

Blended Finance for Clean Water: Applying the Green Bank Model to Fill North Carolina's Water Quality Investment Gap

By

Elizabeth Harvell

Austin Thompson, Advisor and Dr. Jeremy Pare, Advisor

Masters project submitted in partial fulfillment of the requirements for the Master of Environmental Management degree in the Nicholas School of the Environment of Duke University

April 2022

Table of Contents

Executive Summary	2
Background: Water Quality in North Carolina	3
The Water Quality Economy of North Carolina	3
Growing Water Quality Threats to North Carolina	4
The Solution: Blended Finance	7
Blended Finance: An Overview	7
Where should blended finance be applied?	9
Examples of Blended Finance in Practice:	11
The Route: The Green Bank Model(s)	12
Public-Private vs. Non-Profit Models	12
What Water Quality at a Green Bank Looks Like: The Rhode Island Infrastructure Bank	15
Rhode Island Infrastructure Bank Background	15
The RIIB Operating Model	16
Governance	17
Example Projects	17
A Model for North Carolina	18
Looking Forward	21
Appendices	22
Appendix A: Anthropomorphic Nutrient Loading Diagram	22
Appendix B: Harmful Algal Bloom on the Chowan River, August 2021	23
Appendix C: Algal Blooms Recognized by North Carolina Department of Environmental Quality, 2012-2019	24
Resources	25

Executive Summary

As the threat of climate change looms over North Carolina, so does the accompanying risk of deteriorating water quality and the economic impacts it can bring. Improving water quality will require investments beyond just what public funding sources can provide, and the increasingly popular approach of blended finance presents opportunities for private sector financing to alleviate some of this pressure. More specifically, a public-private green bank focusing on water quality improvements could be the answer to unlocking the capital necessary to preserve the resource on which North Carolina's economy relies.

Background: Water Quality in North Carolina

North Carolina is home to 3,375 coastal shoreline miles, 17 river basins, 37,853 river miles, and 160 lakes (NOAA; National Wild and Scenic Rivers System; North Carolina Department of Environmental Quality). These water bodies support both the state's residents and economy by providing drinking water, recreational opportunities, commercial fishing areas, agricultural support, and tourism income across the state. However, these vital roles are threatened by nutrient loading and climate change across the state.

The Water Quality Economy of North Carolina

North Carolina's water bodies, including lakes, rivers, and coastal waters (e.g., estuaries, sounds, and beach coastline) are vital to the state's economy and quality of life. Major areas of the state's economy relying on its high quality of water include:

Drinking Water: Eight out of 10 of North Carolina's nearly 11 million residents rely on drinking water from community water systems served by roughly 200 water supply reservoirs (Van Houtven et al, 2020). While much of the drinking water supplied in the eastern part of the state comes from Coastal Plain aquifers, significant amounts of surface water are used to meet the drinking water needs in the central Piedmont and western mountain regions (EPA, 2010).

Recreation and Tourism: A 2019 report found that the tourism and outdoor recreation industries in the state generate over \$25 billion in visitor spending, support over 230,000 jobs, and result in over \$2 billion in local and state tax revenue every year (North Carolina Department of Commerce, 2010). Furthermore, a 2021 report from the Economic Development Partnership of North Carolina found that while 12.3% (\$2.4 billion) of the tourism spending was directly spent on recreation services, a further 35% (\$6.9 billion) and 21.6% (4.3%) was spent directly on food services and lodging,

respectively, as a result of this tourism (Economic Development Partnership of North Carolina, 2021).

While tourism and outdoor recreation in North Carolina are not limited solely to water-based activities, no numbers are readily available regarding the share of water-based activities reflected in these cash flows. However, a May 2020 report from the North Carolina Division of Parks and Recreation provides an adequate proxy: in a survey to understand trends in outdoor recreation activities in North Carolina, the most popular activity at 69% was visiting a lake or beach, and 50% said fishing from a boat (North Carolina Division of Parks and Recreation, 2020). Furthermore, this survey was conducted before the COVID-19 pandemic dramatically increased outdoor recreation activity.

Recreational fishing and beach visitation are especially popular in North Carolina. According to the US Fish and Wildlife Service, coastline waters, estuaries, lakes, and streams of the state see over 20 million recreational fishing days each year (U.S. Fish and Wildlife Service, 2011). In the Albemarle-Pamlico Watershed alone, beaches experience over 15 million visitor-days annually and over 14 million visitor-days “for other freshwater recreation” (Van Houtven et al., 2016). While a precise number is not readily available, these millions of visitors and their activity, lodging, and food needs undoubtedly contribute more than a non-significant amount to the recreation and tourism industry cash spends described above.

Agriculture: Over \$100 billion dollars of North Carolina’s annual economy is generated by agriculture and agribusiness (Walden, 2021). The productivity and yield of crops are highly dependent on water quality available to farmers for irrigation and management (Davis et al., 2014). A 2014 survey by the North Carolina Department of Agriculture and Consumer Services found that of the 1,017 operations that withdraw at least 10,000 gallons per day on average, 373 make withdrawals from rivers, streams, lakes, or ponds.

Commercial Fishing: \$300 million of North Carolina's annual GDP comes from the wild-caught commercial fishing and seafood industry (Edwards, 2021).

Growing Water Quality Threats to North Carolina

Two of the largest present and growing threats to the state of water quality and its stakeholders in North Carolina are nutrient pollution, also known as nutrient loading, and climate change. The United States Environmental Protection Agency (EPA) defines nutrient pollution as excess amounts of nitrogen and phosphorus in aquatic systems and recognizes it as a leading cause of water quality impairment in the United States. While a natural cycle of nitrogen and phosphorus exists in bodies of water, anthropogenic sources of nutrient loading cause serious ramifications. These human-

caused sources of nutrient pollution include agricultural sources (e.g., fertilizer application and mismanagement), municipal and industrial wastewater treatment plants, urban stormwater, and septic systems. A simplified diagram of anthropomorphic nutrient loading into water bodies can be found in Appendix A.

Increased nutrients of nitrogen and phosphorus in water bodies can lead to the development of cyanobacteria (i.e., blue-green algae) which can form harmful algal blooms (HABs) (Chapra et al., 2017). HABs can have very dangerous effects on environmental health. First, HABs reduce water clarity, reducing the amount of sunlight entering the water, limiting the growth of the aquatic plants on which many organisms of the habitat rely. The blooms are buoyant and form thick, unsightly surface scums (see Appendix B) and often wash up onto shorelines. Upon decomposition, the blooms release a foul odor and reduce the amount of oxygen present in the water, leading to hypoxia or anoxia, a state of low or nonexistent oxygen in the water body, respectively, and cause dead zones. Apart from being unsightly and smelling bad, HABs can cause fish kills (due to hypoxia), severe illness to humans if touched or ingested, and have even been known to kill pets that drink from or swim in the waterbody (Backer et al., 2013).

The presence of nutrient loading and occurrence of cyanobacteria and HABs is not new in North Carolina, and is becoming more common (see Appendix C)(Greif et al., 2020). For example, a 2017 study confirmed the year-round presence of cyanobacteria in B. Everette Jordan Lake, a 13,000 acre drinking reservoir serving nearly 300,000 residents of Cary, Apex, and surrounding areas in North Carolina and receiving over a million recreational visitors per year (Wiltsie et al., 2014). Furthermore, at least four cyanobacteria HABs have occurred in Jordan Lake over the last decade, according to the North Carolina Department of Water Resources Algal Bloom Map. Another example exists in eastern North Carolina, where a 2018 study found that coastal estuarine and riverine waters are particularly vulnerable to nutrient-related hypoxia and resulting fish kills (Pietrafesa et al., 2018). The study found evidence that the Pamlico Sound, for example, has become increasingly hypoxic due to nutrient pollution specifically. These two examples are by far not the entire picture of anthropogenic nutrient loading and its impacts on water quality across the state, but do illustrate its growing presence as a force to be dealt with in coming years as algal blooms become more common.

In addition to nutrient loading, climate change also threatens water quality in North Carolina. A 2020 report from RTI International states that climate change is and will continue impacting water quality in North Carolina in a variety of ways (Van Houtven et al., 2020). Stronger rainstorms following increased periods of drought will cause more soil erosion, which increases pollution runoff and sedimentation in water bodies. As air temperature rises, so will water temperatures, and some aquatic habitats will decrease in suitability for particular species, such as cold-water fish in the western part of the

state, potentially being replaced by non-native, invasive species. Finally, sea level rise will continue to worsen saltwater intrusion of aquifers in the Coastal region of the eastern part of the state, impacting groundwater systems used for drinking water and agriculture irrigation.

Climate change will also intensify HABs, as more frequent extreme precipitation events will cause higher rates of runoff into waterways, warmer water temperatures will promote growth of algae, and periods of drought will allow for longer residence times and extended bloom formation.

At the most basic level, HABs threaten the well-being of North Carolina residents by lowering the quality of drinking water supplies, complicating and increasing treatment costs for potable water, and causing activity reductions and restrictions at recreational water sites (Chapra et al., 2017). Climate change threatens to exacerbate and increase nutrient pollution and HABs, as well as saltwater intrusion in aquifers around the Coastal Plains region. These issues pose an economic threat to the state’s water quality in the following distinct areas organized in Table 1.

Table 1: Economic Threats from Water Quality Vulnerabilities in North Carolina

Issue	Economic Threat
Drinking Water	Drinking water treatments to reduce algal toxins are expensive and the removal efficiency can be as low as 60% (Zamyadi et al., 2012). For example, over \$13 million in additional spending was needed over two years by a local water utility after a large HAB on an Ohio lake in 2010 (EPA Office of Water, 2015).
Recreation	With the adverse health effects of HABs on humans, HABs can cause regulation and limitation on recreational water bodies. Even if the water body is not formally shut down, the unsightly slime and odor associated can cause a decline in water-based recreation, a moderate piece of the previously described \$25 billion annual tourism impact. An extreme scenario could be like one that has already played out in Ohio, where a lingering HAB on one lake caused a loss of \$50 million in tourism revenue over a period of two years (EPA Office of Water, 2015).
Agriculture	The eastern part of the state is both the region most vulnerable to saltwater intrusion and where a large portion of the state’s \$100 billion agriculture industry takes place—60% of North Carolina animal production value and 70% of crop value occur in this region (Van Houtven et al., 2016). This is a potentially devastating combination, as reduced crop yields result when lower quality water enters or is applied to agricultural land.

Commercial Fishing	Commercial fish species on the coast, in the Neuse River, and around the Pamlico Bay are at extreme risk for reduced populations—and as a result, reduced harvests—due to hypoxic conditions resulting from nutrient pollution (EPA Office of Water, 2015). For example, a 13.7% decline in brown shrimp harvests in the Pamlico Sound, worth \$1.7 million annually, has been observed as early as 1999. The state’s estuaries have also experienced and will continue to experience increased temperatures that harm commercial fisheries by not only increasing the size and frequency of fish kills, but also threaten early development habitats (Van Dam et al., 2019).
Property Values	A study examining property values in the New England, Mid-Atlantic, Midwest, and Southeast regions show that the effects of nutrient loaded water (e.g., hypoxic conditions) can lower property values of near-waterfront waterfront and properties by up to 9% (EPA Office of Water, 2015).

The issues and scenarios described above only scratch the surface of the importance of water quality and its role in the North Carolina economy. What regulation and governmental support around water quality does exist is not going to keep pace with the current and growing challenges that climate change threatens to intensify, and private investment will be needed to prevent major degradation of the state’s waterways and mitigate what consequences cannot be avoided. However, technical expertise, governmental support, and policy administration will still be needed for a comprehensive and integrated approach for success. A potential solution to aid in the maintenance and improvement of sustainability issues like water quality in North Carolina is blended finance (Zheng et al., 2020; Rode et al., 2019; Choi et al., 2020; Havemann et al., 2020).

The Solution: Blended Finance

Blended Finance: An Overview

Blended finance allows countries, organizations, or groups with different objectives to invest in a parallel manner and achieve a mix of both social or environmental impact and financial return. The Addis Ababa Action Agenda¹ defines blended finance as a public-private partnership that “combines concessional public finance with non-concessional private finance and expertise from the public and private sector” (pg. 24).

¹ The Addis Ababa Action Agenda is the summary document following the Third International Conference on Financing for Development in July 2015 in Addis Ababa, where the term “Blended Finance” was formally recognized.

At its core, blended finance does exactly as the name implies: allow for a mix of financial investment and resource allocation from both the private and public sector to achieve an impactful outcome on any of the many growing problems our world faces, such as a lack of clean water and sanitation, sustainable infrastructure, or affordable housing.

Blended finance can organize the trillions² of investable capital around the world to be coordinated where it can be most impactful and catalyze existing public sector funds. In short, blended finance is one way the global economy can be mobilized for change and move the needle on some of the world’s most pressing issues (Bank of America, 2020).

Blended finance combines three main types of capital. The first is concessional capital, which refers to financing with the most favorable terms, beginning with grants—100% concessional funding—to first-loss guarantees and debt priced at significantly below-market rates. Non-concessional official resources are the second category, such as funding from public development banks or state infrastructure funds. The third and final type of capital involved in blended finance is commercial finance from private financiers or institutional investors, such as common equity or Senior Debt, seeking market or near-market returns. Table 2 below summarizes these categories of capital:

Table 2: The Three General Categories of Capital in Blended Finance

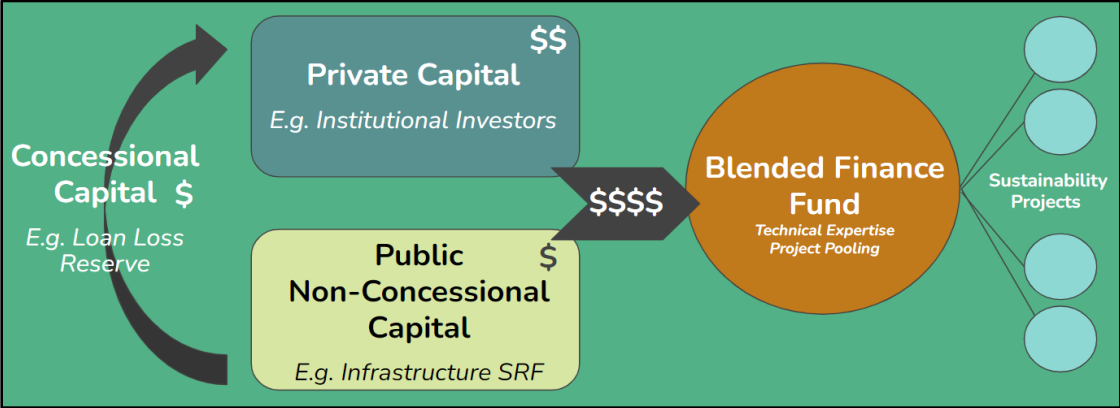
Name	Description	Role	Expected Rate of Return	Example
Concessional Capital	Financing with the most favorable terms; normally governmental development or philanthropic funds	Used to lower risk for private capital (e.g. loan loss reserve; program administration grant)	0-1.5%	Grants Loans w/small admin. Fee E.g. Loan Loss Reserve
Public Non-concessional Capital	Financing from public development banks or state infrastructure funds	Further leveraged to attract private capital	2-6%	Subordinated Debt E.g. State Revolving Fund
Commercial Capital	Financing from private institutions	Close funding gap for project finance	≥7%	Equity or Senior Debt

² In a 2017 report, PricewaterhouseCoopers estimates the \$84.9 trillion of assets under management in 2016 will nearly double to \$145 trillion by 2025 (Alexander et al., 2017).

Beyond the intended social or environmental impact itself, there are three main issues blended finance aims to solve for allocators of private capital that want to invest their funds for both a positive impact and financial returns. The first is lowering both perceived and real risk, and the second is increasing the poor returns for the risk relative to status-quo investments. Blended finance can do this in multiple ways, such as using public or concessionary debt to build in a credit insurance facility or by having public money absorb the first tranche of credit losses (i.e., first-loss guarantee). By achieving these two goals, the public or philanthropic funds involved in the project serve as catalytic capital for private dollars, allowing those original funds to have an impact more robust than if applied individually. This catalytic capital allows public funds to incentivize the private investor to place its funds in sustainable investment over other, status-quo investment vehicles.

The third issue blended finance is poised to solve is lack of technical and operational expertise. The problems that blended finance projects solve are complex, dense issues that require many types of proficiencies and knowledge to effectively manage. For example, the mandate of a family office financial manager could be to invest a portion of its capital in an environmentally impactful space like forestry conservation, but the manager does not know how to do so individually (beyond making a philanthropic donation, which has no direct or sustained financial return). The manager finds New Forest, a sustainable real assets investment company using sustainable forestry management to further forest conservation and rural land management (World Business Council for Sustainable Development, 2018). The manager opts to invest in New Forest’s Southeast Asia Fund, where the company uses development finance funds to mobilize private investment and work toward reforestation and landscape restoration in parallel with the commercial plantation forestry industry. In addition to lowering the financial risk of investing in a reforestation project, the other role this blended finance investment project addresses is technical assistance and operational expertise, a critical component of successful investments seeking environmental impact. Figure 1 below provides a basic conceptual illustration of blended finance:

Figure 1: A Basic Illustration of the Blended Finance Concept



Where should blended finance be applied?

Blended finance was first recognized at the Third International Conference on Financing for Development in July 2015 in Addis Ababa (Addis Ababa Action Agenda, 2015). It was here that the idea was formally recognized as a way of closing the funding gap for the United Nations' Sustainable Development Goals (SDGs) and driving private investment for international development. However, the Addis Ababa Action Agenda also recognized that blended finance is not suitable for all investments related to SDGs and similar missions.

Since its formal naming in 2015, many organizations, institutions, and governments have implemented blended finance. Qualities commonly found for a project or investment to be successful with blended finance include:

- **Parallel Investing Goals:** For an opportunity to be right for a blended finance approach, it must allow at least two investors to operate alongside each other while concurrently targeting their own goals. This is core to blended finance. This allows one group of investors (private capital) to pursue market rate returns while the other (public or philanthropic) provides expertise and accepts—in exchange for social or environmental impact—sub-market rate returns.
- **Leverage:** Another core tenant of blended finance is its ability to leverage public funds to access and recruit private capital, seeing both pools of funds go farther than they would without the other. It should be noted this is different from the governmental body simply subsidizing the private investor, but instead incentivizing through more agreeable terms for the private investor to place its funds in sustainable investment over other, status-quo investment vehicles.
- **Bankability:** Blended finance is best suited for investment opportunities with high impact potential that are not independently attracting private investment but have sound cash flow prospects. The role of blended finance is not to be a financier of social or green assets, but to be a facilitator of finance for these projects (Mehta et al., 2017). In some cases, individual projects and opportunities may not be bankable in their own right, but can be made so through pooling projects.
- **Pooling Potential:** Pooling projects can provide a way to address negative financial attributes of a project, thus diversifying and lowering investor risk—one of the key roles of blended finance (OECD, 2019; Mehta et al., 2017). Pooling can mitigate concerns from commercial investors around not only small ticket size and risk exposure but also limited sector knowledge and high transaction costs.

The Addis Ababa Action Agenda cited blended finance as a route for reaching the UN's SDGs in developing countries, resulting in a majority of literature and research highlighting its usage as a developmental finance tool. However, the blended finance method has been used domestically in the United States, even if not officially labeled "blended finance," with affordable housing and renewable energy investments being prominent examples. In Charlotte, North Carolina, for example, blended finance has been implemented to secure a \$70 million investment in local affordable housing from Bank of America, Ally Financial, and Barings (Fahey, 2019). Of this total, \$50 million will be used to finance affordable-housing developments through below-market loans.

One of the most prominent forms of blended finance in developed countries is the green bank model. Under the umbrella of blended finance, green banks have the ability to center climate finance in a domestic institution, leveraging public funds with private investments. As of early 2022, at least 27 green banks exist across 12 countries, 18 of which are located in the United States (Whitney et al., 2020).

Examples of Blended Finance in Practice:

Many examples of blended finance, in many different forms, exist across the globe today. This small list illustrates the variety of challenges blended finance can take on throughout a range of settings and circumstances.

- **The Africa Agriculture and Trade Investment Fund (AATIF)** invests in agricultural businesses along the sub-Saharan Africa agricultural supply chain in an effort to increase food security, strengthen income for agricultural workers, and improve competitiveness of local agriculture businesses (AATIF Website, 2021). External stakeholders and founding partners include the German Federal Ministry for Economic Cooperation and Development (first loss guarantee), KfW³ (mezzanine transactions), Deutsche Bank (mezzanine transactions), DWS Group (equity investor), and the European Commission (junior equity tranche investor). According to AATIF's 2021 Annual Report, US\$331 million has been distributed since the fund's inception in 2011. One example of AATIF's mission is a US\$2 million loan extended to the Amsons Group, a family-owned flour business in Tanzania, to co-finance a second mill and its future operations.
- **The Land Degradation Neutrality Fund (LDN)** invests in projects that reduce or reverse land degradation, both directly and indirectly, in forests across Latin America, South America, Africa, and Southeast Asia through sustainable agriculture and forestry (Mirova, 2018) operated by the UN Convention to Combat Desertification, is managed by Mirova, and launched in 2019 with a first-

³ KfW is a German, state-owned investment and development bank.

round closing of US\$100 million. Investors include but are not limited to the European Investment Bank, the French Agency for Development, and the Government of Luxemburg (first loss guarantee and de-risking partners), and Fondation and BNP Paribas (senior debt). LDN's current portfolio consists of five projects, including a US\$9 million profit-sharing loan to scale up hazelnut production in Bhutan, resulting in improved livelihoods for 15,000 households and over 7 million hazelnut trees planted exclusively on fallow or degraded land (IDH, 2021).

- **The Upper Tana-Nairobi Water Fund** operates funds sourced from public and private investors who depend on Tana River in Kenya. The Fund provides the area's 15,000 farmers with resources to conserve water, protect the river's health, and increase yields through training in resilient agriculture and riverbank buffer zone building. The Coca Cola Company, the Kenyan Electricity Generating Company (KenGen), and the Global Environment Facility are major investors in the fund. 2019 research by the Fund estimates an investment of \$10 million could return \$21.5 million in economic benefits to the area over three decades.

The Route: The Green Bank Model(s)

The green bank model is one of the most common implementations of blended finance in the domestic setting, with at least 18 green banks⁴ existing in the United States today. A green bank is commonly defined as a mission-driven institution using innovative financing to mitigate environmental challenges and fight climate change, most of which (but not all) are centered around accelerating the transition to clean energy.

The green bank concept was first introduced internationally in 2004 with the inception of the Energy Efficiency and Renewable Sources Fund in Bulgaria, and first launched in the United States in 2007 with the Delaware Sustainable Energy Utility (Whitney et al., 2020). Many of the largest green banks that are most well-known today, such as the Connecticut Green Bank and the New York Green Bank, commenced operations in the early 2010s (2011 and 2014, respectively). These early adopters served as important proof of concepts and use cases, allowing for the thriving green bank market that exists today; in 2020 alone, green banks in the United States mobilized \$1.69 billion of total investments by leveraging \$442 million of green bank funds (Whitney et al., 2020).

⁴ This total is an aggregate sourced from the Coalition for Green Capital, the American Green Bank Consortium, and Rocky Mountain Institute. However, the green bank model is increasing in popularity and several others may be in early planning and operational stages and not included in this estimate.

Public-Private vs. Non-Profit Models

Green banks operate broadly under two different models: public-private and non-profit. Public-private green banks are capitalized by a mix of public and private funds and are chartered or mandated by a legislative body at the local, state, or national level. The public-private capitalization ratio and level of independence from the legislative body can vary greatly, but all have the same end goal to leverage public funds as catalytic capital with private investment. The New York Green Bank, for example, operates as a state-sponsored financial entity working with the private sector to broaden the power of private sector energy financing. The Rhode Island Infrastructure Bank, on the other hand, has a government mandate and operates as a component unit of the State of Rhode Island, but is also partially capitalized by federal-level funding programs and private investors through bond issuances. Both are examples of the public-private green bank model but have varying degrees of government reliance and independence.

A green bank under the non-profit model operates as an independent entity outside of government, leveraging philanthropic capital with private sector resources. It should be noted that green banks operating under the non-profit model can implement public funds in the forms of grants, loan, or other awards, but there is not a direct pipeline of public funding and support indefinitely existing as is in the case of the public-private model. For example, the Colorado Clean Energy Fund, a non-profit green bank formed in 2019, was awarded \$30 million by the State of Colorado to jumpstart deployment of clean energy projects around the state (S.B. 21-230). While many of the more established green banks in the United States grew out of the public-private model, the non-profit model is becoming more common. One of the most recently launched green banks, the North Carolina Clean Energy Fund, operates under the non-profit model for reasons including a shorter development timeframe and avoidance of state political headwinds that could pose barriers to accessing the high amount of public resources (focus, money, and political capital) needed under the public-private model (Weiss, Beinecke, and Bunting, 2020).

One of the main differences between the public-private and non-profit model is the ability to leverage public funds. Due to its nature, the public-private green bank model is the only one that allows for sustained, long-term opportunities for public funds to leverage and expand the impact of private dollars. As a result, the public-private green bank model is necessary for harnessing all the benefits of blended finance in the case of water quality improvements. Table 3 below outlines the major opportunities and disadvantages of both models based on interviews with representatives from the North Carolina Clean Energy Fund, the Rhode Island Infrastructure Bank, and the Connecticut Green Bank.

Table 3: Pros and Cons of Two Green Bank Models

Public-Private		Non-Profit	
Pros	Cons	Pros	Cons
Greater leverage of public funding with private capital	Need state or federal cooperation; longer kickoff timeline	No need for legislative or political support; shorter kick-off timeline	More difficult to raise funds
Large support (monetary and political) from key players	Difficult in polarized political climates	Greater independence from legislative bodies	Less support from public funding sources

Source: Interviews with representatives from the North Carolina Clean Energy Fund, the Rhode Island Infrastructure Bank, and the Connecticut Green Bank

The following table was informed by a truncated typology of all existing green banks in the United States. Due to the scarcity of green banks addressing water quality issues, an elongated typology has been replaced with an in-depth examination of the Rhode Island Infrastructure Bank, the only Green Bank located in the United States that addresses water quality issues.

Figure 2: Existing Green Banks in the United States

Name	Type	Key Topics	Year	Link
Delaware Sustainable Energy Utility	Public-Private	Renewable Energy; Energy Efficiency	2007	https://www.energizedelaware.org/
Michigan Saves	Non-Profit	Renewable Energy; Energy Efficiency	2009	https://michigansaves.org/
California Alternative Energy and Advanced Transportation Financing Authority	Public-Private	Renewable Energy; Energy Efficiency; Clean Transportation	2010	https://www.treasurer.ca.gov/caeatfa/
NYC Energy Efficiency Corporation	Non-Profit	Renewable Energy; Energy Efficiency	2010	https://nyceec.com/
Connecticut Green Bank	Public-Private	Renewable Energy; Energy Efficiency; Clean Transportation	2011	https://www.ctgreenbank.com/
Florida Solar and Energy Loan Fund	Non-Profit	Renewable Energy; Energy Efficiency; Climate Resilience	2011	https://solarenergyloanfund.org/

Hawaii Green Infrastructure Authority, GEMS Program	Public-Private	Renewable Energy; Energy Efficiency	2013	https://gems.hawaii.gov/
New York Green Bank	Public-Private	Renewable Energy; Energy Efficiency; Clean Transportation	2014	https://greenbank.ny.gov/
Montgomery County Green Bank (Maryland)	Public-Private	Renewable Energy; Energy Efficiency	2015	https://mcgreenbank.org/
Rhode Island Infrastructure Bank	Public-Private	Renewable Energy; Energy Efficiency; Drinking Water; Water Quality; Climate Resilience	2015	https://www.riib.org/
Maryland Clean Energy Center	Public-Private	Renewable Energy; Energy Efficiency	2017	https://www.mdcleanenergy.org/
Nevada Clean Energy Fund	Non-Profit	Renewable Energy; Energy Efficiency	2022	https://nevadacef.org/
Inclusive Prosperity Capital	Non-Profit	Renewable Energy; Energy Efficiency	2018	https://www.inclusiveprosperitycapital.org/
DC Green Bank	Public-Private	Renewable Energy; Energy Efficiency; Stormwater	2018	https://dcgreenbank.com/
Climate Access Fund	Non-Profit	Community Solar	2019	https://www.climateaccessfund.org/
Colorado Clean Energy Fund	Non-Profit	Renewable Energy; Energy Efficiency	2019	https://www.cocleanenergyfund.com/
North Carolina Clean Energy Fund	Non-Profit	Renewable Energy; Energy Efficiency; Climate Resilience	2021	https://www.nccleanenergyfund.com/
Philadelphia Green Capital	Public-Private	Renewable Energy; Energy Efficiency	2021	https://phillygreencapital.org/

What Water Quality at a Green Bank Looks Like: The Rhode Island Infrastructure Bank

Rhode Island Infrastructure Bank Background

The Rhode Island Infrastructure Bank (RIIB) was established by the Rhode Island General Assembly in 1989 as the Clean Water Finance Agency, with a mandate to improve drinking water and water quality around the state by leveraging federal and state funds in the bond market.⁵ The agency's mandate was widened in 2015 to include clean energy and brownfield remediation work and its name was changed to the title it bears today.

The RIIB Operating Model

RIIB operates under the public-private green bank model, existing as a component unit of the State of Rhode Island while exercising a degree of independence to access other sources of capital. Chapter 46-12.2 of Rhode Island General Laws defines RIIB as a “body politic” of the State with “distinct legal existence.” The law specifically states that the Bank does not constitute a department of the state government. This means that RIIB interfaces with local governments, federal lending programs, and private lenders, all while still being able to regularly receive funding from the state or communicate directly with the Rhode Island Governor's Office. Chapter 46-12.2 also specifically states that the State of Rhode Island is not responsible for the Bank's debt.

Through this operating model, RIIB is able to effectively leverage state and federal funding to access private capital. In fiscal year 2021 (ended June 30, 2021) alone, it used its \$68 million in Bank financing (from sources such as state funds or federal grant and loan funds) to leverage an additional \$35.8 million in private financing. The Bank mobilizes private sector capital primarily through the issuance of bonds, with 34% of RIIB loans in fiscal year 2021 being funded with third party, private capital. In other words, for every \$2 of public dollars contributed, \$1 of private investment was made.

Since the Bank's inception, it has co-managed the State's Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) with the Rhode Island Department of Environmental Management (DEM) and Department of Health (DOH), respectively. RIIB manages the financial, strategic, and administration aspects of the SRFs, while the state departments serve as a regulatory authority and backstop.

⁵ Information for this case study comes from and overlaps between four key sources: Rhode Island Infrastructure Bank's website, a January 2022 interview with Kimberly Koriath (Rhode Island Infrastructure Bank Stormwater & Resilience Analyst), NRDC's July 2019 Interview with Jeffrey Diehl (Rhode Island Infrastructure Bank Executive Director and Chief Executive Officer) (Baneman 2019), and the Bank's Annual Reports.

In addition to administering the programs, RIIB further leverages the SRFs by issuing revenue bonds secured by a broad pool of loans to local municipalities and their projects. Both SRF-leveraged bonds have AAA ratings, higher than the credit rating of the State of Rhode Island (AA). With the leveraged SRFs serving as RIIB's baseline sustenance, it operates on a mix of traditional and innovative financing programs and has been able to expand infrastructure-based programs beyond the CWSRF and DWRSF, including:

- Brownfields Revolving Loan Program
- Commercial Property Assessed Clean Energy (C-PACE)
- Community Septic System Loan Program
- Efficient Buildings Fund
- Municipal Resilience Program
- Sewer Tie-In Loan Fund
- Stormwater Project Accelerator

Governance

The Rhode Island Infrastructure Bank is governed by a Board of Directors. The Board consists of five people, four of which are members of the public and appointed by the Rhode Island Governor. The fifth member of the Board is filled by the Rhode Island General Treasurer or someone the General Treasurer designates for the role.

Example Projects

The Stormwater Project Accelerator: This program provides upfront capital for municipalities, utilities, and non-profit organizations to finance green stormwater infrastructure projects that have received approval for reimbursement grants from a third party. The Stormwater Project Accelerator (SPA) effectively acts as a bridge loan for green infrastructure projects, with eligibility being contingent on providing a signed grant agreement to show how the loan will be repaid. In addition to green infrastructure, eligible projects include nature-based solutions and stormwater best management practices which address water quality problems. The loan is interest free but is charged a 1.5% administration fee.

Through the SPA, the Woonasquatucket River Watershed Council (WRWC) received a loan of \$161,400 to install stormwater best management practices and a multi-use pathway in a Citizens Bank parking lot in Providence. In addition to creating an urban green space, the project intercepts and treats stormwater to improve local water quality in the Woonasquatucket River.

The Water Quality Protection Charge Program: This program is a collaboration with the Water Resources Board, an executive state agency charged with "managing the

proper development, utilization and conservation of water resources,” according to the Bank’s website. The Water Quality Protection Charge Program offers funding for drinking water protection projects (e.g., wastewater treatment plant upgrades or watershed land acquisitions) to public drinking water suppliers.

According to Chapter 46-15.3-5 of Rhode Island General Laws, the program is funded by a fee placed on major water suppliers of \$.0292 per 100 gallons of water sold. The law dictates that the fee is included in customer billing prices but is not taxable.

In fiscal year 2021, RIIB completed direct grants of \$505,470 under this program. One of the grant recipients was the City of Newport, which will use this funding⁶ to re-establish and protect riparian buffers on six inland and coastal reservoirs in an effort to decrease nutrient loading. The funds will be used to survey the sites, install boundary markers, remove any identified encroachments onto reservoir properties, and restore vegetative buffers around the six targeted reservoirs.

The Municipal Resilience Program: The Bank’s Municipal Resilience Program (MRP) supports municipalities in identifying and implementing adaptation priorities to increase resilience to climate hazards. During the first portion of participation in the program, municipalities must complete a community workshop run in collaboration with The Nature Conservancy. Following the workshop, participating municipalities are eligible to apply for grant funding to implement identified resiliency projects, and a 25% match by the grant recipient is required. As of late 2021, 20 municipalities have participated in the MRP.

Nearly \$1.5 million in grants were dispersed in 2020 through the MRP. One of these grants was received by the City of Newport. Newport received a grant totaling \$181,990 to restore meadow and marshland in the area near Almy Pond by removing over 25,000 square feet of impervious surface. Benefits to the project include an expanded drainage buffer around the pond and local water quality improvement.

The MRP projects in 2019 and 2020 were funded by a variety of sources, such as various federal grant funds, but 2021 MRP projects and those over the next two years will be funded by the \$7 million allotment to RIIB from the State’s 2021 Beach, Clean Water & Green Economy Bond.

A Model for North Carolina

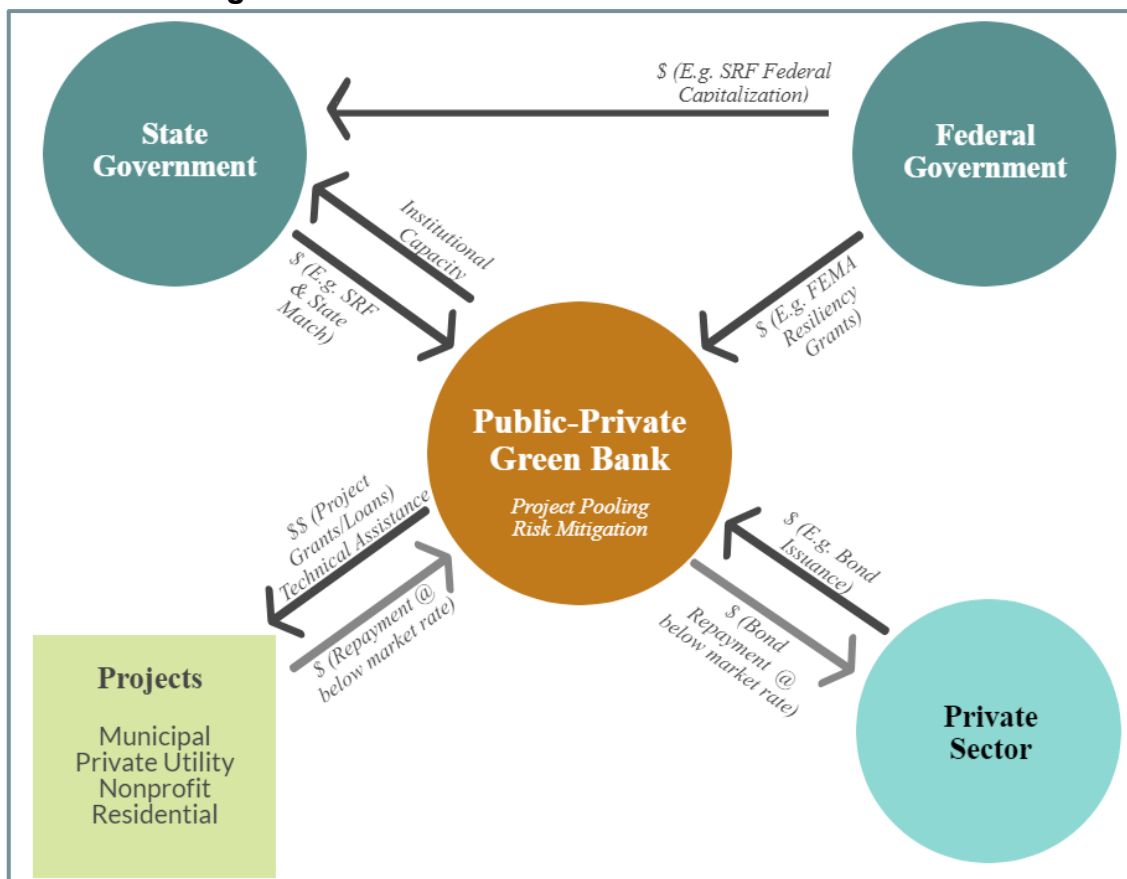
After over 30 years in operation, the Rhode Island Infrastructure Bank could provide some guidance of a model for a water quality green bank in North Carolina. While a direct replica is likely not realistic or appropriate, some parts of RIIB could be beneficial

⁶ The grant award amount for this specific project was not available.

for the challenges facing water quality management and its funding gap in North Carolina. For example, a Bank exclusively financing water quality and related projects (i.e., not approaching the sometimes partisan issue of renewable energy) could have better chances at success in North Carolina. Due to a combination of 1) the important role legislative and state government support has played in RIIB's history and 2) the ability of the public-private model to better leverage private sector investments, this hypothetical model for a water quality green bank in North Carolina will follow the public-private model.

A water quality green bank in North Carolina would serve to 1) pool state and government grants and loans applicable to water quality investments, 2) increase institutional capacity, 3) further leverage public funds, 4) inject private sector dollars into water quality investments, 5) apply technical assistance and expertise, 6) pool bankable projects, and 7) mitigate private investor risk. Figure 3 below illustrates a hypothetical cash and resource flow model for the North Carolina Clean Water Bank:

Figure 3: North Carolina Clean Water Bank Model



Similar to the Rhode Island Infrastructure Bank, the North Carolina Clean Water Bank would rely on the role of SRFs and its leverage potential as the base of its financing. However, since the North Carolina Clean Water Bank would not address drinking water

infrastructure issues, only the Clean Water State Revolving Fund would be utilized, with the Drinking Water State Revolving Fund remaining as in its current management capacity by the North Carolina Department of Environmental Quality's Division of Water Infrastructure (DWI). Additionally similar to RIIB, the financial management and jurisdiction of the CWSRF would come under the management of the North Carolina Clean Water Bank, but co-management overall would be carried out alongside DWI. By removing the CWSRF from direct state management and relinquishing it to a quasi-independent body, it could be further leveraged by bond issuance.

A 2004 study examining state approaches to CWSRF leveraging categorized North Carolina as a state with a "strong commitment to environmental policy" but lacking the degree of institutional capacity necessary to do so (Travis, Morris, and Morris, 2004). Despite this study being nearly two decades old, it is still highly relevant. Recent evidence exists to show that the North Carolina General Assembly and state government still positively regard water issues in the state. For example, of the \$5.4 billion allocated to the State of North Carolina for independent distribution from the 2021 American Rescue Plan Act, \$1.6 billion (29.6%) was allocated to drinking water, wastewater, and stormwater uses, according to a January 2022 press release from the North Carolina Department of Environmental Quality. While only \$18.5 million of this total was earmarked distinctly for stormwater, the remaining \$1.58 billion are allocated for both drinking water and wastewater projects. Additionally, the General Assembly made historically large investments in the outdoor recreation industry when it approved the FY 2021- 2023 budget in November 2021, specifically allocating \$26 million annually to "expand parks, game lands, and nature preserves, as well as stream restoration projects across the state" (North Carolina Outdoor Recreation Coalition, 2021). Even if such evidence does not suffice or concerns still exist around being tied to water quality investments, the General Assembly and North Carolina Governor could remove any political risk around being linked to specific initiatives by creating this quasi-independent body to handle water quality issues and its investments, as legislators could claim as much distance from the Bank as suits them on a case-by-case basis.

The North Carolina Clean Water Bank could implement a range of water quality investment programs similar to many of those of the Rhode Island Infrastructure Bank operates, as well as others that would be appropriate for the unique needs of the state. For example, the Bank would be in the ideal position to finance and administer a water quality trading (WQT) program. This program would allow the Bank to address the issue of nutrient runoff in agriculture, for example. A WQT program would not be a new concept in North Carolina, as several have already been attempted in watersheds where impairments have been identified across the state, including the Jordan Lake Watershed. A 2017 study found that, despite nearly half of area farmers being willing to take on nutrient conservation practices, less than one quarter were willing to even

consider participating in the Jordan Lake WQT program due to uncertainty, risk, and mistrust of the program (O'Connell et al., 2017). With the financial resources and governmental support already demonstrably available, the North Carolina Clean Water Bank would be able to provide the technical assistance and expertise necessary to make a North Carolina WQT program successful.

Looking Forward

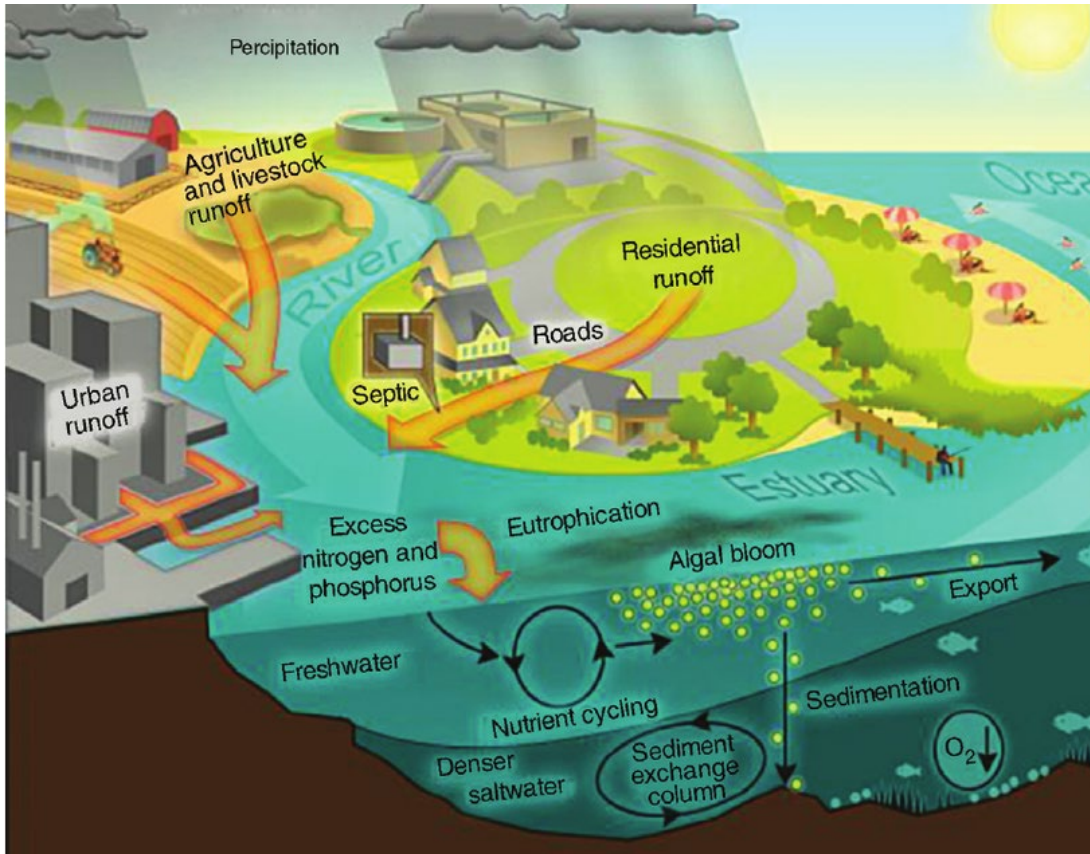
Water quality plays an undeniably important role in the economy of North Carolina and wellbeing of its residents. With everything from individual drinking water needs to large scale recreation and agriculture systems being threatened by nutrient loading and climate change, additional funding will be needed in the years to come to maintain the vibrancy of this state. A blended finance approach has the potential to leverage existing public funds to access the private sector investments needed to improve and maintain this precious resource.

While a seemingly positive outlook of legislative support exists for water quality initiatives and funding in North Carolina, an expected next step to ensure successful development of the North Carolina Clean Water Bank could be a state-wide contingent valuation study regarding water quality investments. A 2017 study found that willingness to pay for water quality improvements in impaired waters can serve as a qualitative indicator of political support, and it can be expected that establishing and confirming stakeholder buy-in would be a vital step in development of the North Carolina Clean Water Bank (Söderberg and Barton, 2014). For example, a 2001 study surveying residents around the Catawba River basin found a mean willingness to pay of \$139 for a management plan protecting water quality at its current level, aggregating to an annual economic benefit of more than \$75 million for Catawba basin counties (Kramer and Eisen-Hecht, 2002). A similar study updated to reflect current economic conditions and broadened to encapsulate the entire state could be a vital next step in moving towards a North Carolina Clean Water Bank.

The few water quality example programs explored in this report (CWSRF bonds, stormwater project accelerator, municipal resilience program, water quality surcharge, and water quality trading program) are just the beginning of how the North Carolina Clean Water Bank could transform water quality investments across the state, but effectively illustrate the potential of this nearly untapped blended finance opportunity.

Appendices

Appendix A: Anthropomorphic Nutrient Loading Diagram



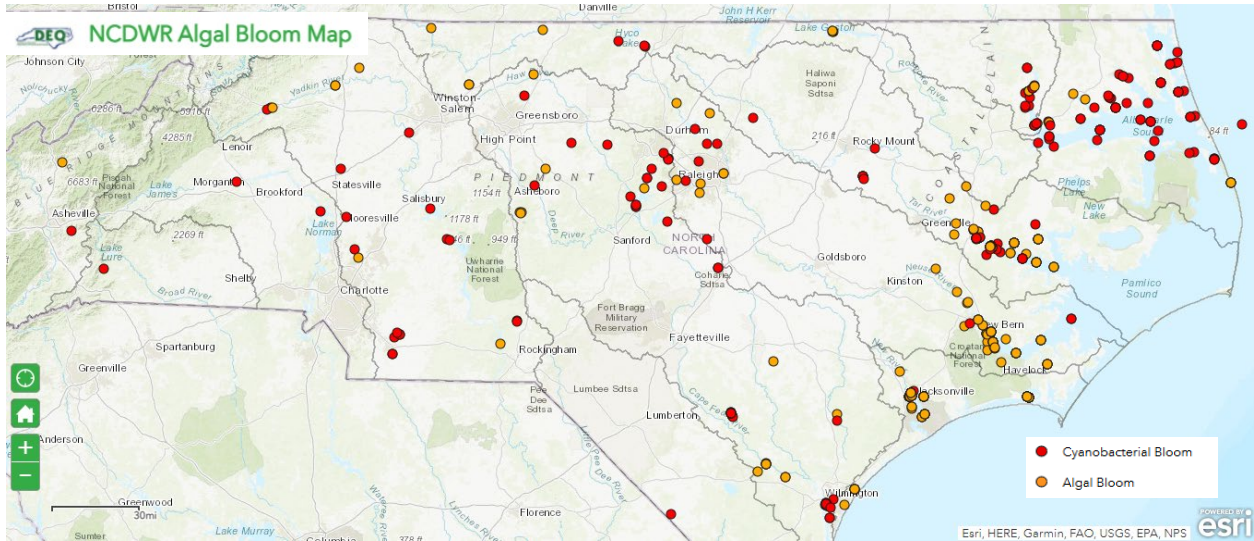
(Eldridge and Roelke, 2021)

Appendix B: Harmful Algal Bloom on the Chowan River, August 2021



(Strong 2021)

Appendix C: Algal Blooms Recognized by North Carolina Department of Environmental Quality, 2012-2019



(North Carolina Department of Environmental Quality, 2019)

Resources:

Addis Ababa Action Agenda. The United Nations. July 2015. Retrieved from: https://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf

AATIF. AATIF Annual Report 2020/21. 2021. Retrieved from: [https://www.aatif.lu/annual-reports.html?file=files/assets/downloads/annual reports/AATIF AR 2020-2021.pdf](https://www.aatif.lu/annual-reports.html?file=files/assets/downloads/annual%20reports/AATIF_AR_2020-2021.pdf)

AATIF Impact Briefs: <https://www.aatif.lu/impact-briefs.html>

AATIF Website. 2021. <https://www.aatif.lu/home.html>

Alexander, Olwyn, et al. Asset & Wealth Management Revolution: Embracing Exponential Change. PricewaterhouseCoopers. 2017. Retrieved from: https://www.pwc.com/jg/en/investment-management/awm_revolution_report.pdf

Backer, Lorraine C., et al. Canine Cyanotoxin Poisonings in the United States (1920s–2012): Review of Suspected and Confirmed Cases from Three Data Sources. Toxins (Basel). September 2013.

Baneman, Roger. Rhode Island Infrastructure Bank: A Green Bank with Shades of Blue. National Resources Defense Council. July 2019. Retrieved from: https://greenbanknetwork.org/wp-content/uploads/2019/07/GBN-Rhode-Island-Bank-19-06-B_03_locked.pdf

Chapra, Steven C., et al. Climate Change Impacts on Harmful Algal Blooms in U.S. Freshwaters: A Screening-Level Assessment. Environmental Science & Technology. 2017

Choi, Esther and Seiger, Alicia and Seiger, Alicia, Catalyzing Capital for the Transition toward Decarbonization: Blended Finance and Its Way Forward (June 15, 2020).

“Companies Invest \$70 Million to Boost Affordable Housing in Charlotte.” Affordable Housing Finance. January 2019. Retrieved from: https://www.housingfinance.com/news/companies-invest-70-million-to-boost-affordable-housing-in-charlotte_o

Convergence. Blended Finance. Retrieved from: <https://www.convergence.finance/blended-finance>.

Economic Development Partnership of North Carolina. 2020 Tourism Economic Fast Facts. 2021. Retrieved from: <https://partners.visitnc.com/contents/sdownload/72194/file/2020-Economic-Impact-Fast-Facts.pdf>

Eldridge, P.M. and Roelke, Daniel. Hypoxia in Waters of the Coastal Zone: Causes, Effects, and Modeling Approaches. Treatise On Estuarine and Coastal Science. January 2021.

EPA Office of Water. A Compilation of Cost Data Associated with the Impacts of Nutrient Pollution. May 2015.

Fahey, Ashley. "BofA, Ally Financial and Barings to invest \$70M-plus for affordable housing in Charlotte." Charlotte Business Journal. January 2019. Retrieved from: <https://www.bizjournals.com/charlotte/news/2019/01/15/bofa-ally-financial-and-barings-to-invest-70m-plus.html>

Global Impact Investing Network. Blended Finance Working Group. Retrieved from: <https://thegiin.org/blended-finance-working-group>

Greif, Jake; Roth, Lindsay; Swann, Kristine; Townsend, Tristen; Watson, Carolina. Redefining algal bloom management pathways in North Carolina. Duke University Nicholas School of the Environment. May 2020.

Havemann, T., et al. Blended finance for agriculture: exploring the constraints and possibilities of combining financial instruments for sustainable transitions. *Agric Hum Values* 37, 1281–1292. 2020.

IDH. Learning Brief: New insights from the Land Degradation Neutrality Fund and Technical Assistance Facility. March 2021. Retrieved from: <https://www.idhsustainabletrade.com/uploaded/2021/03/2020-LDN-Report-10.5-Large.pdf>

Kramer, R. A. and Eisen-Hecht, J. I. Estimating the economic value of water quality protection in the Catawba River basin, *Water Resour. Res.*, 38(9). 2002.

Mehta, et al. Catalyzing Green Finance, a Concept for Leveraging Blended Finance for Green Development. Asian Development Bank. 2017. Retrieved from: <https://www.adb.org/sites/default/files/publication/357156/catalyzing-green-finance.pdf>

National Wild and Scenic Rivers System. North Carolina Fact Page. Retrieved from: <https://www.rivers.gov/north-carolina.php#:~:text=North%20Carolina%20has%20approximately%2037%2C853,of%20the%20state's%20river%20miles>

NOAA Office for Coastal Management. Shoreline Mileage of the United States. Retrieved from: <https://coast.noaa.gov/data/docs/states/shorelines.pdf>

North Carolina Department of Agriculture and Consumer Services. North Carolina Agricultural Water Use. 2014. Retrieved from: [https://www.ncwater.org/Reports and Publications/GWMS Reports/AgStatReports/AgWaterUseNC-WU2014.pdf](https://www.ncwater.org/Reports%20and%20Publications/GWMS%20Reports/AgStatReports/AgWaterUseNC-WU2014.pdf)

North Carolina Department of Commerce. Visitor spending in North Carolina grows at near record pace. N.C. Commerce News. May 2019. Retrieved from: <https://www.nccommerce.com/news/press-releases/visitor-spending-north-carolina-grows-near-record-pace>

North Carolina Department of Environmental Quality, Ambient Lakes Monitoring. Retrieved from: <https://deq.nc.gov/about/divisions/water-resources/water-resources-science-and-data/water-sciences-home-page/intensive-survey-branch/ambient-lakes-monitoring>

North Carolina Department of Environmental Quality, DWR Algal Bloom Map <https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=58e9afca8b724b3f82cc81a8b825f83e>

North Carolina Department of Environmental Quality, River Basin Classification Schedule. Retrieved from: <https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/river-basin-classification>

North Carolina Department of Environmental Quality. Press Release. “North Carolina Department of Environmental Quality, State Seeks Public Comment on Proposed Plan to Administer American Rescue Plan Act’s State Fiscal Recovery Funding. January 4, 2022. Retrieved from: <https://deq.nc.gov/news/press-releases/2022/01/04/reminder-state-seeks-public-comment-proposed-plan-administer-american-rescue-plan-acts-state-fiscal>

North Carolina Division of Parks and Recreation. North Carolina Outdoor Recreation Plan May 2020. Retrieved from: <https://files.nc.gov/ncparks/north-carolina-statewide-comprehensive-outdoor-recreation-plan-2020.pdf>

North Carolina Outdoor Recreation Coalition. Press Release: “NC State Budget Provides Historic Investments in Outdoor Recreation.” November 19, 2021. Retrieved from: <https://www.ncorec.com/news/2021/11/19/historic-investments-in-outdoor-recreation-in-nc-state-budget>

Organisation for Economic Cooperation and Development (OECD). Making Blended Finance Work for Water and Sanitation. 2019. Retrieved from: <https://www-oecd-ilibrary-org.proxy.lib.duke.edu/docserver/5efc8950-en.pdf?expires=1643319249&id=id&accname=ocid177459&checksum=4B70E365A46ED3552F73163D267DA173>

Pietrafesa, Leonard J., et. al. A Comparison of Fish Kills in the Pamlico River and the Neuse River in Coastal North Carolina (A Symptom) and Abiotic Factors (The Root Causes). *Oceanography and Fisheries Journal*. April 2018.

Rhode Island General Laws, Chapter 46-12.2

Rhode Island General Laws, Chapter 46-15.3-5

Rhode Island Infrastructure Bank Website: <https://www.riib.org/>

Rode, Julian, et al. Why ‘blended finance’ could help transitions to sustainable landscapes: Lessons from the Unlocking Forest Finance project. *Ecosystem Services*, Volume 37. 2019.

S.B. 21-230, 73rd General Assembly, 2021 Reg. Sess. (CO 2021).
<https://leg.colorado.gov/bills/sb21-230>

Söderberg, Magnus and Barton, David. Marginal WTP and Distance Decay: The Role of 'Protest' and 'True Zero' Responses in the Economic Valuation of Recreational Water Quality. *Environ Resource Economics*. 2014.

Strong, Stacia. "Algae Blooms found in Chowan River." WITN News. August 2021. Retrieved from: <https://www.witn.com/2021/08/03/algae-blooms-found-chowan-river/>

Travis, Rick; Morris, John C.; Morris, Elizabeth D. State implementation of federal environmental policy: explaining leveraging in the Clean Water State Revolving Fund". *Policy Studies Journal*. Vol. 32, Issue 3. August 2004.

United Nations Department of Economic and Social Affairs. Policy Brief #100: Effective blended finance in the era of COVID-19 recovery. April 2021. Retrieved from: <https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-100-effective-blended-finance-in-the-era-of-covid-19-recovery/>

U.S. Environmental Protection Agency. A compilation of cost data associated with the impacts and control of nutrient pollution. 2015.
<https://www.epa.gov/sites/default/files/2015-04/documents/nutrient-economics-report-2015.pdf>

U.S. Fish and Wildlife Service. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: North Carolina. 2011. Retrieved from: <https://www2.census.gov/programs-surveys/fhwar/publications/2011/fhw11-nc.pdf>

Van Houtven, George, et al. Economic Valuation of the Albemarle-Pamlico Watershed's Natural Resources. The Albemarle-Pamlico National Estuary Partnership and RTI International. April 2016. <https://apnep.nc.gov/media/296/open>

Van Houtven, George; Woollacott, Jared; Bean, Alison. Climate Change in North Carolina: Near-Term Impacts on Society and Recommended Actions. RTI International. October 2020.

Walden, Mike. Agriculture and agribusiness: North Carolina's number one industry. May 2021. Retrieved from: <https://cals.ncsu.edu/agricultural-and-resource-economics/wp-content/uploads/sites/12/2017/07/NC-Value-of-Agriculture-and-Agribusiness.pdf>

Weiss, Jennifer; Beinecke, Hannah; Bunting, Jill. How a Green Bank can Drive the North Carolina Clean Energy Economy: a Market Opportunity Overview. Nicholas Institute for Environmental Policy Solutions. The Coalition for Green Capital. 2020.

Whitney, Angela; Grbusic, Tamara; Meisel, Julia; Becerra Cid, Adriana; Sims, Douglass; Bodnar, Paul. State of Green Banks 2020, Rocky Mountain Institute, 2020.

World Business Council for Sustainable Development. New Forests: Mobilizing finance for sustainable forests and the climate. 2018. Retrieved from:

<https://www.wbcsd.org/Sector-Projects/Forest-Solutions-Group/Forest-Sector-SDG-Roadmap/New-Forests-Mobilizing-finance-for-sustainable-forests-and-the-climate>

Zamyadi, A.; MacLeod, S. L.; Fan, Y.; McQuaid, N.; Dorner, S.; Sauvé, S.; Prévost, M. Toxic cyanobacterial breakthrough and accumulation in a drinking water plant: A monitoring and treatment challenge. *Water Research*. 2012

Zheng, Jiani I. and Battiston, Stefano and Nuttall, Christophe, *Blended Finance Solutions For Scaling Up Sustainability Investments: Opportunities and Challenges*. October 26, 2020.