, stored, and made available online. Resulting data can be used for monitoring water quality, detecting changes over time, sending notifications on existing or emerging water

quality issues, and contributing to a long-term big dataset to support predictive modeling. Over the past fifteen years, many examples of wireless sensor networks used for water quality monitoring have been developed throughout the world and are reviewed in Dong et al. (2015) and Adu-Manu et al. (2017). The Intelligent River© system on the Savannah River in South Carolina (White et al., 2010) is of particular relevance to the mid-Atlantic region of the U.S.

Making the Rappahannock Virginia's first complete SmartRiver through the strategic placement of wireless sensors from its headwaters to the Chesapeake Bay will enable real-time monitoring of the river and its tributaries for pollutants that damage the ecological health of the river. The river will include an automated wireless sensor network that relays real time data on water quality and quantity parameters such as temperature, pH, flow rate, and turbidity, used to predict water availability and the effects of weather or climate-based events on the watershed. In addition to standard water quality and quantity technology, experimental sensors for emerging contaminants such as microplastics, pharmaceuticals, and perfluorinated compounds may be developed and tested as part of the installed network. Big data from this effort can be used to identify pollution sources, enable rapid mitigation responses, and support predictive modeling to inform regional, national, and global freshwater challenges. The development of a smart wireless sensor network through the full length of the Rappahannock will enable much-needed proactive monitoring, mitigation and planning measures as projected population growth and development upstream place increased pressure on the river. The Rappahannock SmartRiver Initiative can also support and complement the growing network of technology-based, precision conservation initiatives within the Chesapeake Bay watershed (Burke & Allenby, 2013).

RIVERESM will support research efforts to acquire and apply emerging technologies associated with Smart Cities to the Rappahannock SmartRiver Initiative (Trindade et al., 2017), and will accomplish this goal through several key relationships. First, RIVERESM will help water researchers pilot and test new wireless sensor network initiatives through a collaboration with the Virginia Innovation Partnership Corporation (VIPIC) and its Virginia Smart Community Testbed (a partnership between VIPIC and Stafford County Economic Development Authority). VIPIC created the Testbed in Stafford to test new technologies in a real-world setting to drive faster innovation. Smart Stafford is the first Smart City Testbed in Virginia involving an IoT platform, fully integrated with 5G and other new and emerging technologies for Smart Cities in the state. RIVERESM will complement Smart Stafford's Integrated Water Management initiative by connecting water researchers with the Testbed. Through a collaboration with VIPIC, RIVERESM can help water researchers pilot and test design ideas prior to implementation of the full Rappahannock SmartRiver Initiative by (a) determining if there are available sensors or sensors that can be developed to collect desired data, (b) deploying sensors, (c) bringing data from sensors into the cloud, and (d) making those data available in an online dashboard. RIVERESM will also collaborate with VIPIC to write joint grant applications to seek federal funding in support of the SmartRiver concept. Ultimately, the Rappahannock SmartRiver Initiative will enable researchers and government agencies to identify correlations between the built and natural environment within the Rappahannock Watershed. Resulting data will improve the capacity of rapid mitigation responses as well as support predictive modeling of water availability and use in relation to increases in frequency and severity of flooding and droughts.

Second, RIVERESM will learn from and collaborate with RIoT, a non-profit organization that aims to accelerate and increase the impact of start-up businesses involved in IoT

technology (RIoT, 2022). RIoT has played a central role in helping Stafford County develop the Testbed and can serve as a critical liaison to ensure that the RIVERESM Center's research technology objectives align with, and complement, the Testbed in efficient and synergistic ways. RIoT can also assist RIVERESM during its development stages by co-writing grant proposals, connecting RIVERESM with its IoT business consortium network, and training RIVERESM staff via the 12-week RIoT Accelerator Program. After the Center is established, RIoT can offer workshops that help inform researchers with IoT-5G technology training.

Third, to support water research involving big data, predictive modeling, artificial intelligence, and machine learning, RIVERESM is partnering with the Artificial Intelligence Assurance and Applications (A3) lab at Virginia Tech. The A3 lab is interested in understanding the effects that episodic events have on detectable patterns in water quality data and work to develop solutions for those issues. Their overall goal is to improve water quality data to inform better decision-making while also improving data security. Through this collaboration, RIVERESM and the A3 lab can provide data storage and computing power, as well as expert guidance in AI/machine learning applications and data security. Resulting data from the SmartRiver project will be made publicly accessible for research and decision-making purposes.

Finally, RIVERESM will seek support from initiatives such as Microsoft's AI for Earth (Microsoft, 2022a), Amazon's Imagine Grant Program (Amazon, 2022), and IBM Cloud (IBM, 2022). These initiatives support environmental research by providing funding and cloud-based resources to store and analyze big data. Examples of support requests include credits for big data storage, a dedicated data scientist at RIVERESM, and funding for emerging technologies such as microsensors that advance measuring, monitoring, and analysis of water quality.

Supporting Environmental Education

Of equal importance to the RIVERESM Center's mission is supporting the Friends of the Rappahannock (FOR) non-profit organization. FOR works throughout the watershed to provide high quality environmental education programs, address nutrient, sediment, and bacteria pollution, enhance terrestrial and aquatic habitat for fish and wildlife, and increase public access to outdoor spaces. Through a collaboration with FOR, RIVERESM is well-positioned to support regional education and outreach efforts. The Center will provide flexible classroom space, access to the river and creative outdoor landscaping where educators can develop and implement environmental education outreach programs that complement research conducted at the Center. RIVERESM will also support FOR's coordination of the Rappahannock River Roundtable by offering highly flexible coworking and educational space that can be adapted to the needs of educational and community groups, as well as government agencies involved in watershed conservation. Additionally, leveraging the power of virtual/augmented reality technology will promote accessibility and reach of environmental education through virtual field trips and immersive learning experiences related to Rappahannock River ecology and regional Native American Tribes.

Supporting Outreach, Ecotourism, and Ecoculture

As a world class ecological center, RIVERESM will serve as a novel ecotourism destination for both visitors and residents. The Center will showcase small scale urban landscape practices and be known for promoting water research, education, and cultural programs for the community, with an opportunity to become a trend setting tourist attraction. The RIVERESM

Center is well positioned geographically to attract national and international visitors. The greater Fredericksburg area is equidistant from the state and nation's capitals, along Interstate 95's corridor, making it equally accessible to Virginians, as well as national and international tourists.

The RIVERESM site of interest is located in the Creative Maker District in Fredericksburg, Virginia with easy walking distance to parks and local restaurants. With close proximity to the Patowomeck Native American Tribe in Stafford County, RIVERESM will collaborate with the Tribe to integrate Traditional Ecological Knowledge into the Center design by supporting and promoting scientific research, sustainable landscape practices, and indigenous relationships with the land. As a culture of people historically dependent on water ecosystems, the location of the Patowomeck Native American Tribal Center is positioned as an important sentinel, just a short paddle down river on the banks of the Rappahannock. The Center will bring together researchers and Native American Tribal members throughout Virginia, using intentional design principles that weave BMP watershed research, sustainable landscaping, and indigenous knowledge into the surrounding grounds of the Center. The integration of Scientific Ecological Knowledge and Traditional Ecological Knowledge will provide visitors with meaningful educational opportunities, inspire sustainable design principles, and serve as an example for home landscapes.

Showcasing Sustainability

RIVERESM will integrate principles of economic, environmental, social, and cultural sustainability into the design and operations of the Center. Economic sustainability will be ensured through membership income from flexible coworking, research lab, and auditorium space. Environmental sustainability will include LEED® Platinum and Living Building design criteria and best management landscape practices. Social and cultural sustainability efforts will balance Traditional and Scientific Ecological Knowledge in collaboration with the Patowomeck Tribal Center and other cultures.

Environmental Sustainability

The Center design will showcase the surrounding landscape by restoring diverse habitats with small scale urban BMPs. The design team will strive to meet Leadership in Energy and Environmental Design (LEED®) and Living Building Challenge (LBC) stringent requirements and meet the most ambitious environmental performance standards. Transparency of the building design and operation will provide a deep learning experience for optimizing energy use, engaging member occupants and short-term visitors. The RIVERESM Center will also entice the public with educational opportunities and provide platforms for students to use available space and the surrounding landscape as living learning laboratories. From monitoring the renewable energy systems of the building, to maintaining outdoor demonstration BMP landscaping, and overseeing the water systems in the building, the Center will provide many opportunities to engage and learn. Firsthand regenerative approaches will be showcased to students, administrators, and researchers with local integrated river sensor technology that can be appreciated globally.

Economic Sustainability

The 2020 global pandemic highlighted the fact that overhead costs for building occupancy can be reduced through leasing/rental shared spaces. From small availability to large conference spaces, having flexibility in office space and associated costs reduces overall overhead expenses. All levels of successful organizations have shifted away from the 'business as usual' norm to discovering innovative ways to work. In this spirit, the RIVERESM Center will use a flexible coworking and membership financial model for economizing space as conceptualized and proven successful by Gather.[®], a registered trademark of Gather Workspaces, LLC. In addition, RIVERESM has consulted with Wipfli LLP, to conduct a financial analysis to determine how much square footage must be leased at the Center to cover annual operating costs. The analysis will be used to determine size of the Center and rates for leasing space, hereinafter referred to as 'membership'. See the 'Projections of Facility Cost and Endowment Needs' section below for more details.

Social and Cultural Sustainability

The Center will also explore social systems and how human interaction with natural environments can be improved and sustained through a balance of Traditional and Scientific Ecological Knowledge. The RIVERESM Ecological Center will work in conjunction with the Native American Tribes to offer a unique balance of sustainability that is in keeping with the balance of both forms of Ecological Knowledge. The RIVERESM laboratories will be committed to science-based decision-making and long-term strategic planning. Considering long-term goals while addressing short term gains, the Center will provide a clearing house and focal point for mission critical research, environmental ecosystems exploration, as well as cultural awareness.

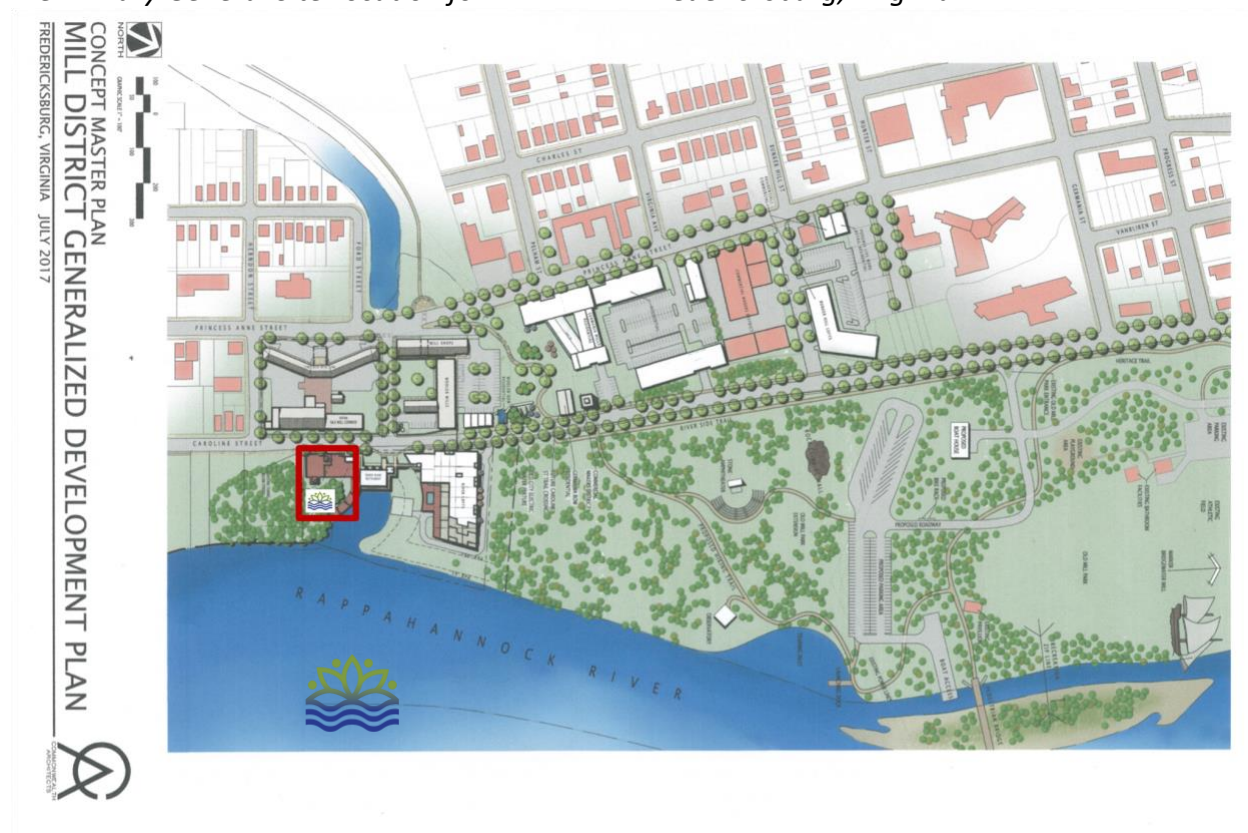
Location Analysis

RIVERESM considered several sites along the Rappahannock River and decided on a 4-acre property in Fredericksburg that is well positioned geographically to attract national and international visitors. Fredericksburg is equidistant from the state and nation's capitals along Interstate 95's corridor, making it accessible to locals and tourists. The RIVERESM Center will be located on Caroline Street on the banks of the Rappahannock River at the historic Embrey Power Plant site as part of a revitalization of Fredericksburg's Creative Maker District (Figure 3). The Center will be within walking distance to vibrant downtown Fredericksburg, a high tourism area, local hotels, the Canal Path walking and biking trail, and a train station that connects to Richmond and Washington D.C. The RIVERESM site is also within walking distance to Old Mill Park, a public park on the Rappahannock River featuring a swimming beach, soccer fields, picnic areas and restrooms.

The RIVERESM Ecological Center will be a major tourist attraction, along with numerous historical sites within the greater Fredericksburg area. As an ecological center that showcases research, education and sustainability, RIVERESM will serve as an ecotourism destination that appeals to all ages. The exterior landscape of the Center design will support and integrate scientific research, sustainable agriculture, and indigenous relationships with the land. RIVERESM will provide visitors with scientific demonstrations and opportunities to interact with various exhibits throughout the surrounding landscape.

Figure 3

Preliminary General Site Location for RIVERESM in Fredericksburg, Virginia



Note. Location for the RIVERESM Center site on Caroline Street in Fredericksburg.

Justification

The RIVERESM Center will align with and enhance both national and regional priorities by supporting environmental research, technology, educational programming, and ecoculture. First, the high-tech design of the RIVERESM Center will support scientists aligned with national water research priorities (see above sections ‘Supporting Watershed Research’ and ‘Supporting Use of Emerging Technologies to Create the Rappahannock SmartRiver Initiative’). Second, RIVERESM will collaborate with and support already established regional stakeholders to address environmental pressures on the Rappahannock River in association with projected regional growth (see ‘Collaborators, Partners, and Stakeholders’ section below). Finally, RIVERESM will support and align with strategic plans for the City of Fredericksburg in their objectives to protect and restore the ecological integrity of local waterways while also promoting economic development and ecotourism.

Alignment with Regional Strategic Plans

RIVERESM will align with the Fredericksburg Virginia Comprehensive Plan (City of Fredericksburg, 2015) and Fredericksburg Economic Development Strategic Plan (Fredericksburg EDA, 2019) by contributing to four core industry targets that will help Fredericksburg meet its objective of becoming an employment epicenter. In alignment with

Fredericksburg's tourism, hospitality, and specialty retail industry target, RIVERESM will build a world-class ecological center designed in form and function to attract and engage ecotourists with cutting-edge science, technology, environmental education, and ecoculture. To be located at the historic Embrey Power Plant site, the RIVERESM Center will contribute to the revitalization of Fredericksburg's Creative Maker District in a way that connects the community to the Rappahannock River. RIVERESM will obtain design guidance from prestigious SmithGroup architects and Commonwealth Architecture to integrate sustainable, futuristic design features into the facility while honoring Fredericksburg's commitment to preserving its authentic historic character.

The RIVERESM Ecological Center will jointly align with Fredericksburg's professional and corporate office users industry target as well as the science and technology, R&D, contracting/consulting industry target by offering flexible coworking memberships to corporations, academic institutions, non-profit organizations, governmental agencies, and start-up technology companies with an environmental focus. The RIVERESM Center will provide a dynamic, collaborative environment that generates synergistic opportunities for members and promotes their work through public outreach. RIVERESM will attract coworking members by coordinating the Rappahannock SmartRiver Initiative, which will serve as a focal point for making Greater Fredericksburg the "go-to" region for academic researchers and high-tech companies interested in developing, manufacturing, and deploying emerging sensor technologies to enhance water quality monitoring. RIVERESM has established a Research Advisory Board comprised of local and regional experts to guide this initiative. RIVERESM is also partnering with Virginia Innovation Partnership Corporation (VIPC) to facilitate research on the Rappahannock in the areas of wireless water quality sensor acquisition and deployment, data integration, and cloud-based computing by engaging the Virginia Smart Community Testbed (a partnership between VIPC and Stafford County EDA). RIVERESM will complement the Testbed's integrated water management initiative while benefiting from three ecosystems that confluence at the Testbed: 1) Verizon Innovation Hub ecosystem, 2) RIoT ecosystem, and 3) VIPC Living Laboratories ecosystem to identify technology and entrepreneurs.

Finally, RIVERESM will align with Fredericksburg's education and health services industry target by partnering with Friends of the Rappahannock, who will oversee environmental education at the RIVERESM Ecological Center. These green programs will increase public awareness in many federal and state mandated topic areas, such as protecting drinking water resources, effective and proper use of fertilizers and pesticides, and habitat restoration. RIVERESM will donate profits from the coworking facility revenue to support FOR's mission. FOR's administrative staff can locate at the RIVERESM Center at no cost once the facility becomes profitable, enabling FOR to expand educational capacity at their existing site. RIVERESM is also engaging high-tech companies and researchers to develop virtual and augmented reality immersive learning experiences to support, enhance and expand the capacity of FOR's educational outreach efforts.

Benefits to the City of Fredericksburg

Through its alignment with Fredericksburg's long-term strategic plans, RIVERESM will bring economic, environmental, and public benefits to the region. RIVERESM will contribute to the protection and enhancement of *natural goods, services, and resources* in Fredericksburg by collaborating with Fredericksburg in water quality management. Through its support of BMP

watershed research, RIVERESM affiliates will help protect and restore streams through reduction of surface and groundwater pollution, helping the City of Fredericksburg identify, adopt, and implement programs that protect the Chesapeake Bay watershed. RIVERESM can also assist the City of Fredericksburg in floodplain management efforts through the development, testing, and implementation of state-of-the-art monitoring equipment. Floods are the most common and most expensive natural disaster, and according to FEMA's Historical Flood Impact data (FEMA, 2018). In the state of Virginia, flooding and associated costs are expected to increase dramatically over the next sixty years. Notable findings from the *2021 Virginia Coastal Resilience Master Plan* technical study's impact assessment shows that between 2020 and 2080, "the number of miles of roadways exposed to chronic coastal flooding is projected to increase from approximately 500 to nearly 2,800 miles, an increase of 460%", and "the number of residential, public, and commercial buildings exposed to an extreme coastal flood is projected to increase by almost 150%, from 140,000 to 340,000, while annualized flood damages increase by 1,300% from \$0.4 to \$5.1 billion" (Department of Conservation and Recreation, 2021). As increased flooding occurs in the coming decades, research conducted by RIVERESM affiliates will contribute to the region's efforts to manage flood-related events, helping to save lives, structures, and other important resources. RIVERESM will contribute to offsetting the City of Fredericksburg's flood-associated costs, which are expected to increase dramatically over the next 60 years (Department of Conservation and Recreation, 2021).

As a scientific and educational coworking space for the region, RIVERESM can contribute to *fiscal health* in Fredericksburg by attracting new home buyers who are looking for more desirable places to live, work, and raise a family. Attracting new residents will provide increased revenues from personal property as well as sales tax. According to the National Association of Realtors (2020), in the *2020 Profile of Homebuyers and Sellers*, 26% of buyers who purchased a home in a suburb or subdivision listed 'convenient to parks/recreational facilities', as a factor influencing neighborhood choice, that is 2% higher than 'convenient to schools' at 24%. Having RIVERESM as an educational draw for the region could influence home buying decisions for those seeking to relocate to or near Northern Virginia. Property values will increase in Fredericksburg with the addition of offerings at RIVERESM. The price of homes near natural areas and gathering spaces have been found to command an eight to ten percent premium on property values. The location for the RIVERESM Ecological Center in Fredericksburg will help increase the surrounding area's appeal even further for those looking to relocate to this area, with the potential to increase real estate prices for current residents. With increased business-related travel to Fredericksburg, associates traveling to RIVERESM will help support the City with both increased spending and tax revenue for local businesses. In 2019, the average travel party spending for business trips in Virginia was \$932 per trip with each trip lasting, on average, 2.8 nights with a majority (68%) of visitors originating from somewhere outside of the state (Virginia Tourism Corporation, 2019).

RIVERESM will support *regional ecotourism and outdoor recreation* both directly and indirectly. The Rappahannock River represents a means of enjoyment for both tourists seeking paddling activities and as an economic engine for the businesses catering to outdoor recreation. In 2012, economic impacts and benefits of recreational paddlers along the Northern Forest Canoe Trail in Vermont were quantified, including individual and group spending while on the trail. The study found that approximately 90,000 paddlers spending money in local communities "created \$12 million in total economic impacts and supported about 280 jobs. The

median paddler group spent \$215 per trip, primarily at lodging establishments, restaurants, grocery stores, and service stations. Nonlocals spent an average of \$414-498, or \$46 per person per day” (Pollock et al., 2012). Similarly, the Rappahannock River serves the greater Fredericksburg region as a means of outdoor recreation. Through its support of collaborators that work to protect and maintain the health of the Rappahannock River, RIVERESM will contribute to improving the experience of recreational paddlers and preserve the pastime of freshwater fishing for local and regional residents. In the City of Fredericksburg, the Department of Wildlife Resources issued a total of 1,087 fishing licenses in FY 2022, with 513 Resident State Freshwater Fishing licenses (Department of Wildlife Resources, 2023). Since fishing is important to many residents and visitors to the Fredericksburg region, protecting the water quality of the Rappahannock River to promote the health of fish is imperative. Over 800,000 Virginia residents and non-residents participate in fishing each year, with the economic impact from fishing, more than \$1.3 billion to the State of Virginia (Department of Wildlife Resources, 2022). Combined, these efforts will help bring adventure-seekers to the area and promote new and existing businesses. RIVERESM will also support regional ecotourism through its educational outreach in coordination with Friends of the Rappahannock, BMP demonstration projects, and natural gathering spaces for events.

Finally, the RIVERESM Ecological Center will also contribute to improving *public health and wellbeing* of the regional community by promoting key values associated with nature centers including environmental connection, leisure provision, community resilience, and civic engagement (Browning et al., 2018). RIVERESM can provide residents with access to an ecological center next to Old Mill Park where visitors can be physically active while increasing their connection with the natural world. Having a community that is more physically active can help reduce health related expenses and increase quality of life (Kahn et al., 2002).

Collaborators, Partners, and Stakeholders

The RIVERESM concept is based on collaboration of organizations who work together as a community of professionals striving toward ecological solutions through science, education, technology and ecoculture. It is important to note that the primary role of RIVERESM is to serve as a conduit of connection, support, and promotion of the work conducted by these collaborators and stakeholders. A vast community of collaborators and stakeholders has already been established and will continue to develop with interest toward a more responsible view of watershed and ecosystem services.

Friends of the Rappahannock (FOR)

Friends of the Rappahannock is an impactful organization that focuses on the health of the river and educating citizens about environmental wellbeing. Since 1985, FOR’s successes are long and distinguished and have worked throughout the basin to be the voice and active force for a healthy and scenic Rappahannock River watershed. FOR works throughout the entire 18 county region of the watershed to offer a broad spectrum of programs to address nutrient and sediment pollution outlined in the Chesapeake Bay Total Maximum Daily Load (TMDL), local bacteria pollution, enhance terrestrial and aquatic habitat for fish and wildlife, increase public access to outdoor spaces, and provide high quality environmental education programs. In 2016, FOR began administering the Rappahannock River Roundtable (Roundtable) in

partnership with the Virginia Department of Environmental Quality (DEQ). The Roundtable is a strategic partnership of stakeholders working to accelerate the pace of land and water conservation through increased community engagement, education, and capacity building throughout the entire Rappahannock River Watershed. The Roundtable works to implement the Rappahannock River watershed's portion of Phase III watershed implementation plan which outlines priority BMPs for the agricultural, urban, and natural sectors. In 2019, the Roundtable was awarded a \$810,000 grant to accelerate collaboration and implementation of non-point source pollution BMPs. The initiatives underway range from riparian buffers, tree plantings, nutrient management planning, and livestock exclusion in the upper portions of the watershed to oyster reef restoration and living shorelines in the lower watershed. Virginia Tech, Virginia Cooperative Extension, soil and water conservation districts, natural resource conservation service, and many other organizations participate in projects and programs with the Roundtable. This collaborative approach to regional water quality improvement is an innovative way to share resources, expertise, and maximize economies of scale and pollution reduction.

Virginia Cooperative Extension (VCE)

RIVERESM engaged with VCE in 2018, to explore the possibilities of sighting an Ecological Center (EC) on the Rappahannock River. Funding was raised through three different sources to fund two different efforts. First, VCE and RIVERESM agreed to fund an Extension Agent position to facilitate the RIVERESM concept with area stakeholders to include FOR, Stafford County and the City of Fredericksburg. This position helped solidify relationships with area stakeholders and nonprofits with existing facilities to include the Chesapeake Bay Foundation, the Stroud Lab, Ohio State Universities Stone Lab and the Cary Institute in New York.

RIVERESM and VCE and Virginia Tech are committed to the development of the Ecological Center with employee support to further the cause. The second effort involved funding from RIVERESM and the Wetland Studies and Solutions Trust Fund to support several projects on the Rappahannock. The first study is being conducted to verify assumptions made within the Environmental Protection Agency's Chesapeake Bay Model by documenting the concentration of nutrients and sediments within run-off water during storm events for 5 different land uses in the Fredericksburg area. VCE researchers are working with the University of Mary Washington and Friends of the Rappahannock to collect this information. VCE and Biological Systems Engineering at Virginia Tech are currently assessing the potential for a long-term physical presence on the Rappahannock and position the Rappahannock as a Model Study System for watershed research. This would be a significant alliance and potential for an anchor tenant.

Virginia Innovation Partnership Corporation

The Virginia Innovation Partnership Corporation (VIPC) is a non-profit corporation that creates technology-based economic development strategies to accelerate innovation, imagination, and the next generation of technology and technology companies in Virginia. VIPC has worked closely with the Stafford County Economic Development Authority (EDA) to create the Virginia Smart Community Testbed initiative in Stafford to test new technologies in a real-world setting to drive faster innovation. Through a MOU collaboration with VIPC, RIVERESM will complement Smart Stafford's Integrated Water Management initiative by helping water researchers pilot and test design ideas in association with the Rappahannock SmartRiver.

RIVERESM will also work with VIPC to write joint grant applications to seek funding support for water research involving emerging sensor technologies.

Stafford County Economic Development Authority

RIVERESM embraces cross county collaboration with the Stafford County Economic Development Authority (EDA) and partners with the Virginia Innovation Partnership Corporation to establish the Virginia Smart Community Testbed, located in Stafford. Through its partnership with VIPC, RIVERESM works with Stafford EDA to write grant applications and seek support funding for technology-based water research in alliance with the Testbed.

RIoT

RIoT is a non-profit organization that aims to accelerate and increase the impact of start-up businesses involved in Internet of Things (IoT) technology. RIoT played a central role in helping VIPC and Stafford County develop the Smart Community Testbed and has been instrumental in supporting economic development by working with emerging markets and accelerating startups. RIoT Labs provide hardware, wireless and software prototyping with all the tools startup companies need. RIVERESM is learning from the RIoT team as we develop the Rappahannock SmartRiver Initiative and identify ways to support research involving emerging technologies. RIoT can assist RIVERESM by co-writing grant proposals, connecting RIVERESM with its IoT business consortium network, and training RIVERESM staff via the RIoT Accelerator Program. After the RIVERESM Center is established, RIoT can offer workshops to provide researchers with IoT-5G technology training.

Virginia Tech (VT)

RIVERESM continues to develop ongoing relationships with a variety of researchers at Virginia Tech. This includes the College of Agriculture and Life Sciences (Department of Biological Systems Engineering), College of Science (Department of Biological Sciences, Department of Geosciences), College of Architecture, Arts, and Design (School of Architecture), and the College of Engineering (Bradley Department of Electrical & Computer Engineering, Artificial Intelligence Assurance and Applications (A3) lab in Arlington, VA). See the Acknowledgements section for specific faculty members with whom RIVERESM has collaborated.

Virginia State University (VSU)

As a historically black land grant university, established in 1882, Virginia State University is the first fully, state supported four-year university of higher education for Black Americans. The RIVERESM Center supports all cultures and will work to establish a culturally diverse stakeholder community that works together for improvements in water quality and river research. With a robust aquaculture program, Virginia State University will be integral to research and education in this region. As an already established stakeholder with Virginia Tech and Virginia Cooperative Extension, Virginia State University is key to promoting diversity and cultural awareness for the community.

George Washington Regional Commission (GWRC)

The RIVERESM team has collaborated with GWRC who took the lead on a grant proposal with former Executive Director, Dr. Linda Milsaps. RIVERESM facilitated an alliance in 2020, with a four-

member team consisting of GWRC, and researchers and professional staff from Virginia Tech and the University of Mary Washington together with support from Friends of the Rappahannock. The grant proposal was structured to identify and ensure the most cost-effective Best Management Practices (BMPs) to meet the EPA required reductions of Nitrogen (N), Phosphorous (P) and sediment.

Rappahannock River Roundtable (RRR)

Collectively, the RRR is a partnership coordinated by Friends of the Rappahannock that works to accelerate the pace of implementation for priority best management practices (BMPs) and associated conservation programs outlined in the Virginia Phase III Watershed Implementation Plan (WIP) through innovation, resource sharing, capacity building, and technical assistance. The Roundtable provides assistance with grant writing, project development, outreach and education programs and campaigns, social media and digital content development and management, GIS and mapping support, and a variety of other support services to members and partners serving the Rappahannock River Region. The RIVERESM Ecological Center will be a home for the RRR members.

University of Mary Washington (UMW) and UMW Foundation

RIVERESM has helped fund projects involving environmental projects for UMW scientists and students. RIVERESM helped coordinate an alliance with VCE and Biological Systems Engineering Department in the College of Agriculture and Life Sciences at Virginia Tech to assess runoff water within the City of Fredericksburg. Similar studies can be initiated with Stafford County. The UMW business school was integral to researching key elements for the RIVERESM business plan.

American Canoe Association (ACA)

The American Canoe Association with an Olympic Gold Medalist in a past summer's Olympics has voiced interest in locating their offices within the RIVERESM Ecological Center and would take advantage of the easy access to the Rappahannock River.

The Nature Conservancy

The Nature Conservancy (TNC) are the overseers of the City of Fredericksburg's impressive 31-mile long conservation easement along the river upstream of the City and will be a logical collaborator to advance their role for this beautiful section of the Rappahannock River.

Patawomeck Tribal Office

As a State recognized Native American Tribe, the Patawomeck Tribal Center has a membership of approximately 2,500 strong, the largest in Virginia. The RIVERESM Center will work in conjunction with the Patawomeck Tribe, offering a unique balance of sustainability that is in keeping with the balance of Scientific Ecological Knowledge and Traditional Ecological Knowledge. The RIVERESM laboratories will be committed to science-based decision making and long-term strategic planning. Considering long-term goals while addressing short term gains, the Center will provide a clearing house and focal point for mission critical research with reverence to Indigenous knowledge.

Rappahannock Tribe

As a Federally recognized Native American Tribe, the Rappahannock's were founded prior to 1570. The Rappahannock mission is to preserve tribal culture, social, and political structures, while educating the public on rich contributions to Virginia and the Nation. The RIVERESM Center will work with all Native American tribes, but especially those that have direct connections with the Rappahannock River.

Additional stakeholders that may have interest in the RIVERESM facility (listed alphabetically):

- American Battlefield Trust (ABT)
- George Washington Regional Commission (GWRC)
- National Parks Conservation Association
- National Park Service
- Virginia Department of Conservation and Recreation
- Virginia Department of Conservation Resources (DCR)
- Virginia Department of Environmental Quality (DEQ)
- Virginia Department of Health (VDH)
- Virginia Department of Historic Resources
- Virginia Department of Wildlife Resources (DWR)
- Virginia Marine Resources Commission
- Virginia Outdoors Foundation (VOF)
- Tri-County/City Soil & Water Conservation District (TCCSWCD)
- US Army Corps of Engineers (ACOE)
- US Department of Agriculture: Farm Service Agency (FSA)
- US Department of Agriculture: Natural Resources Conservation Service (NRCS)
- US Geological Services (USGS)

Comparative Analysis of Commensurate Facilities

A comparative analysis was conducted to enhance sustainability through a collection of empirical data and research-supported solutions from twelve commensurate organizations. This data will be valuable to address planning outcomes, programs and general operating procedures during the design and building phases for construction. This information will provide a basis for a forward and sustainable trajectory in building design, program and initiative development, and research. A rubric was developed to guide data collection, form data sets, and provide comparable information for analysis in site location, organizational concept and structure, programs and initiatives, rentable space, annual reports, accountability, funding sources, building design and construction, and overall costs. Rubric and data set information results are available in Appendix A.

Upon completion of data set analyses, notable similarities and differences were highlighted as areas of interest and consideration. Organizational initiatives, interdisciplinary collaboration, educational programs, community inclusion, and outreach were common with similarities in fundraising approaches. Differences existed in the delivery method and degree of success of each organization's initiatives. The strengths and strategies identified by this comparative analysis will inform the design and development of the RIVERESM Center.

Center Design Concept

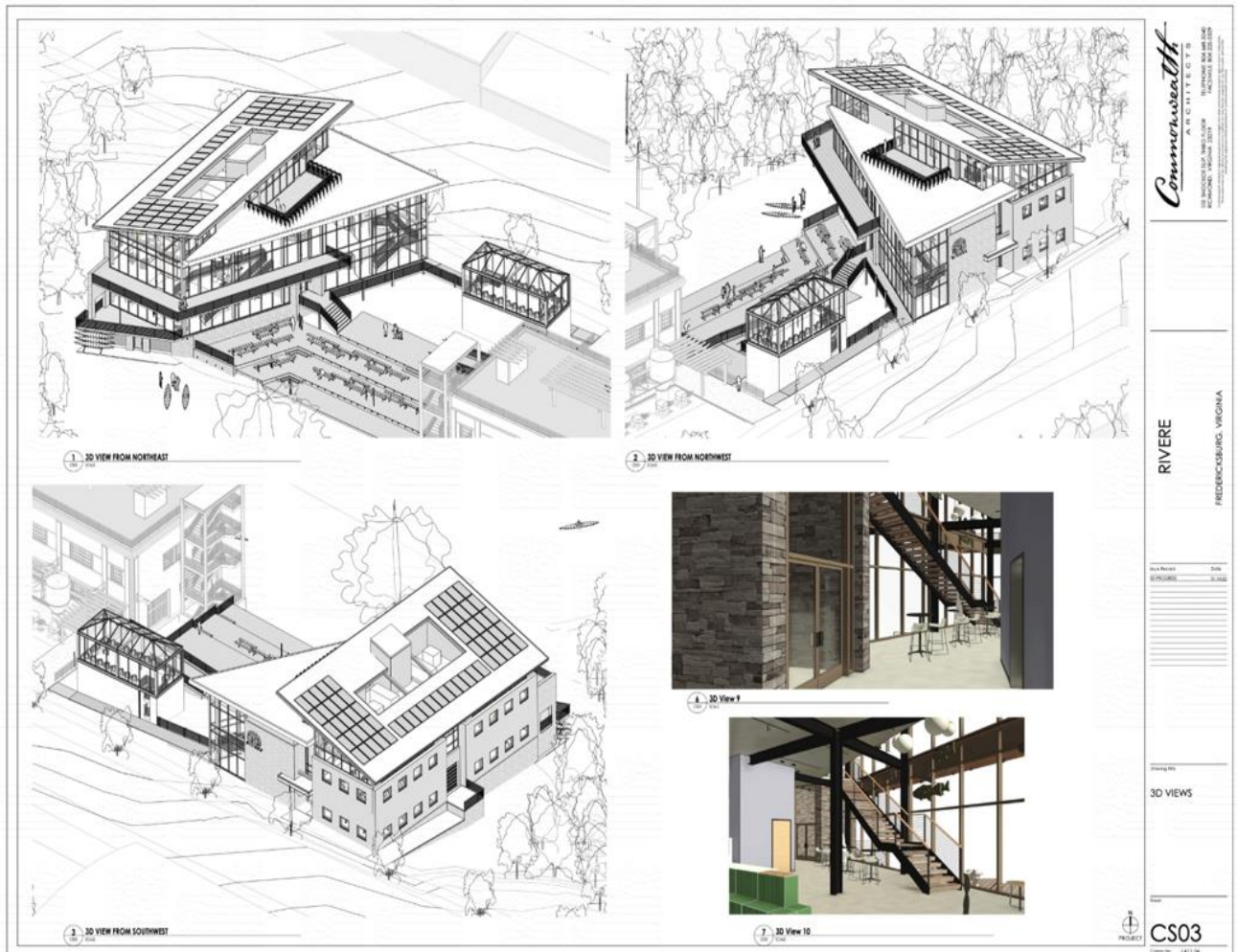
The creation of the RIVERESM Center on the Rappahannock River will provide a much-needed centralized location for a wide range of stakeholder involvement including environmentally focused researchers, non-profit organizations, governmental organizations, K-12 students, special interest community groups, and tourists. The Center will be a physical conduit for conservation-related collaboration in research, to deliver and participate in meaningful educational opportunities, host symposiums, and educational conferences. The Center will also serve as a centralized community space for environmentally relevant gatherings and special events. RIVERESM will be an architecturally organic structure on the banks of the Rappahannock, using green living, biophilic, and LEED® design principles.

Architectural Design

The RIVERESM Ecological Center will be a facility with wet and dry scientific laboratories, flexible auditorium space, flexible office and coworking space, collaboration space, adaptable education space, dedicated space for education exhibits, interactive learning stations and artistic displays, a greenhouse, state of the art audio-visual and internet capability, office support, a kitchen, and an educational dock. The surrounding urban landscape will be designed and managed to support learning opportunities featuring native plants and modern methods for utilizing plants and biological systems to treat runoff pollutants on a smaller scale. RIVERESM will also offer 24/7 secure access and parking and direct access to the shallows of the Rappahannock River. RIVERESM will strive for LEED® Platinum or Living Building Challenge certification and serve as a smart facility with integrated technology. The facility will use the latest technology building management system to (a) promote energy efficiency through features like motion detectors and individualized room controls to automatically adjust lighting and ventilation, and (b) provide high-speed wireless capacity to members and guests. Figures 4-7 depict architectural renderings for a 10,000 sq. ft. center suitable for the 4-acre site in Fredericksburg, reflecting design principles. More detailed information on these architectural renderings can be found in Appendix B. A video of the RIVERESM Center concept can be found on the RIVERE website at www.RIVERECenter.org.

Given its emphasis on showcasing sustainability and green building design principles, RIVERESM is consulting with the Vice President, Corporate Director of Sustainability at SmithGroup architecture firm in Washington, DC. SmithGroup architects have expertise in campus planning, energy & environmental modeling, LEED, strategy, sustainable design, and are known for green building design work on the [Brock Environmental Center in Virginia Beach, VA](#), the [Philip Merrill Environmental Center in Annapolis, MD](#), and the [Virginia Tech Innovation Campus and Academic 1 Building in Alexandria, VA](#). RIVERESM is excited to bring SmithGroup's extensive experience with LEED® certification and Living Building Challenge certification standards to the design of the Center. Given the significant evolution of the RIVERESM vision since its inception, including site considerations and associated opportunities, architectural design concepts in Figures 4-7 (and the video referenced above) are also likely to evolve. Consequently, these figures and videos should be viewed as conceptual renderings only.

Figure 4
Conceptual Digital Rendering of the RIVERESM Center



Note. Views of the RIVERESM Center from different angles. Developed by Commonwealth Architects for the 4-acre location in Fredericksburg.

Figure 5

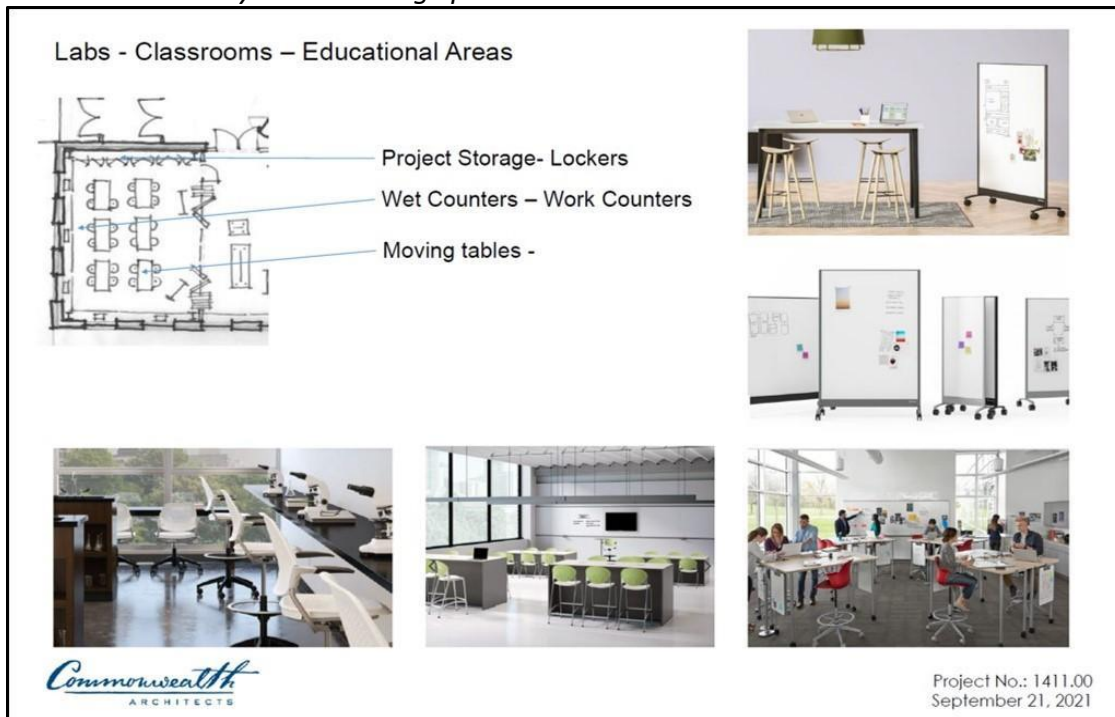
Conceptual Digital Rendering of the RIVERESM Center Exterior



Note. Riverfront view of the RIVERESM Center. Developed by Commonwealth Architects for the 4-acre location in Fredericksburg. Features shown include an open design with ample natural lighting, a greenhouse propagation lab, a green roof terrace and a canoe/kayak storage area.

Figure 6

Flexible Laboratory and Learning Spaces



Note. Examples of how laboratories and learning spaces can be designed with flexibility. Open designs with moveable tables and chairs enable adjustment to accommodate different needs.

Figure 7

Flexible Office and Coworking Space



Note. Examples of how office space can be designed with flexibility in mind. An open design with moveable walls, tables and chairs enables flexible adjustment of the same workspace to provide different formats that accommodate differing tenant needs over time.

Green Building Design and Management

As a Center that focuses on environmental sustainability, the RIVERESM Center construction will model energy and environmental design principles in conjunction with the LEED[®] certification and the Living Building Challenge certification standards. Members (occupying rentable space) and visitors will be exposed to unique innovative design solutions, utilizing smart technology, environmentally friendly design concepts, and recycled building materials.

Living laboratories will be provided to demonstrate and disseminate real time data, generated from research within the building. To prioritize building efficiency, LEED[®] building certification will decrease operational costs, increase asset value and ensure productivity, comfort, health and well-being for occupants, as well as aid in implementing ecologically ethical management practices for investors (Williams, 2021). LEED[®] certification will position RIVERESM as a globally recognized symbol of sustainability and leadership, utilizing sustainable construction as part of the effort to address climate change and resource depletion (Pham, et al., 2020).

The Living Building Challenge performance standard provides a framework of regenerative design to create spaces that are empathetic to nature, a system beneficial for human interaction with light, air, food, and nature, and designs that offer positive impact for the community (Williams, 2021). The Living Building Challenge is a design concept for regenerative buildings connecting collaborators to a holistic approach to construction with site location self-sufficiency. This Challenge is the world's most rigorous proven performance standard for buildings and people from around the world using regenerative design framework to create spaces that give more than they take.

The RIVERESM Center's building management will utilize resources similar to Microsoft's Cloud for Sustainability platform that will be helpful to record, report and reduce emissions

while gaining efficiencies (Microsoft, 2022b). This system of carbon accounting and insight technology will help generate data to track the Center's carbon footprint and meet goals of sustainability (i.e., attain carbon neutrality). Tracking of data reporting and decision making will drive sustainability objectives.

Accessibility

The RIVERESM design plan will allow for unrestricted access to the entire building and surrounding landscape areas. The building design will focus on the American Disabilities Act (ADA) compliance for ease of entrance for all, with prominent ramps to ensure effortless access to educational exhibits and gathering spaces. The ADA sets building standards for handicap access. In kayak/canoe launch layouts, specifications will be used to govern width, turning radius, degree of incline, and side rail protection.

Design of Natural Environments

The building site provides an opportunity to showcase natural based solutions for best management practices in both restorative and regenerative model study systems that benefit water quality. As an example of transformational landscape change, innovative management practices for sustainable land and building management will be implemented. The 4-acre RIVERESM site location in the City of Fredericksburg provides an exciting opportunity to showcase urban BMP landscaping to protect water quality in the Rappahannock watershed.

Landscape Design Concept

The RIVERESM site location will have significant potential for visual and tangible exhibits and urban, small-scale BMP landscaping that showcase Research, Education, and Cultural Knowledge. The Center will partner with Virginia Tech, Friends of the Rappahannock, and Native American Tribal members to use intentional design principles that weave Best Management Practice watershed research and indigenous knowledge into the surrounding landscape. This integration of Scientific Ecological Knowledge and Traditional Ecological Knowledge will provide visitors with meaningful educational opportunities and inspire the use of sustainable design principles in home landscapes.

A pristine view and access to the Rappahannock River will be the focus of the exterior grounds for research and education exhibit opportunities. An outdoor classroom and dock will be available for research, educational tours, and monitoring stations at this location, accessorized with plants that secure the riparian zone (the interface between land and river). These plants will prevent direct runoff of storm water and silt deposits through erosion mitigation strategies including a sloping riparian bench, riparian plantings, and existing trees (Appendix C, Figure 1). The canoe launch will also be available to members, including Friends of the Rappahannock and The American Canoe Association for education as well as recreation tours (Appendix C, Figure 2). River access will be the source for community involvement, research, and education that will focus on improving the health of this environmental asset.

RIVERESM will also showcase sustainable design principles both within and around the facility that connect people with the importance of plants in promoting watershed health. Landscape design will use watershed-specific plant choices included with Virginia stormwater Best Management Practices (BMP's) and demonstrate how native plant gardens serve as natural filters that prevent polluted runoff from entering the watershed. The erosion

prevention exhibits at RIVERESM will show tangible natural filtration planning schemes that use an understanding of root morphology and layers (structural, seasonal, ground cover) and can be replicated throughout the region to reduce sediment run-off into the river (Appendix D, Figure 3). Central to the Center's landscape design research strategy, will be access to native plant landscape design schemes and long-term monitoring of soil inputs. The Center will also offer researchers a variety of BMP designs at one location, for better monitoring and data collection. There are 15 practices listed in subsection [9VAC25-870-148](#) of the Virginia Stormwater Management Program VSMP regulation (LIS Virginia State Law, 2022) (Appendix C). From a Vegetated Roof to permeable pavements and even rain gardens, there are many options. Project settings will be available at the Center for year-long senior design projects that identify and analyze water resource problems and develop practical solutions based on the BMP's identified. A phased approach for installation of BMPs will be utilized with location and size of the building determining scope and scale of those practices.

Finally, the RIVERESM facility's interior and exterior will serve as inviting spaces for the community to dwell in an ecologically friendly landscape and learn how sustainable landscaping can simultaneously contribute to both ecological and human well-being. Using an intimate knowledge of plant growth habits and ecology, native plant selections will be arranged in the surrounding landscape in aesthetically pleasing drifts of color (Figure 9). Because plants benefit human health by providing cleaner air, increased well-being, reduced stress, and increased productivity (Lohr, 2010), RIVERESM will integrate living wall accents into the design of the building interior (Figure 10). By demonstrating how aesthetically pleasing landscape designs can be incorporated into work and living spaces (Figure 11), we hope to inspire home and business owners to consider using sustainable design principles.

Figure 9
Drifts of Color



Note. A visual of the diversity of plants and color drifts that can be created with proper plant placement. Photo Credit: Piet Oudolf and Noel Kingsbury Plant Design.

Figure 10
Interior Living Wall



Note. Interior living wall in work and gathering spaces. Photo Credit: Greenroofs

Figure 11

Natural Outdoor Workspaces



Note. Outdoor workspaces by Alberto Mattiello and Davide Anzalone. Photo Credit: Global Design News.

Exhibit Design Concepts

The Creative Director of RIVERESM will be responsible for the artistic design of interior exhibit space, collaborating with staff and administrative boards on the development of exterior features. Exhibits will be inviting, inclusive and sensitive to all social and cultural aspects. Exhibits will seek to educate individuals on topics related to the Rappahannock River watershed in scientific and traditional ecological knowledge, emerging technologies in science, restorative and regenerative landscaping, and environmental ecology. Exhibits will be designed to incorporate current RIVERESM research on water quality and support in-house educational programming already established by Friends of the Rappahannock. Whether static, dynamic, or interactive, exhibits will offer independent opportunities for visitors of all ages to experience an in-depth exploration into geography of the river, various historical cultures, and chemical and biological systems affecting a wide range of native flora and fauna.

During the development phase of the optimal visitor experience, RIVERESM cross-referenced data from a strategic resource for cultural organizations. According To Colleen Dilenschneider (2022), the Chief Market Engagement Officer at IMPACTS Research & Development, research data determined that 10 metrics can be utilized to identify attractiveness for consumers to enjoy an optimal visitor's experience. This is an on-going long-term study of perceptions and behaviors related to visitor-serving organizations in the United States. Following the metrics, the RIVERESM Center scored very high in the top five most desirable areas, especially in proximity to waterfront, historical value, hiking trails, and park locations, and the offering of scientific experiences. Using high-confidence data, these metrics offer developing businesses with audience engagement strategies that benefit visitors with an enjoyable cultural experience, while optimizing mission execution and financial sustainability

(Dilenschneider, 2022). Using these metrics will offer strategies to optimize experiences for visitors at the RIVERESM Center.

The Creative Director will collaborate with staff to develop an inviting venue, complete with intuitive floor plans sensitive to inclusivity for all visitors. Suggested flow patterns with clear and concise signage will alert and guide visitors to important interior and exterior exhibits and current program offerings.

The plan for flexibility of design exhibits will be utilized to produce permanent structural and interactive exhibits as well as dynamic exhibits that alternate with spatial and temporal patterns in nature. Advisory boards will offer suggestions for exhibits supporting areas of Research, Education, Technology, and Ecoculture. Relevant ideas for displays and interactive experiences will focus on in-depth sciences such as stream ecology, conservation biology, and human health. The Creative Director will meet frequently with Friends of the Rappahannock (FOR) educational staff, to review upcoming curricular themes and education objectives needed to support and promote FOR programming, for seamless integration of Center exhibits.

RIVERESM staff will consider code of ethics strategies in preparation for designs and exhibit implementation in alignment with the American Alliance of Museums, as well as through support from professional agencies. Strengths and weaknesses will be identified to develop and initiate a positive visitor experience. An implementation of a structured exhibit design plan proposal will outline the process for exhibit creation, from concept to construction.

Artistic displays coordinating the inclusion of environmentally themed art from local and regional artisans will serve as design enhancing features for the interior of RIVERESM. Meaningful permanent and semi-permanent artwork displays will serve as vibrant components conveying environmental activism, generating stimulating conversations, and inviting participation. Local and regional artists will provide a positive impact on numerous topics of environmental justice to inspire and support transdisciplinary learning. The local Fredericksburg area has already been established as a mecca for numerous artists whose expertise will be showcased and provide items available for purchase at the Center.

Biophilic design elements will be incorporated to enhance visitor experiences, in keeping with environmental principles and practices of LEED[®] Design strategies. The integration of emergent technology is included within the design and operations of the Center and will be utilized in research programs. Augmented Reality, IoT, and 5G technologies will be useful tools for enhancing educational programs, interactive exhibits, and artistic displays. An example of emergent technology, involving an augmented reality sandbox, is shown in Figure 11.

To enhance the visitor experience for all, RIVERESM will experiment with reserve times and locations for visitors requiring special accommodations, providing guests with more autonomy and support within the least restrictive environment. An example of augmented reality that would be helpful for engaging visitors with disabilities shown in Figure 12. Additional examples of novel and interactive exhibits are available in Appendix D.

Figure 12
Shaping Watersheds Augmented Reality Sandbox



Note. Sand is overlaid with top-down projection so visitors can physically manipulate various characteristics of water flow within watersheds Image Credit: Silverman

Figure 13
Augmented Reality User Application



Note: Augmented reality is an exciting, interactive way for visitors to interact with exhibitions. Image Credit: Prafulla

An Online Retail Venue for the RIVERESM Center

As an integral part of public outreach, RIVERESM will design and operate an online retail store, the River's Edge. All inventory will reflect environmental themes relevant to conservation and river ecology, including both gift-oriented and functional items. All products will have a limited impact on the environment and positive influence on the consumer. Retail offerings will include items that continue to inspire and engage visitors in conservation appreciation and activism. Merchandise will be diverse, with emphasis on locally sourced items, including RIVERESM branded gifts, handcrafted items, clothing, and accessories. Available literature will focus on environmental topics, instructional kits, and guides for implementing environmentally conscious projects. A Green Retail Management Plan will also be developed by the RIVERESM team, in keeping with the sustainability concept for the building to improve retail value of products, eliminate waste, increase efficiency, and reduce costs. Items will be sourced that provide repurposed items and materials and promote fair trade organizations and local producers. The Center will utilize shipping materials with eco-friendly/recycled packaging, tags, and bags demonstrating zero-waste and recycled or repurposed materials for online shopping.

Organizational Structure

The focus of the RIVERESM organization structure is to create a model of cultural acceptance and community within the center. As a phased approach that will expand over time, the center will be based on diversity and inclusion, and promote a multicultural community, with a sense of belonging for all, that attracts top talent and drives innovative results. Hybrid work modes and transitional office spaces will provide a more comfortable place to attract like-minded members of the community working to improve sustainability for this river environment. Since the majority of waking hours are spent in a work status, it is important for the culture of RIVERESM to promote and support cultural acceptance through employee recruitment and practice, creating an overall positive and aesthetically pleasing work environment. The concept is purposely designed to leverage the synergy of like-minded environmental concerns by locating them in a single location to enhance the abilities of those organizations to collaborate for the greater good of all participants. RIVERESM will be the facilitator for positive environmental progress in the region by fostering research concepts applicable to watersheds across the globe.

Nondiscrimination Policy

This policy states the RIVERESM position on discrimination and applies to all RIVERESM employees, volunteers, members, clients, and contractors. RIVERESM does not discriminate on the basis of race, creed, color, ethnicity, national origin, religion, sex, sexual orientation, gender expression, age, height, weight, physical or mental ability, veteran status, military obligations, and marital status. This policy also applies to internal promotions, training opportunities for advancement, terminations, outside vendors, organizational members and customers, service clients, use of contractors and consultants, and dealings with the general public. The research component of this organization is critical and will draw strength from collective data obtained by research associates who utilize the center. Attracting professionals to the center with laboratory space to perform meaningful research, the ecological collaborative will accomplish

multi- disciplinary projects with the opportunity to accommodate on-site global researchers and promote diversity from all walks of life.

Executive Team

The RIVERESM executive team will strive to be inclusive of gender and cultural diversity with technology accessible to everyone. Internship opportunities will be an integral part of the structure with possibilities for future employment. Many volunteers will continue to be involved from the beginning of this concept and continue to devote time, amassing hours of work along with the Executive staff. Three Advisory Boards will offer expert advice throughout the planning, design, construction, and operational phases, guiding the executive team in all aspects of research, education, technology and ecoculture. The RIVERESM Executive team will be comprised of four levels:

1. The first level will be held by the Executive Director of Operations
2. The second level will comprise of department directors
3. The third level is for jobs held under those department directors
4. The fourth level is for intern positions held under those departments

The organizational structure will be composed of levels, and staff hiring will be accomplished through a phased approach noted in Figures 12, 13, 14, 15, and 16, based on the organization phases of planning, building design, building construction, and building completion. The present plan for day-to-day management of the rentable space and coworking areas will be contracted with the professional management company, Gather.[®]. Information on Staff duty details can be found in Appendix E.

RIVERESM Board of Directors

The RIVERESM Board of Directors will represent a diversity of organizations and establish a governance system for the Center. Information on confirmed board members is provided below. An additional four board members will be sought to ensure gender and cultural diversity and will be identified upon confirmation.

EXECUTIVE STAFF

- Executive Director; Mikel Ann Manchester

DIRECTORS (confirmed)

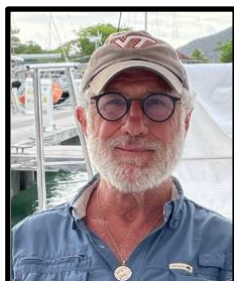
- Henry “Buck” Cox, PhD, Chairman
- John Coleman, CPA
- Ed Jones, PhD
- David Paylor
- Suzanne Y. Pierce Esq. | Attorney, CowanPerry PC

PROFESSIONAL BIOGRAPHIES



Mikel Ann Manchester, MS

Mikel Ann Manchester serves as the Executive Director at RIVERESM. She has more than 20 years of experience managing people with multimillion-dollar retail establishments as well as large groups of volunteers. She also holds the position of Associate Extension Specialist for Water Quality and Community Development in the Agricultural Leadership, and Community Education department at Virginia Tech as an Alumna as well as the community at large. She holds her level I and II certification as a Chesapeake Bay Landscape Professional. With a bachelor of arts in environmental studies from Virginia Wesleyan University, and a master of science in agriculture and life science, plant science and pest management, from Virginia Tech, she has a well-rounded background. She has vast knowledge in environmental studies, plant and pest management, greenhouse management, landscape design as well as professorial duties at the university level with Virginia Wesleyan University and University of Mary Washington. She enjoys public engagement with the community and is passionate about community gardens. Working with consultants, partners and stakeholders, Mikel has guided the team on research and development of the RIVERESM Business Plan. She is currently pursuing her PhD at Virginia Tech in the field of Life Science - Agricultural and Extension Education, with a focus on eco culture and Indigenous Tribes. Mikel's broad skill set will be invaluable for the Center in management, fundraising, education, research, eco culture, and community affairs.



Henry "Buck" Cox, PhD

Henry "Buck" Cox grew up in Fredericksburg, Virginia, where he spent his younger years on the Rappahannock River developing a passion for the natural world. After earning his bachelor of science from Virginia Tech, Buck worked with Virginia's State Water Control Board to monitor pollution sources entering rivers and streams of Northern Virginia. He earned a master of science and PhD in Environmental Engineering at Virginia Tech and started a career in environmental remediation. Over his 37-year career, he jointly owned/co-owned and operated three environmental clean-ups companies prior to starting his fourth business, Advanced Oxidation Technology (AOT) in 1998. His initial startup began in 1982 as Environmental Technology, Inc. (later HazWaste Industries) in Richmond, VA. It became one of the fastest growing small businesses in the US with annual revenue of over \$50 million when it merged with EarthTech in 1993. His second company, BioSystems Technology, Inc., became a leader in petroleum soil remediation using a unique biological method, trademarked as Biological Enhanced Remediation. This concept resulted in treatment of millions of tons of contaminated soil in eleven biological treatment facilities around the country. Breakthroughs in his fourth start-up, AOT, in the early 2000's, resulted in 18 patents for advancing treatment of hazardous waste in soil and groundwater as well as treatment of hydrogen sulfide in natural gas and wastewater. Buck is now focused on giving back to the community where he grew up by creating the RIVERESM Ecological Center to conserve the Rappahannock River and support the advancement of water quality monitoring, environmental education, and innovative research.



John Coleman, Commonwealth Business Services, CPA/Owner

John Coleman is a Certified Public Accountant with over 30 years of business experience in the areas of corporate, nonprofit and individual taxation. Mr. Coleman is the current owner and President of Commonwealth Business Services (CBSI) which serves the tax and accounting needs of businesses and individuals throughout the world. Mr. Coleman has worked on speaking engagements with the Better Business Bureau on a variety of topics. He has also been the lead panelist for Podcasts by Smartvault and

Powerfulaccounting.com. Mr. Coleman has worked in both public and private industry. For six years, he worked with both public and private firms with Deloitte & Touche in Washington DC. In 1999, he accepted a Tax Manager position with publishing giant Gannett Co. Inc. In 2004, Mr. Coleman formed his own company which merged with CBSI in 2006. Since then, CBSI has tripled in size in terms of client base. This is primarily due to Mr. Coleman's commitment to Uncommon Service and Integrity which has been the company's mantra since his leadership began in 2006.

Mr. Coleman is a member of the American Institute of Certified Public Accountants, the Virginia Society of CPAs, the National Association of Tax Preparers and the National Society of Accountants. He has both a Bachelors and Masters degrees in Accounting, with Concentration in Taxation, from Virginia Tech. Mr. Coleman currently lives with his family in Fredericksburg, Virginia and has served in various volunteer positions for Spotsylvania County Little League.



Edwin Jones, PhD

Edwin Jones is currently Executive Director of the Extension Committee on Organization and Policy 4-H Leadership Committee and is director emeritus of Virginia Cooperative Extension and associate dean emeritus of the College of Agriculture and Life Sciences at Virginia Tech. He served as associate dean and director from 2011 - 2022. Prior to service at Virginia Tech he served as associate director and state program leader for Agriculture, Natural Resources,

and Community and Rural Development; assistant department head and department extension leader in forestry; and as extension wildlife specialist and professor of forestry at North Carolina State University. He has also served as extension wildlife specialist at Mississippi State University. Jones has a bachelor of science degree in zoology from the University of Washington, and master of science and a doctoral degree from Virginia Tech in fisheries and wildlife sciences. He has held leadership positions in numerous Extension associations, including Chair of the Extension Committee on Organization and Policy for the Cooperative Extension Section and Co-chair of the ECOP 4-H Leadership Committee. He is the 2021 recipient of the Distinguished Ruby Award of Epsilon Sigma Phi.



David K. Paylor, MS

David served as Director of the Virginia Department of Environmental Quality (DEQ) from 2006-2022 under Governor's Kaine, McDonnell, McAuliffe and Northam. From 2002-2006 he served as Governor Warner's Deputy Secretary of Natural Resources, a cabinet position associated with all natural resource agencies. Paylor began his career in 1976 as an aquatic biologist with the State Water Control Board and served in a number of technical and administrative positions throughout his career. He is currently serving on the Board of the Environmental Research Institute of the States working with the EPA Office of Research and Development. David holds a bachelor's degree in zoology from Duke University and a master of science focusing on fish toxicology from Oregon State University.



Suzanne Y. Pierce Esq., Attorney, CowanPerry PC

Suzanne's practice concentrates on business formation, governance and conversion, contract negotiation and drafting, mergers and acquisitions, and trademark filings and enforcement. She has developed specific expertise in working with intellectual property related issues, assisting businesses of all sizes in the technology sector. Suzanne also helps clients with data privacy issues and compliance, advising on data regulations such as the European Union's General Data Protection Regulation ("GDPR"). A large part of Suzanne's recent practice has involved assisting clients as they navigate commercial real estate transactions, including, purchases, sales, leases, tax-free exchanges and financings. Prior to focusing her practice on corporate matters, Suzanne worked on high value litigation on both sides of the Atlantic. Her commercial litigation experience includes international and regional mediations in the United Kingdom, breach of contract disputes in the Federal court in Washington State, and intellectual property disputes in the Southern District of New York (Suzanne was admitted into this court in early 2016). Beginning her practice in the area of commercial litigation has greatly shaped her approach to her corporate practice, being aware of disputes that could occur in the future. Prior to joining CowanPerry, Suzanne worked as a qualified solicitor with Pinsent Masons LLP, a top 20 UK law firm, with offices across the world. Her U.S. experience also includes attending a U.S. university to complete a Certificate in American Business Practice and completing an internship at Capitol Hill. Suzanne was recently recognized by Best Lawyers®: Ones To Watch 2021 inaugural edition, recognizing extraordinary lawyers who have been in private practice for less than 10 years for her work in Corporate Law, and Super Lawyers as a Business/Corporate Virginia Rising Star [2019 – present]. She also serves on the Board of Directors of Southwest Virginia Agrarian Commons as Secretary and Board Member since May of 2020.

Advisory Boards

A **Research Advisory Board** was established in 2022 to bring together a well-rounded team of local and regional experts from Virginia Cooperative Extension, Virginia Tech, Virginia Innovation Partnership Corporation, Friends of the Rappahannock, Chesapeake Bay Foundation, USGS Next Generation Water Observing System, Rappahannock River Basin Commission, and the University of Mary Washington. The Research Advisory Board will guide the development and direction of the RIVERESM Center design and effectively support water research involving emerging technologies and big data. This board will also guide the Rappahannock SmartRiver Initiative, phases, and timeline, and identify emerging technologies needed for the SmartRiver and RIVERESM Center. The Research Advisory Board meets three times a year. Professional biographies of the advisory board members can be viewed on the RIVERESM website at:

<https://www.rivercenter.org/researchadvisoryboard>

An **Education and Outreach Advisory Board** will be established with staff from RIVERESM and Friends of the Rappahannock to inform and guide education and outreach efforts, ensuring that indoor and outdoor interactive exhibits serve the needs of RIVERESM members and the community at large. The board will provide expert educational advice and seek interactive exhibits that will complement standards of learning established by regional school systems based on their already successful curriculum. The RIVERESM Center will showcase interior and exterior exhibits, serving as an anchor, and promoting positive educational outcomes. This advisory board will not interfere with already successful education programs offered by Friends of the Rappahannock; it will support their efforts.

The **Ecoculture Advisory Board** will be established as a collaboration of ecological fellowship to help encourage and support ecoculture with compassion and empathic responses to current issues. This advisory board will work to promote, develop, and critically assess cultural engagement needed for momentum toward socio-ecological change. It will be established with experts in education, communications, ecology, Native American, and other diverse cultures. The Ecoculture advisory board will work to embrace ecological aspects, while recognizing the necessity for negotiation of diverse inhabitants of many places, both locally and globally. RIVERESM will offer a series of speakers and research associates to promote cultural understanding and educate the public on socio-ecological topics.

Internships and Independent Study

RIVERESM has a strong tradition of attracting collaborations with other institutions. The majority of our Science, Education, Technology and Ecoculture grounded staff routinely collaborate with colleagues at other institutions, through government channels, and other non-profit organizations. It is with this center-wide networking, that we have the ability to extend internship opportunities to students through university affiliations. RIVERESM has offered paid internships through collaborative efforts with University of Mary Washington, Virginia Wesleyan University and Virginia Tech. Internships fall under the direction of the executive team in departments that have a need when appropriate. It is our hope that these short-term relationships will provide long-term employment opportunities for the surrounding community.

Phases of Development

Phases of development for RIVERESM will be determined by incremental growth based on: Initial planning, fundraising, building design, building construction, membership recruitment, move-in and training, as well as a fully operational Center. As the team moves forward utilizing the phased approach of implementation, time will allow for better planning, control, and testing of all systems prior to a fully functioning ecological Center. Hiring and recruitment of employees will follow phases of development and provide staff as required in those phases (Appendix F).

Phase I - Planning and Fundraising

The Center began this planning operation phase with four staff members, two interim positions, and three interns. During this phase, a site location will be determined, and the business plan will be complete. A financial consultant, hired to determine economic sustainability for the center, will provide direction and guidance. Website construction will be completed and launched. The organization will continue to develop with advisory boards, collaborators, and building and landscape design for the site. Planning will continue with an aggressive marketing and fundraising strategy, design of building spaces and exterior exhibits.

Staff

- Executive Director of Operations - Mikel Ann Manchester
mmanchester@RIVERECenter.org
- Creative Director - Michele Phillips
mphillips@RIVERECenter.org
- Communications Director - Taylor Johnson
tjohnson@RIVERECenter.org
- Tribal Liaison - Barry Sullivan
- Financial Director – Pending (currently a consulting accounting firm)

Interim

- Founder and Interim Director - Henry “Buck” Cox, PhD
- Environmental Consultant - Lori Blanc, PhD

Interns

- Ava DiVita - Virginia Polytechnic Institute and State University
- Kyle Close - University of Mary Washington
- Matthew Amato - Virginia Wesleyan University

Volunteers

- A large number of volunteers will be committed to the success of the Center throughout all phases of development and fall under the direction of associated departments

In Phase I, employees and interns are included in the organizational chart as noted in Figures 13 and 14. Information on Staff duty details can be found in Appendix E.

Figure 13
Phase I Organizational Chart



Note. Planning and Fundraising Phase I, organizational chart with positions identified.

Figure 14
Intern Organizational Chart



Note. Phase I, Interns identified in this phase.

Phase II - Building Design

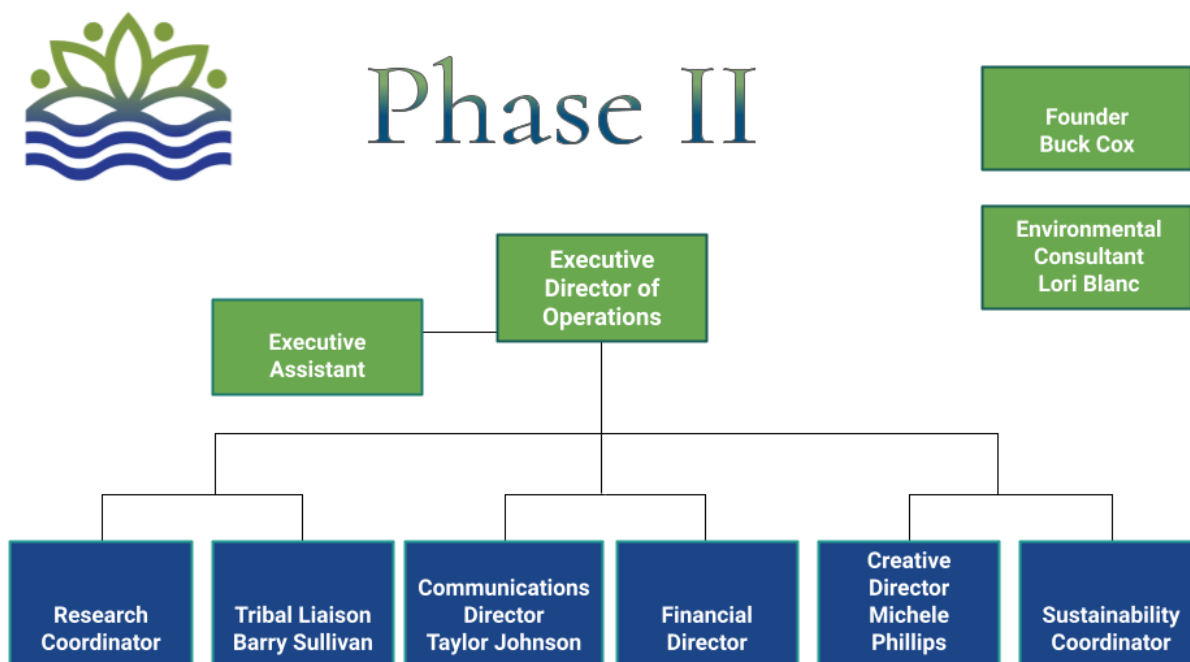
As RIVERESM moves forward into Phase II, acquiring a building location, working with architects and commissioning agents on green building design and construction plans, and recruiting more employees to support the diversity of the organization. Data will be analyzed

from financial consultants to determine size and sustainability requirements of the building. Advisory boards will be instrumental in organization of proper lab facilities and structure of other departments for Research, Education, Technology and Ecoculture. The Tribal Liaison will be needed for center connections with Native American aspects incorporated into the overall vision. The Patawomeck Tribal Center will provide initial input. As one aspect of the Center, RIVERESM is ideally situated to accommodate representatives from all Indigenous Tribes in the Commonwealth of Virginia. A large group of volunteers will be required to assemble for installation and maintenance of the urban BMP landscape exhibits as well as the green roof garden. Additional employees in this phase:

- Executive Assistant
- Communications Intern
- Financial Director
- Sustainability Coordinator
- Research Coordinator
- IT Consultant

In Phase II, employees are identified in the organizational chart as noted in Figure 15. Information on Staff duty details can be found in Appendix E.

Figure 15
Phase II Organizational Chart



Note. Building Design Phase II, organizational chart with positions identified.

Phase III - Building Construction and Membership Recruitment

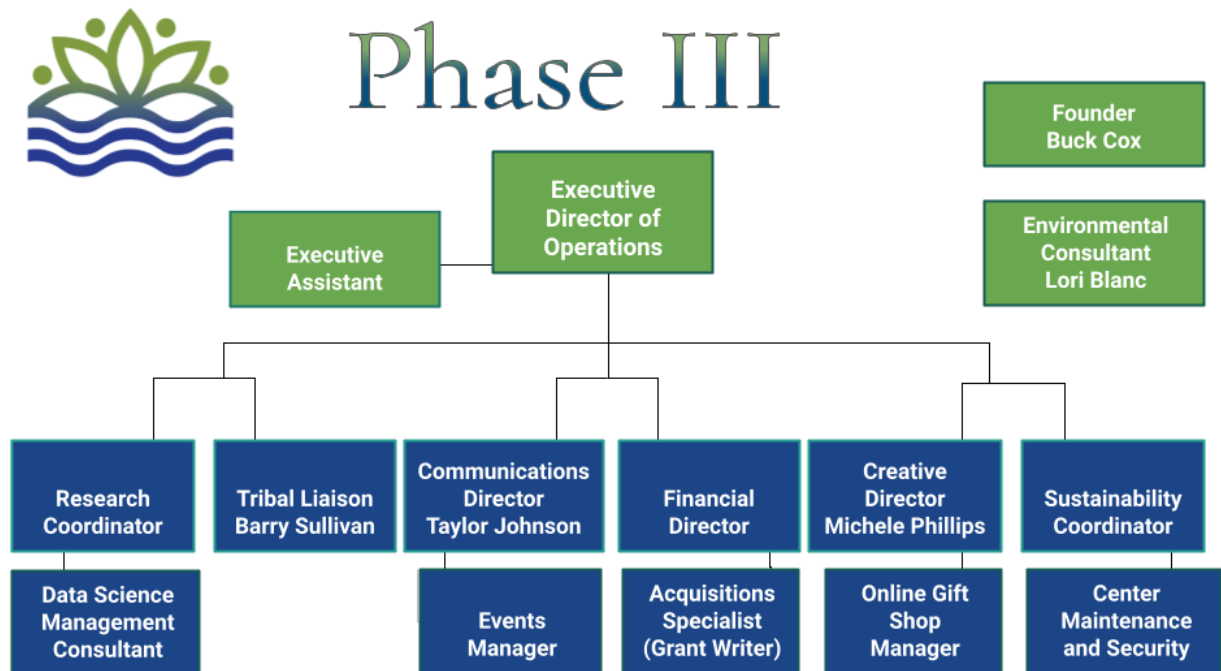
With the foundation of consultant input, during this phase of the building design completion, RIVERESM will be prepared to break ground in this construction phase. Parallel to building construction, RIVERESM will engage collaborators and facilitate lease agreements for

available space. The present plan for day-to-day management of the rentable space and common space will be contracted with the professional management company, Gather.®. Research for the Center will focus on water quality data for the Rappahannock River and stress the development of robust sensing technology components to benefit the region. Educational programs will take center stage with Friends of the Rappahannock implementing their already successful program lineup with meaningful watershed experiences. A commissioning agent will be consulted and be instrumental in addressing proper design of building systems, especially non-traditional building systems, to ensure alignment with green building certification. Interior and exterior exhibits will begin construction for displays in educational spaces and areas throughout the site. The *River's Edge* online store will provide visitors with educational and ecological retail items, with artistically, locally sourced, as well as free-trade options from abroad. The overall goal is to provide opportunities to make impactful connections between research, education, emerging technologies and ecoculture that reach the community. In Phase III, additional employees will be needed in the organizational chart as noted in Figure 17. Information on Staff duty details can be found in Appendix E.

Additional employees in this phase:

- Research Coordinator
- Event Manager
- Acquisitions Specialist (Grant Funds)
- Online Gift Shop Manager
- Maintenance and Security Manager
- Membership Manager

Figure 17
Phase III Organizational Chart



Note. Building Construction and Membership Recruitment Phase III, organizational chart with positions identified.

Phase IV - Move-In and Training

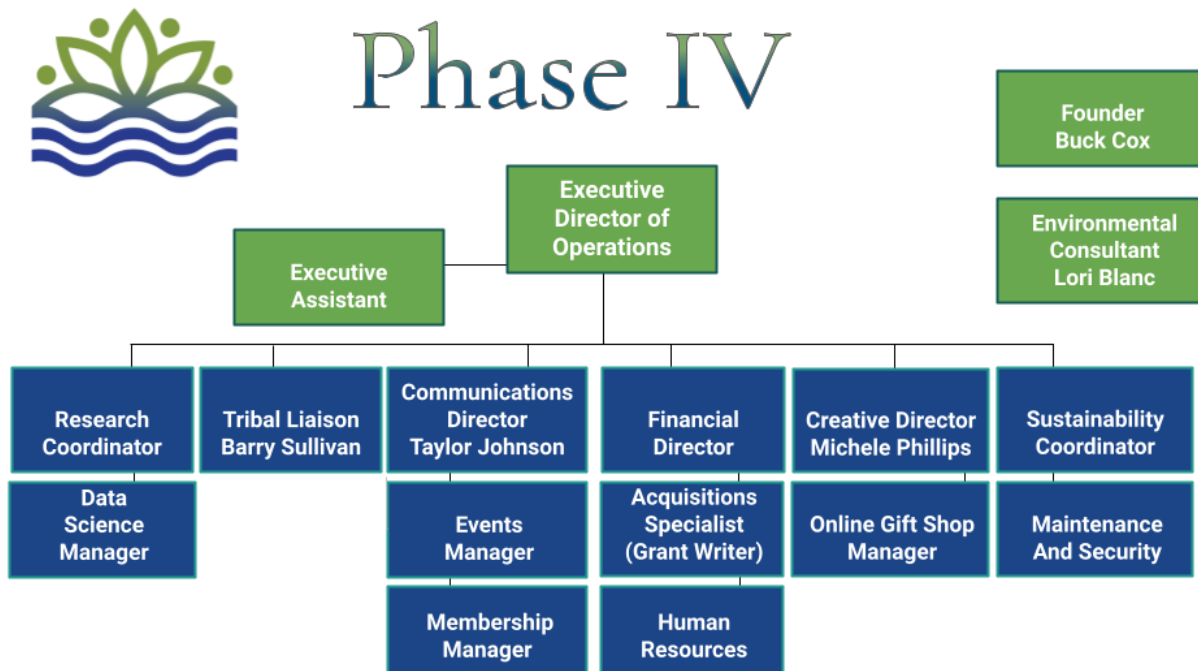
During this transitional period, nearing the end of building construction completion, staff and recruited members will be moving into the building under the direction of the Maintenance and Security Manager. A commissioning agent will be consulted to test the design of the building systems, especially non-traditional building systems, to ensure alignment with green building certification. New technology will be incorporated into all aspects of the building design and available for use upon completion of training. Safety training will be required for staff and members. Laboratory space safety training will be required for all members occupying the laboratory space. Water safety training, as well as first aid certification and automated external defibrillator training will be required for all staff. This phase will address any logistical problems, allowing staff to take corrective action to resolve issues prior to a fully functional Center.

In Phase IV, additional employees will be needed in the organizational chart as noted in Figure 18, which will carry over into Phase V, as a fully operational Center. Information on Staff duty details can be found in Appendix E.

Additional employees in this phase:

- Membership Manager
- Human Resources Manager
- Data Science Manager

Figure 18
Phase IV Organizational Chart



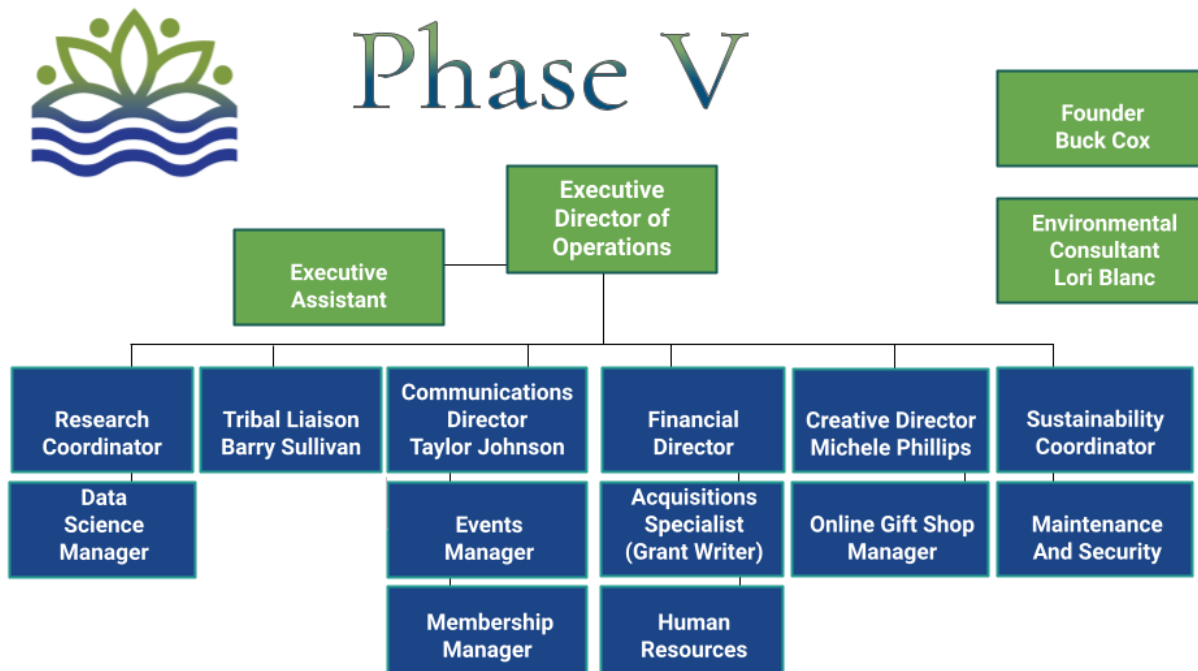
Note. Move In and Training Phase IV, organizational chart with positions identified.

Phase V - Operational Center

As a fully operational center, RIVERESM will serve as a conduit for ongoing research, program education extension, technology integration, as well as ecoculture aspects. Accommodations for environmental collaborators will be available for, long-term research. Staff will be required in this operational phase with attention turned to the Center's daily activities in interior spaces, as well as the exterior grounds. The inspiration for a native planted urban garden space was initiated in appreciation for an honored donor, Weber Taylor. The *Taylor Made Conservatory* and greenhouse laboratory space will be a draw and location for educational programming. Throughout the interior of the building, exhibits will be available, bringing the outdoors inside, enhancing the overall experience. With living walls, innovative waterwise systems, and educational design elements, RIVERESM will be a draw for all ages. An investment in this facility will be an investment in community economic development as well as habitat restoration in urban landscapes. With all available space utilized, the Center will be an attraction for the region.

In Phase V, additional employees will be included in the organizational chart as noted in Figure 19, carried over from the Move-in and Training Phase IV. Information on Staff duty details can be found in Appendix E.

Figure 19
Phase V Organizational Chart



Note. Operational Phase V, organizational chart with positions identified.

Communications, Marketing, and Advertising

RIVERESM will establish and use an online presence to communicate the mission of the organization and provide information on resources that support and promote collaborators and partners for our target audience. The RIVERESM website, www.RIVERECenter.org is a modern, user-friendly website that complies with the Americans with Disabilities Act (ADA). This website provides an overview of support for collaborators involved with research, education, technology, and ecoculture at the Center with links to more detailed information in the business plan and collaborator websites. Available memberships and event rental space at the Center will be made available on the website when final architectural plans are available. The RIVERESM website will also highlight the importance of watersheds scales from local to global, and how critical research completed at RIVERESM will support other communities. Email marketing and philanthropic initiatives will also be employed through the website, offering a range of platforms for more community involvement.

Collaborations and partnerships will be established with a network of ecological organizations, agencies, and institutions with shared visions. The RIVERESM website will draw from and showcase their work, connecting the public with a broader online presence. Following the launch of the website, a social media presence through Facebook, Instagram, Twitter, and LinkedIn, will be established to initiate marketing the Center through clever, inspiring posts, photos, and videos instilling passion for the community. Digital (including online, TV and streaming services), print and social media advertising will be used to promote brand awareness for the Center, publicize programs, special events, coworking memberships, and

space rentals, encouraging collaborators and community members to engage with and visit RIVERESM. There are two main categories for target markets in which stakeholders play a role for RIVERESM. Stakeholders are either those who will impact the successful establishment of the Center or those who will be impacted by what is provided. The target markets are derived from three main categories of stakeholders: enablers, influencers, and users (Figure 20). Additional details on communications and marketing and advertising plans can be found in Appendix F, including a SWOT analysis, primary marketing goals, metrics, strategies and tactics, and marketing budget.

Figure 20
Target Markets for RIVERESM



Note. Categories of stakeholders from which target markets are derived.

Financial Model for Economizing Space in the RIVERESM Ecological Center

The financial success of RIVERESM will rely on four major forms of revenue as follows:

1. Revenue from coworking memberships as offered by modern office concepts similar to Gather Workspaces, LLC.
2. Revenue from rentable space for conferences, programming, and special events.
3. Fundraising with a significant focus on large companies that prioritize support for technology-based environmental initiatives in their business plans.
4. Grants from government and private sources.

Forming an alliance with a major entity in the emerging technology, AI and big data market is a major goal for the concept of RIVERESM. The key players in this market include, but are not limited to Microsoft, Amazon, and IBM. The Rappahannock SmartRiver Initiative is a unique opportunity for large corporations to make an impactful environmental statement and showcase distinctive, state of the art research technology. RIVERESM will consider a partnership with any large business in this market to offer high level funding and associate their brand with the Center.

Projections for filling membership space in the RIVERESM Center indicate that the concept could be supported financially through memberships in the building with organizations that focus on clean water and river conservation. Survey results, conducted by Wipfli, LLP financial consultants for RIVERESM, indicated strong interest in the overall concept. The list of favorable stakeholders interviewed involved many impactful organizations including the Chesapeake Bay Foundation, Virginia's Division of Environmental Quality, Virginia Tech, University of Mary Washington, Friends of the Rappahannock, and more. Numerous grant opportunities have been identified to pursue developmental funding.

The Ecological Center's Projected Coworking Model for Membership Space

Space within the RIVERESM Ecological Center will be designed to establish professional coworking space as conceptualized and proven successful by Gather Workspaces, LLC (Gather.®). RIVERESM has invited Gather.® to manage the physical facilities of the Ecological Center using the services they provide at their seven existing facilities in Richmond and Hampton Roads. Gather.® is a coworking hospitality business. They will manage all details of running office space so that RIVERESM members can focus on what they do best. The core values of Gather.® align closely with RIVERESM and include:

- Maintaining a policy that member's interest always come first
- Intensely focusing on building a caring community of like-minded organizations and companies within the RIVERESM Center
- Caring for the most important assets at the location - employees
- Treating everyone within the space with respect, courtesy, civility, and dignity

Configuring the Space to Maximize Profit and Collaboration

The RIVERESM Ecological Center will offer flexible coworking memberships to corporations, academic institutions, non-profit organizations, governmental agencies, and start-up technology companies with an environmental focus. The RIVERESM Center will provide a dynamic, collaborative environment that generates synergistic opportunities for members and

promotes their work through public outreach. The Center will be designed in form and function to promote a collaborative dynamic by tasking architects with the following interior space allocation requirements:

- A work café including kitchen, coworking area, reception, and event space for a 90 – 120-person cocktail party - it is ideal to be able to see all of the work café from the reception desk
- Items to include in the kitchen area of the work café include a variety of equipment needed to support large social events and amenities for day-to-day use by members
- Men's and women's showers
- A wellness room for nursing mothers with a small sink, refrigerator, and microwave
- A sound studio (to hold a minimum of three people with a table)
- A place to store bicycles inside (if feasible/necessary)
- Two 2-person Gather.® and RIVERESM offices for managers - near reception, if possible
- "Neighborhoods" of different size offices
- A secure IT/Server room - not accessible to the general population
- A secure mailroom - accessible to the general population via Proxy
- Banquet seating and booths in the work café
- "Coworking tables" for coworking areas
- A space for a mini market in the kitchen area
- Soft seating areas in the work café and throughout the space
- The mix of office seats to dedicated desk seats to coworking seats. The following mix is being considered, but flexibility will be necessary, particularly for the number of dedicated desks and coworking seats:
 - 70 - 85% of seats for offices
 - 10 - 15% of seats for coworking
 - 5 - 10% of seats for dedicated desks
- The following mix of offices by size is being considered but can be flexible depending on demand and building design considerations. A large open office area with dedicated office sections can also be considered.
 - One-person offices - 30 - 40%
 - Two-person offices - 30 - 40%
 - Four-person offices - 10 - 15%
 - Six-person offices - 3 - 6%
 - Eight-person offices - 2 - 4%
 - Ten-person offices - 1 - 3%
 - Fifteen-person offices - 1 - 2%
- The number of each office size are guidelines for architects. Flexibility to alter spacing will be built into the concept. In addition, the designs consider the maximum number of desks (seats) into each office that can fit comfortably.
- The following number of conference rooms by size is being considered but can be flexible depending on demand and building design considerations. Conference rooms will also serve as educational spaces. For a 15,000 sq. ft. space would typically specify:
 - One fifty-person conference room that can be divided into two 25-person rooms. A larger meeting room may be a preferred regional amenity. If design

considerations allow, this conference room should be designed in a way that can combine with event space for use as an auditorium.

- Two eight-person conference rooms that can be divided into four 4-person conference rooms
- Two six-person conference rooms
- Phone booths. A reasonable number of phone booths can be achieved by dividing the number of potential phone booth users by 25. The number of phone booth users is defined as the total number of coworking and dedicated seats in the facility minus people in one-person offices that do not use phone booths.
- Number and general location of copy/print stations
- Offices are to offer windows as much as possible with a bias for locating smaller offices near windows (i.e., one-person offices, two-person offices rather than six or eight-person offices). Reasoning for this strategy is to offer a premium, charging more per sq. ft. for smaller offices.
- Conference rooms and phone booths are to be designed for areas with less light (no windows) if possible.
- A “coworking seat” is any seat that is not an office seat, a dedicated desk, a conference room or a phone booth
- The office area should be secure and separated from the work café with a locked door accessing a digital identity in a physical space (with a Proxy App)
- The large conference room, one or two smaller conference rooms and three or four phone booths should be accessible from the work café, offering guest access without navigation through secured doors.
- The economics of a coworking space are predicated on density (the sq. ft. per seat)
- Laboratories - RIVERESM will differ substantially from basic office space membership fees. Each of the three labs projected will cost substantially more to build and equip than common office space. Laboratory space pricing will vary depending on client needs, but will be competitive with similar regional laboratory space
- Density - The RIVERESM Center will be designed around a range of 25-40 usable sq. ft. per seat (25 sq. ft. per seat in conference rooms; 40 sq. ft. per seat for office and coworking space; adjustable as design considerations allow). A seat is defined by individual seats in offices, dedicated desks and coworking seats.

Pricing Per Seat

Average pricing has proved to be acceptable in the marketplace based on the following cost structure:

- Coworking Seats - \$375 per seat per month
- Dedicated Seats - \$450 per seat per month
- Overall average - \$400 per seat per month

Systems

- **HubSpot** - Through our work with Gather.[®], RIVERESM will use HubSpot for Customer Relationship Management (CRM). This system allows for tracking potential members and has a high rate of success if properly utilized. Every contact RIVERESM receives from a prospective member or networking source will be entered. RIVERESM will use this information to track a number of metrics. For example:

- Close rates
- Number of tours given for potential members each week
- The robustness of the pipeline (i.e., the number of opportunities being actively worked)
- Periodic contact tracking with prospective members
- Data related to the contacts future needs and timing for those needs
- **Office RND** – This is software for the coworking industry. This invoicing software keeps records of all members, type of membership, the specific office or dedicated desk the member has (if applicable), and their payments. Specific information available includes:
 - For Offices, the number of offices and seats
 - Available
 - Occupied
 - Available Soon (the member has given notice and are leaving)
 - Reserved (a membership agreement has been signed, but the member will not move in until a future date)
 - For dedicated desks
 - Available
 - Occupied
 - Available Soon
 - Reserved
 - For coworking memberships
 - Available
 - Occupied
 - Pay-as-you-go memberships
 - Available
 - Occupied
 - Available Soon
 - Virtual Offices (Mailbox)
 - Available
 - Occupied
 - Revenue and projected revenue
- **QuickBooks** - All financial statements for RIVERESM will be managed using QuickBooks. QuickBooks is integrated with Office RND. Office RND generates the invoices and they are exported to QuickBooks.
- **Bill.com** - This system will be used to pay bills. Invoices are scanned into the system. They then are coded for the following:
 - Expensed or Capitalized
 - The line item on the Income Statement or Balance Sheet that is to be charged
 - The person approving the bill for payment (Executive Operations Director or her designee)

Projections of Center Cost and Endowment Needs

An in-depth analysis for design of the RIVERESM Center (operating costs and projected revenues from memberships) was conducted by Wipfli LLP, prominent financial consultants. The Wipfli analysis estimated the basic capital cost, operating costs, and expectations for member income for the Center. Estimated capital cost per square foot (sq. ft.) to build the facility using LEED® Platinum designation cost was \$600 (low) to \$750 (high) per sq. ft. These estimates do not include leasehold conditions or improvements related to lab specifications and related equipment. A wider range of costs per sq. ft. reflects pandemic market pricing shifts and potential inflation surge pressures.

In consideration of the full range of construction alternatives, c consulted a local Fredericksburg contractor as well as SmithGroup Architects to obtain additional per sq. ft. cost estimates using conventional architectural design and construction (\$300 per sq. ft.) and the highest level of Green Building Certification construction, Living Building Challenge (\$1000 per sq. ft.). If fundraising revenue is sufficient to enable Living Building Challenge construction, the RIVERESM Center will minimize its ecological footprint by producing more energy than it requires for day-to-day operations, and recycling all water used, while utilizing building construction that minimizes its carbon footprint.

Because RIVERESM aims to build a world-class facility that, in form and function, inspires buildings of the future and attracts ecotourists, the minimum desired construction alternative will be LEED® Platinum Certification (which falls just below Living Building Challenge certification). Table 1 represents summary projections for construction of the RIVERESM Center at varying facility sizes using LEED® Platinum construction and a 10% contingency estimate. For purposes of comparison, conventional construction cost projections are also provided.

Table 1

Cost Estimates for RIVERESM Center Construction by facility size using LEED® Platinum Certification and a 10% Contingency Fund.

Facility Size (sq. ft.)	Conventional Construction (\$300 per sq. ft.)	LEED® Platinum Construction (Low: \$600 per sq. ft.)	LEED® Platinum Construction (High: \$750 per sq. ft.)	LEED® Platinum Project Factor Cost (Low)	LEED® Platinum Project Factor Cost (High)	Total LEED® Platinum Project Cost (Low)	Total LEED® Platinum Project Cost (High)
15,000	\$4,500,000	\$9,000,000	\$11,250,000	\$900,000	\$1,125,000	\$11,700,000	\$14,625,000
17,500	\$5,250,000	\$10,500,000	\$13,125,000	\$1,050,000	\$1,312,500	\$11,550,000	\$14,437,500
20,000	\$6,000,000	\$12,000,000	\$15,000,000	\$1,200,000	\$1,500,000	\$13,200,000	\$16,500,000
22,500	\$6,750,000	\$13,500,000	\$16,875,000	\$1,350,000	\$1,687,500	\$14,850,000	\$18,562,500
25,000	\$7,500,000	\$15,000,000	\$18,750,000	\$1,500,000	\$1,875,000	\$16,500,000	\$20,625,000

Note: Estimates assume LEED® Platinum certification costs (\$600-\$750 per sq. ft.) and do not include leasehold conditions or improvements related to lab specifications and related equipment. A wider range of costs per sq. ft. reflects pandemic market pricing shifts and potential inflation surge pressures. Estimated costs using conventional construction are provided in gray font for comparison.

First Full Year Profit/Loss Projections

Financial projections for the RIVERESM Center are centered around the concept of a 15,000 to 25,000 sq. ft. LEED® Platinum certified research and education center that provides coworking space for conservation-oriented public and private organizations. The coworking model is intentionally designed to promote collaboration among like-minded organizations to mitigate impacts of human population growth and global climate change on freshwater systems. In short, the RIVERESM Center aims to be a recognized global hub for networking and collaboration to find solutions for rivers locally and globally.

In a changing world brought on by digital networking and telecommuting, traditional office space becomes a far more expensive venture for many businesses that now see the value in 'work from home' and mobile office concepts, particularly in light of the advent of online meeting technologies. The recent global pandemic has clearly demonstrated the feasibility of this concept. For these reasons, the RIVERESM Center will be modeled after Gather.®, a very successful Virginia-based company that offers co-working office space for public and private businesses to locate their operations. Gather.® has been working with RIVERE to elevate our understanding of how to integrate coworking into the RIVERESM Center business model. In addition, RIVERESM is in negotiation with Gather.® to oversee and manage the coworking at the RIVERESM Center. Gather.® offers a variety of flexible options to become a member. A company can opt to purchase a fixed number of seats in an office or, if they have employees that come and go on a frequent basis, they may choose to purchase a few coworking seats to save money. In short, Gather.® is flexible in many ways to accommodate the needs of clients. The Gather.® model is used to project the financial future at RIVERESM as it relates to economizing the space. Gather.®, operates a new 25,000 square foot facility at one of their operations in Richmond, which has enabled RIVERESM to project monthly operating expenses and revenue based on the number of membership seats at RIVERESM using an average rate of \$400 per seat per month and adapted to building sizes ranging from 15,000 to 25,000 sq ft. Projections have been generated to identify when the Center becomes profitable at varying square feet under two scenarios, revenue from coworking memberships only (Table 2) and revenue from coworking memberships, event rental space, grants and donations (Table 3). Both scenarios build in a 10% contingency factor for unexpected costs. We conservatively estimated grant, donation and event/programming revenue based on IRS tax reports of commensurate facilities. We selected three facilities that most closely align with the RIVERESM model (Cary Institute in New York, Stroud Environmental Center in Pennsylvania, Brock Center in Virginia). Based on this analysis, RIVERESM identified two key areas of revenue to target, including grants/donations and events/programming. Examples of event and programming revenue include hosting small conferences and workshops and renting space for meetings. To project estimates of income, we averaged these revenue sources from relevant commensurate facilities and assumed ten percent of those revenues as a conservative estimate for RIVERESM for year one.

In summary, the Gather.® model for facility operations (coworking revenue only) can support building expenses with occupancy rates from 60-80%, depending on the facility size. RIVERESM expects to fill or nearly fill the facility because the environmental research and technology sectors are expected to continue to grow. Furthermore, revenue from grants, donations, events, and programming have been projected at very conservative rates resulting in a break-even point at only 50-70% occupancy.

Table 2.

Projected Annual Profitability by Facility Size with Revenue from Coworking Memberships Only

25k Sq Ft Facility with Full Occupancy at 275										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Annual Revenue (Occupancy Income)	1,320,000	1,190,400	1,056,000	926,400	792,000	662,400	528,000	398,400	264,000	134,400
Annual Expenses										
Building Management	468,619	450,337	431,379	413,097	394,138	377,324	371,192	365,279	359,147	353,234
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	768,369	750,087	731,129	712,847	693,888	677,074	670,942	665,029	658,897	652,984
Annual Cash Flow (Subtotal)	551,631	440,313	324,871	213,553	98,112	-14,674	-142,942	-266,629	-394,897	-518,584
Contingency costs (10%)	55,163	44,031	32,487	21,355	9,811	0	0	0	0	0
Annual Cash Flow	496,468	396,281	292,384	192,198	88,301	-14,674	-142,942	-266,629	-394,897	-518,584
22.5k Sq Ft Facility with Full Occupancy at 248										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Annual Revenue (Occupancy Income)	1,190,400	1,070,400	950,400	835,200	715,200	595,200	475,200	355,200	240,000	120,000
Annual Expenses										
Building Management	439,303	422,376	405,448	389,198	372,270	361,998	356,523	351,048	345,792	340,317
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	739,053	722,126	705,198	688,948	672,020	661,748	656,273	650,798	645,542	640,067
Annual Cash Flow (Subtotal)	451,347	348,274	245,202	146,252	43,180	-66,548	-181,073	-295,598	-405,542	-520,067
Contingency costs (10%)	45,135	34,827	24,520	14,625	4,318	0	0	0	0	0
Annual Cash Flow	406,212	313,447	220,681	131,627	38,862	-66,548	-181,073	-295,598	-405,542	-520,067
20k Sq Ft Facility with Full Occupancy at 220										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Annual Revenue (Occupancy Income)	1,056,000	950,400	844,800	739,200	633,600	528,000	422,400	316,800	211,200	105,600
Annual Expenses										
Building Management	409,311	394,414	379,518	364,622	349,726	334,830	341,854	337,036	332,218	327,400
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	709,061	694,164	679,268	664,372	649,476	634,580	641,604	636,786	631,968	627,150
Annual Cash Flow (Subtotal)	346,939	256,236	165,532	74,828	-15,876	-106,580	-219,204	-319,986	-420,768	-521,550
Contingency costs (10%)	34,694	25,624	16,553	7,483	0	0	0	0	0	0
Annual Cash Flow	312,245	230,612	148,979	67,345	-15,876	-106,580	-219,204	-319,986	-420,768	-521,550
17.5k Sq Ft Facility with Full Occupancy at 193										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Annual Revenue (Occupancy Income)	926,400	835,200	739,200	648,000	556,800	465,600	369,600	278,400	187,200	91,200
Annual Expenses										
Building Management	379,995	367,130	353,588	340,723	327,858	314,993	327,185	323,024	318,863	314,483
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	679,745	666,880	653,338	640,473	627,608	614,743	626,935	622,774	618,613	614,233
Annual Cash Flow (Subtotal)	246,655	168,320	85,862	7,527	-70,808	-149,143	-257,335	-344,374	-431,413	-523,033
Contingency costs (10%)	24,666	16,832	8,586	753	0	0	0	0	0	0
Annual Cash Flow	221,990	151,488	77,276	6,774	-70,808	-149,143	-257,335	-344,374	-431,413	-523,033
15k Sq Ft Facility with Full Occupancy at 165										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Annual Revenue (Occupancy Income)	792,000	715,200	633,600	556,800	475,200	398,400	316,800	240,000	158,400	81,600
Annual Expenses										
Building Management	350,002	339,168	327,658	316,824	305,313	294,480	312,516	309,012	305,289	301,785
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	649,752	638,918	627,408	616,574	605,063	594,230	612,266	608,762	605,039	601,535
Annual Cash Flow (Subtotal)	142,248	76,282	6,192	-59,774	-129,863	-195,830	-295,466	-368,762	-446,639	-519,935
Contingency costs (10%)	14,225	7,628	619	0	0	0	0	0	0	0
Annual Cash Flow	128,023	68,653	5,573	-59,774	-129,863	-195,830	-295,466	-368,762	-446,639	-519,935

Note. Green highlight indicates percent of occupancy at which the RIVERESM Center becomes profitable.

Table 3.

Projected Annual Profitability by Facility Size: Coworking Revenue, Event Space Rental and Grants/Donations

25k Sq Ft Facility with Full Occupancy at 275										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Revenue Source										
Occupancy Income	1,320,000	1,190,400	1,056,000	926,400	792,000	662,400	528,000	398,400	264,000	134,400
Grants and Donations*	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Events Rental Space Income**	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Annual Revenue	1,440,000	1,310,400	1,176,000	1,046,400	912,000	782,400	648,000	518,400	384,000	254,400
Annual Expenses										
Building Management	468,619	450,337	431,379	413,097	394,138	377,324	371,192	365,279	359,147	353,234
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	768,369	750,087	731,129	712,847	693,888	677,074	670,942	665,029	658,897	652,984
Annual Cash Flow (Subtotal)	671,631	560,313	444,871	333,553	218,112	105,326	-22,942	-146,629	-274,897	-398,584
Contingency (10% cash flow coworking only)	55,163	44,031	32,487	21,355	9,811	0	0	0	0	0
Annual Cash Flow	616,468	516,281	412,384	312,198	208,301	105,326	-22,942	-146,629	-274,897	-398,584
22.5k Sq Ft Facility with Full Occupancy at 248										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Revenue Source										
Occupancy Income	1,190,400	1,070,400	950,400	835,200	715,200	595,200	475,200	355,200	240,000	120,000
Grants and Donations*	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Event Space Rental Income**	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Annual Revenue	1,310,400	1,190,400	1,070,400	955,200	835,200	715,200	595,200	475,200	360,000	240,000
Annual Expenses										
Building Management	439,303	422,376	405,448	389,198	372,270	361,998	356,523	351,048	345,792	340,317
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	739,053	722,126	705,198	688,948	672,020	661,748	656,273	650,798	645,542	640,067
Annual Cash Flow (Subtotal)	571,347	468,274	365,202	266,252	163,180	53,452	-61,073	-175,598	-285,542	-400,067
Contingency (10% cash flow coworking only)	45,135	34,827	24,520	14,625	4,318	0	0	0	0	0
Annual Cash Flow	526,212	433,447	340,681	251,627	158,862	53,452	-61,073	-175,598	-285,542	-400,067
20k Sq Ft Facility with Full Occupancy at 220										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Revenue Source										
Occupancy Income	1,056,000	950,400	844,800	739,200	633,600	528,000	422,400	316,800	211,200	105,600
Grants and Donations*	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Event Space Rental Income**	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Annual Revenue	1,176,000	1,070,400	964,800	859,200	753,600	648,000	542,400	436,800	331,200	225,600
Annual Expenses										
Building Management	409,311	394,414	379,518	364,622	349,726	334,830	341,854	337,036	332,218	327,400
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	709,061	694,164	679,268	664,372	649,476	634,580	641,604	636,786	631,968	627,150
Annual Cash Flow (Subtotal)	466,939	376,236	285,532	194,828	104,124	13,420	-99,204	-199,986	-300,768	-401,550
Contingency (10% cash flow coworking only)	34,694	25,624	16,553	7,483	0	0	0	0	0	0
Annual Cash Flow	432,245	350,612	268,979	187,343	104,124	13,420	-99,204	-199,986	-300,768	-401,550
17.5k Sq Ft Facility with Full Occupancy at 193										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Revenue Source										
Occupancy Income	926,400	835,200	739,200	648,000	556,800	465,600	369,600	278,400	187,200	91,200
Grants and Donations*	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Event Space Rental Income**	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Annual Revenue	1,046,400	955,200	859,200	768,000	676,800	585,600	489,600	398,400	307,200	211,200
Annual Expenses										
Building Management	379,995	367,130	353,588	340,723	327,858	314,993	327,185	323,024	318,863	314,483
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	679,745	666,880	653,338	640,473	627,608	614,743	626,935	622,774	618,613	614,233
Annual Cash Flow (Subtotal)	366,655	288,320	205,862	127,527	49,192	-29,143	-137,335	-224,374	-311,413	-403,033
Contingency (10% cash flow coworking only)	24,666	16,832	8,586	753	0	0	0	0	0	0
Annual Cash Flow	341,990	271,488	197,276	126,774	49,192	-29,143	-137,335	-224,374	-311,413	-403,033
15k Sq Ft Facility with Full Occupancy at 165										
Occupancy Rate	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Revenue Source										
Occupancy Income	792,000	715,200	633,600	556,800	475,200	398,400	316,800	240,000	158,400	81,600
Grants and Donations*	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Event Space Rental Income**	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Annual Revenue	912,000	835,200	753,600	676,800	595,200	518,400	436,800	360,000	278,400	201,600
Annual Expenses										
Building Management	350,002	339,168	327,658	316,824	305,313	294,480	312,516	309,012	305,289	301,785
RIVERE Salary and Wage expenses	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750	299,750
Total Annual Expenses	649,752	638,918	627,408	616,574	605,063	594,230	612,266	608,762	605,039	601,535
Annual Cash Flow (Subtotal)	262,248	196,282	126,192	60,226	-9,863	-75,830	-175,466	-248,762	-326,639	-399,935
Contingency (10% cash flow coworking only)	14,225	7,628	619	0	0	0	0	0	0	0
Annual Cash Flow	248,023	188,653	125,573	60,226	-9,863	-75,830	-175,466	-248,762	-326,639	-399,935

Note. Green highlight indicates percent of occupancy at which the RIVERESM Center becomes profitable.

Fundraising

To build a fully self-sufficient coworking ecological center, RIVERESM will need to raise building construction funds and generate continuous income to support annual Center operations. RIVERESM has already retained an option to secure property in Fredericksburg for developing the RIVERESM Center as a gift, subject to obtaining enough financial capability to fund the building and operation of the facility. The projected construction cost of the RIVERESM Center will be a function of two factors: (1) per sq. ft. cost, which will be determined by the level of Green Building Certification interest by investors, and (2) facility size, which will be determined by the level of coworking membership interest. Determination of both factors will take a prominent role in the fundraising effort.

The projected minimum demand for coworking membership with the RIVERESM Center that can financially support annual operating costs of a fully staffed facility is 70-80% capacity of a 15,000 sq. ft. building (Table 2). Therefore, assuming the smallest feasible facility size (15,000 sq ft) and the preferred LEED® Platinum certified building construction, RIVERESM will need to raise a minimum of \$11,700,000 (Table 1) plus approximately \$1 million endowment to support operating costs during the start-up period of the Center.

The fundraising goal for the Center will be to raise 50% of the necessary money to construct the facility within 8 to 12 months from the official start of the fundraising effort. We expect to achieve this goal primarily by focusing on high net wealth individuals and corporations interested in naming rights for important components of the building (e.g, conference rooms, laboratories, virtual reality educational space, etc.) Fundraising will continue after the 50% goal is achieved; however, achieving this level of success will position RIVERESM to seek qualified funding from major grant organizations that have already been identified. This level of dedicated support will also position RIVERESM to work with a Community Development Financial Institution to finance the remaining costs of construction at zero-percent interest. With this kind of backing, RIVERESM could potentially begin the groundbreaking process for the Center at an accelerated rate. A professional fundraiser will be soon hired to develop the formal fundraising strategy and execution plan for launching the fundraising phase of RIVERESM.

Risk Assessment

Risk management planning is important to identify and assess risks before they occur. Using data from the Comparable Analysis of Commensurate Organizations, the RIVERESM risk management plan will seek best management practices from Cary Institute of Ecological Studies, Brock Environmental Center, Stroud Water Research Center, Chesapeake Bay Foundation and several botanical gardens in the planning of a well-rounded risk management plan. The focus of these best practices will be on the operation and sustainability aspect of development, that will include the day-to-day operation of the shared lab and research space. The Executive Director of Operations, Mikel Manchester, is the current risk manager and will supervise the risk management and analysis process for RIVERESM in the immediate future. Risk analysis can be engaged through a multiple step process as outlined in an initial Risk Management Plan created by the University of Mary Washington's College of Business for RIVERESM during a three-semester directed study course. Risks that have been identified will be

monitored through a risk register. The risk register will act as a single location where identified risks will be documented, monitored, and tracked.

In addition to benchmarking risk management plans from similar research institutions, RIVERESM consulted with non-profit industry expert, Wipfli LLP to identify and assess risks. As part of the risk assessment process, RIVERESM used a Logical Framework Approach to clearly articulate the Center's Goals, Outcomes, Outputs and Activities. The indicators of success were identified for, what metrics used to measure those indicators, and what risks and assumptions hold for each of the categories (Appendix H). A full risk analysis completed by Wipfli is provided in Table 4. RIVERESM will do follow-up consulting with Wipfli to develop strategic plans to address and minimize these projected risks.

Table 4*Identification and Assessment of Risks for the RIVERESM Center.*

RISK CLASS	RISK RATE	RISK DESCRIPTION	MITIGATING STRATEGIES
Funding	High	Overall interest in renting office space is lacking	RIVERE SM is working with rapidly growing Gather [®] LLC to manage rentable space. The Gather [®] model offers maximum flexibility for renting space that meets the needs of companies and organizations in the rapidly changing office leasing market. See WorkAtGather.com.
Operational	High	Construction difficulties and costs increase as a result of the pandemic – i.e. inflation and supply chain issues	RIVERE SM will remain open to rapidly changing conditions for building the facility. Back up planning will include strategies to mitigate challenges due to changes in market conditions. What won't change is RIVERE's dedication to helping facilitate SmartRiver research on the Rappahannock
Strategic	High	University of Mary Washington Jepson Center may be competition	The University of Mary Washington (UMW) is an important stakeholder and collaborator in the RIVERE SM concept. RIVERE SM has donated money to researchers at UMW and facilitated collaboration for projects with Virginia Tech. RIVERE SM will continue to push UMW as a key player for research projects identified by collaborators.
Strategic	High	Cost of leasing space is a draw back for many	The Gather [®] LLC model offers maximum flexibility for office space at significant savings as compared to the traditional leasing model. See WorkAtGather.com.
Funding	High	Difficulties in funding a large project	RIVERE SM is engaging a professional fundraiser to develop a successful funding plan. The first phase of RIVERE's fundraising campaign will seek to identify key corporate partners that have a vested interest in water technology using artificial intelligence and big data expertise to showcase the possibilities of a fully functional Smart River. RIVERE SM is interested in approaching Microsoft, Amazon Web Services and IBM among others.
Strategic	Medium	Stakeholders questioned, if technology is the actual strategy; what is the need for the building?	RIVERE SM will showcase innovative technology developed by collaborators through exhibits, social media and seminars.

Funding	Medium	Work from home is devaluing office space	Gather® LLC is thriving in the declining traditional office space market through innovative concepts designed to reduce cost while maximizing opportunities to collaborate. See WorkAtGather.com
Funding	Medium	Ability to raise enough capital	Philanthropy increased by 19% from 2019 to 2020 primarily driven by big donors. The message here is to target big donors.
Strategic	Medium	Potential misalignment of cause with underlying objectives – are we really addressing what we set out to accomplish? Mission creep	The build will serve as a nexus, supporting collaborative efforts, working toward a healthy watershed. RIVERE SM will support and promote members without competition.
Funding	Medium	Direct competition for fund-raising	RIVERE's fundraising strategy will focus on larger donors that are not likely to compete with local stakeholder funds.
Funding	Low	Several stakeholders indicated they would not want to pay for office space Lack of consistent, ongoing funding	RIVERE SM has identified several interested organizations to include governmental organizations that will consider taking a hard look at the Gather model for renting space. Many organizations realize that flexible rental options could mitigate issues with traditional long-term leasing agreements.
Operational	Low	Sustainable buildings are hard to build and maintain – cost per square foot	The Chesapeake Bay Foundation's Brock Environmental Center is a shining example of innovative building concepts that has resulted in numerous positive benefits for the community. The architects responsible for that building (SmithGroup) are the architects for RIVERE SM . The facility will be more expensive to build but the benefits will outrun the costs.
Strategic	Low	Part of the plan is lab space, but users may only be interested in labs tailored to their specific needs	Flexible strategies will support the needs of members.
Operational	Low	Sustainable buildings require appropriate occupancy behaviors – i.e., they need the right type of client	Strategies to rent space to ecologically minded entities may limit risk.

Note. Risk assessment conducted by Wipfli LLP

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With an allegiance to gratitude, RIVERESM accepts the responsibility of environmental stewardship and will support those who leave the earth a little better than it was found. We acknowledge and thank the many people who contributed to creating the RIVERESM concept and bringing it to reality - our founder, professional team, collaborators, and stakeholders.

The vision for creating an ecological center on the Rappahannock started with Dr. Henry “Buck” Cox, who grew up in Fredericksburg and spent countless hours fishing, canoeing, and swimming on the Rappahannock. In the 1970s, after graduating from Virginia Tech, Buck worked for the State Water Control Board (now the DEQ). His job was to sample the Rappahannock and its tributaries from the headwaters to Port Royal. Over the past 60 years, Buck has witnessed slow but insidious sediment on the Rappahannock due largely to runoff from agriculture and development. It has been Buck’s dream to give back to the Rappahannock and region that means so much to him, by creating an ecological center that will help us better understand and mitigate projected impacts to the river and, importantly, provide significant economic benefits to the area through ecotourism.

We are grateful for the dedicated RIVERESM team who contributed significantly to developing the RIVERESM concept, writing the business plan, and converting this vision into action. The founding RIVERESM team includes Dr. Henry “Buck” Cox (Founder), Mikel Manchester (Executive Director), Dr. Lori Blanc (Environmental / Business Consultant), Michele Phillips (Creative Director), Taylor Johnson (Communications Director), and Ava DiVita (Research Coordinator). Significant contributions were also made by our student interns, Kyle Close (University of Mary Washington), and Matthew Amato (Virginia Wesleyan University).

It is with sincere gratitude that the RIVERESM team recognizes Mrs. Weber Taylor for her legacy of supporting environmental causes, including RIVERESM, and will be naming The *Taylor Made Conservatory* and greenhouse space in her honor.

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