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Integrated Estuary Governance

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INTEGRATED ESTUARY GOVERNANCE

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ABSTRACT

Estuaries are complex, dynamic ecosystems that play a critical role in supporting crucial economic industries, such as commercial fishing and tourism, and providing the resources necessary to sustain coastal communities. A range of anthropogenic environmental stressors are threatening the health of estuaries throughout the world. Traditional top-down single resource focused environmental regulatory approaches have proved inadequate to protect and restore estuarine systems. In recent years, scientific and legal academics, as well as policymakers, have called for more holistic participatory approaches to addressing environmental challenges. Drawing on the literature on ecosystem management, integrated water resources management, collaborative governance, and adaptive management, we offer a new approach, which we refer to as Integrated Estuary Governance. Our proposal incorporates elements of other approaches that have been demonstrated to be essential in managing natural systems in general and that have particular applicability to estuarine systems.

Through in-depth case studies, we examine existing estuary programs established pursuant to the Clean Water Act's National Estuary Program through the lens of Integrated Estuary Governance. This evaluation reveals a strong link between successful estuary management and the employment of a robust Integrated Estuary Governance approach. Extrapolation of this approach to other estuary management programs, and to other ecosystem management programs in general, in a deliberative and methodical fashion may result in greater success in protecting, managing, and restoring important ecological resources while, at the same time, ensuring that community social and economic values are protected.

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INTRODUCTION

Estuaries throughout the United States and the world are in serious decline.[1] Environmental, economic, and social consequences of these declines may be devastating. The interjurisdictional nature of estuaries, coupled with the complexity and dynamism of these systems, calls for an integrated approach to protection, management, and restoration. In this Article, we offer a new structured approach, "Integrated Estuary Management," and demonstrate its efficacy through case studies.

During the past few summers, images on the news and social media have highlighted the ravages of some of the most dramatic environmental assaults on estuaries, including widespread blue-green algae blooms and red tide outbreaks.[2] Haunting never-before-seen images of dead manatees, hundreds of dead fish floating belly-up, and guacamole-like algae blanketing waterways in green slime tell a story of serious environmental devastation.[3] At the same time, images of lost fishing businesses, closed beaches, and shuttered hotels, restaurants, and shops along the coast demonstrate the devastating economic and social consequences of this environmental destruction.[4] Anthropogenic contributions to estuary declines include nutrient runoff from agriculture and urban and suburban development, too much or too little freshwater input due to altered hydrology and intensive water use, increased water temperature due to global warming, "coastal squeeze"[5] resulting from sea level rise, wetland destruction, channelization, overfishing, and various other factors. While some estuaries, such as Tampa Bay, have experienced significant improvements in water quality, habitat, and other environmental indicators, other estuaries have continued to decline.[6] This Article explores governance strategies for estuary

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[1] Heike K. Lotze et al., *Depletion, Degradation, & Recovery Potential of Estuaries & Coastal Seas*, 312 SCI. 1806, 1806 (2006).

[2] Ocean Service, *Harmful Algal Blooms: Tiny Organisms with a Toxic Punch*, NOAA, https://oceanservice.noaa.gov/hazards/hab/ [https://perma.cc/KX2D-G5H6] (last visited Nov. 24, 2020); Don Anderson, *Why Are Outbreaks of Pfiesteria & Red Tides Suddenly Threatening Our Oceans?*, SCI. AM. (Apr. 20, 1998), https://www.scientificamerican.com/article/why-are-outbreaks-of-pfie/?print=true [https://perma.cc/LVC7-2LBG].

[3] Greg Allen, *With Murky Water & Manatee Deaths, Lagoon Languishes*, NPR (Sept. 26, 2013), https://www.npr.org/2013/09/26/223037646/with-murky-water-and-manatee-deaths-lagoon-languishes#:~:text=FAU [https://perma.cc/LDN7-CP3V].

[4] Sinéad M. Borchert et al., *Coastal Wetland Adaptation to Sea Level Rise: Quantifying Potential for Landward Migration & Coastal Squeeze*, 2018 J. APPLIED BIOLOGY 2876, 2877.

[5] *Id.*

[6] *Tampa Bay*, SW. FLA. WATER MGMT. DIST., https://www.swfwmd.state.fl.us/projects/swim/tampa-bay [https://perma.cc/39BJ-WWFV] (last visited Nov. 24, 2020).

protection and restoration. Through case studies of highly successful, and less successful estuary governance strategies, this Article seeks to identify successful approaches and patterns that could serve as governance models for other locales.

A variety of federal laws exist that play a role in estuary governance. Some, such as the regulatory programs contained in the Endangered Species Act ("ESA"),[7] the Clean Water Act ("CWA"),[8] and the Coastal Zone Management Act ("CZMA"),[9] directly regulate certain activities that affect estuaries or provide regulatory protections for certain aspects of estuary resources. Other laws, such as the nonpoint source pollution planning programs of the CWA,[10] are primarily planning-based and aspirational, and thus have limited authority to prevent or regulate harmful activities. Another category of laws, such as the National Estuary Program ("NEP")[11] of the CWA and the National Estuarine Research Reserve System ("NERRS")[12] of the CZMA, seek to protect estuary health with a more holistic and collaborative approach. Layered on top of these federal laws are a myriad of state and local laws that address various aspects of estuary health through a range of regulatory and non-regulatory mechanisms.[13]

To vertically and horizontally integrate the existing morass of federal, state, and local laws and policies to achieve sustainable estuary health, a system of governance is needed. This Article explores the environmental governance literature with an eye toward estuary health. Through the use of case studies from the NEP, this Article demonstrates the value of an integrated governance approach as a framework for successful governance and identifies strategies within that framework that optimize the likelihood of success.

Part I of this Article describes the vast economic, social, and environmental values estuaries provide to communities and the significant environmental stressors that are threatening the provision of these services. Part II outlines some of the most salient regulatory and non-regulatory estuary protection programs that currently exist and evaluates their strengths and weaknesses in addressing the dynamism and complexity of estuaries. Drawing from literature on ecosystems management,

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[7] Endangered Species Act, 16 U.S.C. §§ 1531–1544 (2018).
[8] Clean Water Act, 33 U.S.C. §§ 1251–1388 (2018).
[9] Coastal Zone Management Act, 16 U.S.C. §§ 1451–1466 (2018).
[10] Nonpoint Source Management Programs, 33 U.S.C. § 1329 (2018).
[11] National Estuary Program, 33 U.S.C. § 1330 (2018).
[12] National Estuarine Research Reserve System, 16 U.S.C. § 1461 (2018).
[13] Holly Greening & Chris Elfring, *Local, State, Regional, & Federal Roles in Coastal Nutrient Management*, 25 ESTUARIES 838, 839–40 (2002).

integrated water resource management, collaborative governance, and adaptive water law, Part III of this Article identifies key features of effective Integrated Estuary Governance. Extrapolating these concepts to estuary restoration management and protection this Article develops the concept of Integrated Estuary Governance. Part IV then explores case studies of successful and less successful NEP programs, assessing the extent to which each of the programs incorporate concepts of Integrated Estuary Governance. Finally, the Conclusion states that Integrated Estuary Governance can serve as an important roadmap to policy makers and environmental managers in estuary management and beyond.

I. ESTUARY SERVICES AND STRESSORS

Estuaries are transitional areas that exist where freshwater from rivers and streams mixes with saline ocean water in a partially enclosed area.[14] Although tidally influenced, they are partially enclosed by barrier islands or other land formations that protect them from the brunt forces of waves, winds, and storms that impact ocean shorelines.[15] Considered some of the most productive ecosystems on earth due to the vast quantity of organic matter they produce, estuaries are home to thousands of species of fish and wildlife that depend on the productive food sources and shelter provided.[16] Many imperiled wildlife species rely on estuarine habitat.[17] Moreover, estuary resources such as seagrass beds, salt marshes, and mangroves are estimated to provide substantial economic benefits to the communities in which they exist and beyond.[18] Estuaries provide enormous economic benefits by serving as nursery habitats for a vast array of commercial and sport fisheries.[19] Additional benefits derive from the use of estuaries in tourism and recreation and as shipping and transportation harbors, making them significant economic contributors to the U.S. economy and critical economic drivers in many coastal communities.[20] Additionally, estuary swamps and marshes filter out sediments and other

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[14] *Basic Information about Estuaries*, EPA, https://www.epa.gov/nep/basic-information-about-estuaries#:~:text=Estuaries%20also%20perform%20other%20valuable,and%20pollutants%20are%20filtered%20out [https://perma.cc/5XWN-48FK] (last visited Nov. 24, 2020).
[15] *Id.*
[16] *Id.*
[17] *Id.*
[18] *See generally* Edward B. Barbier et al., *The Value of Estuarine and Coastal Ecosystem Services*, 81 ECOLOGICAL MONOGRAPHS 169 (2011).
[19] Correigh M. Greene et al., *A National Assessment of Stressors to Estuarine Fish Habitats in the Contiguous USA*, 38 ESTUARIES & COASTS 782, 782 (2015).
[20] *Id.*

pollutants carried downstream by rivers and stream, resulting in improved water quality for marine resources.[21] Other environmental services provided by estuary saltmarshes include preventing erosion, stabilizing shorelines, and serving as protective buffers that help to absorb floodwaters and storm surge, thereby protecting natural habitats and human-built structures.[22]

The very features that make estuaries unique and important habitats that provide critical environmental services also make them vulnerable to anthropogenic activities.[23] For example, the fact that numerous rivers and streams feed into a particular estuary means that the estuary serves as a repository for sediments and other pollutants collected and carried downstream from large geographic areas.[24] Moreover, estuaries' natural beauty, fish and wildlife, and recreational opportunities draw people into them, leading to overfishing, pollution from boaters and other recreational uses, boat prop scarring, and other human impacts.[25] In fact, estuaries and other coastal ecosystems are among the most heavily used and most imperiled natural systems on earth.[26] Finally, roughly half of the U.S. population lives in coastal areas, and because estuaries by definition occur in coastal areas, dense and intense human land uses contribute to estuary harm.[27]

Estuaries and other coastal ecosystems throughout the world are experiencing significant environmental stressors causing a global decline in critical ecosystem services, including an estimated 33% decline in viable fisheries, a 69% decline in the provision of nursery habitats, and a 63% decline in pollution filtering services.[28] While no estuaries are immune, Florida estuaries are particularly threatened due to the state's unique low-lying geography, long history of extensive hydrologic system alterations, and ever-increasing population growth.[29]

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[21] Barbier et al., *supra* note 18, at 169, 181, 184.
[22] *Id.* at 184.
[23] Katherine A. Dafforn et al., *The Challenge of Choosing Environmental Indicators of Anthropogenic Impacts in Estuaries*, 163 ENV'T POLLUTION 207, 207 (2011).
[24] *See* Peter M. Chapman & Feiyue Wang, *Assessing Sediment Contamination in Estuaries*, 20 ENV'T TOXICOLOGY & CHEMISTRY 3, 5 (2001).
[25] Barbier et al., *supra* note 18, at 176; Alan K. Whitfield & Alistair Becker, *Impacts of Recreational Motorboats on Fishes: A Review*, 83 MARINE POLLUTION BULL. 24 (2014).
[26] Barbier et al., *supra* note 18, at 169.
[27] *Basic Information about Estuaries*, *supra* note 14.
[28] Barbier et al., *supra* note 18, at 169.
[29] Duane E. De Freese, *Threats to Biological Diversity in Marine and Estuarine Ecosystems of Florida*, 19 COASTAL MGMT. 73, 73–74 (1991).

A significant issue facing Florida's estuarine environments is habitat modification, driven largely by population growth and the associated coastal development.[30] For decades, Florida's coastal development has been unrelenting, with approximately 75% of Florida's 21,000,000 residents living in coastal counties.[31] Dredge and fill activities for residential and commercial construction, seawall construction and other coastal armoring associated with coastal development, and dredging for shipping channels has led to large-scale mangrove and seagrass destruction.[32] In the Indian River Lagoon, there was an 86% decline in the availability of mangrove habitat to fisheries and a 30% loss of seagrass acreage over a forty-year period.[33] Similarly, in Tampa Bay approximately 80% of seagrasses and 45% of mangrove and salt marsh acreage were lost over the past 100 years.[34] Destruction of sea grass and mangrove habitat causes harm to commercial fish species and other wildlife that rely on them while eliminating other environmental services provided by these ecosystems.[35]

Eutrophication is a common environmental problem facing waterbodies in general and estuaries in particular, throughout the world.[36] Florida estuaries, as repositories for excessive nutrients carried downstream, are particularly challenged by eutrophication.[37] The influx of nutrients, including nitrogen and phosphorous, results from the anthropogenic input of nutrients to coastal areas from sources such as wastewater treatment plants, nonpoint sources runoff from agricultural operations, urban, and suburban storm water, as well as atmospheric deposition.[38] Excess nutrient loading into coastal ecosystems can lead to harmful algal blooms, including explosions of toxic blue-green algae,[39] as well as disruptions in

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[30] *Id.*
[31] ALBERT C. HINE ET AL., SEA LEVEL RISE IN FLORIDA: SCIENCE, IMPACTS, AND OPTIONS 125 (2016).
[32] De Freese, *supra* note 29, at 83–84.
[33] *Id.*
[34] *Id.*
[35] *Id.* at 77.
[36] *See* European Commission Press Release IP/20/1160, More Protection for our Seas and Oceans is Needed, Report Finds (June 25, 2020) ("Almost half of Europe's coastal waters are subject to intense eutrophication."); *see also* American Geophysical Union, *Phosphorus Pollution Reaching Dangerous Levels Worldwide, New Study Finds*, PHYS.ORG (Jan. 25, 2018), https://phys.org/news/2018-01-phosphorus-pollution-dangerous-worldwide.html [https://perma.cc/X6Y9-223M].
[37] *See* Holly Greening et al., *Ecosystem Responses to Long-Term Nutrient Management in an Urban Estuary: Tampa Bay, Florida, USA*, 151 ESTUARINE, COASTAL & SHELF SCI. A1, A1–A2 (2014).
[38] *Id.*
[39] John Hoornbeek et al., *Symposium: Watershed Based Policy Tools for Reducing Nutrient*

food chains, increased sedimentation, and depletion of dissolved oxygen known as hypoxia.[40] Seagrasses and other aquatic flora are also harmed because an overgrowth of algae reduces the ability of light to penetrate through the water and reach plants growing under the surface.[41]

Another anthropogenic harm to Florida estuaries stems from the state's long history of altering its hydrology to drain wetlands for agriculture and development by creating impoundments to control mosquito populations.[42] Decades of ditching, channelizing, and diking off areas of wetlands have significantly altered hydrology in many parts of Florida, particularly in the southern part of the state.[43] In addition to alterations resulting in diversions of freshwater flows away from estuaries, increased consumption of surface and groundwater has further reduced freshwater inputs to many estuaries in the state.[44] Where freshwater flows have been significantly reduced, salinity has increased, resulting in significant changes to natural habitats and sometimes making them inhospitable to certain fish and other species.[45] In contrast, in some areas of the state, increased channelization to drain inland wetlands, coupled with dramatic increases in land uses that rely on impervious surfaces, has led to increased freshwater flows to some estuarine areas.[46] These increased freshwater flows reduce salinity, thereby adversely affecting estuarine resources.[47]

The overexploitation of both living and nonliving resources is another major issue affecting Florida's estuarine ecosystem health.[48]

Flows to Surface Waters: Addressing Nutrient Enrichment and Harmful Algal Blooms in the United States, 29 FORDHAM ENV'T L. REV. 50, 53 (2017) (describing eutrophication from overloading of nutrients as a major factor in the development of harmful algae blooms, which produce toxic of harmful effects on humans, fish, and wildlife).

[40] *Id.* at 54.

[41] Frederick T. Short & Sandy Wyllie-Echeverria, *Natural and Human-Induced Disturbance of Seagrasses*, 23 ENV'T CONSERVATION 17, 17, 22 (1996).

[42] De Freese, *supra* note 29, at 83, 91; *Florida's Wetlands*, U.S. DEP'T AGRIC., NAT'L RES. CONSERVATION SERV. FLA., https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/fl/newsroom/features/?cid=stelprdb1252222 [https://perma.cc/27F2-35BM] (last visited Nov. 24, 2020).

[43] SOUTH FLA. WATER MGMT. DIST., FRED SKLAR ET AL., CHAPTER 2: HYDROLOGIC NEEDS: THE EFFECTS OF ALTERED HYDROLOGY ON THE EVERGLADES, EVERGLADES INTERIM REPORT 2-1, 2-1 to 2-3 (1999).

[44] Christine A. Klein et al., *Modernizing Water Law: The Example of Florida*, 61 FLA. L. REV. 403, 460–61 (2009).

[45] KARL HAVENS, CLIMATE CHANGE: EFFECTS ON SALINITY IN FLORIDA'S ESTUARIES AND RESPONSES OF OYSTERS, SEAGRASS, AND OTHER ANIMAL AND PLANT LIFE, UNIV. FLA. IFAS EXTENSION 1, 2 (2017).

[46] Jacquelyn A. Thomas, *The Failure and Future of Lake Okeechobee Water Releases: A Quasi-Governmental Solution*, 42 FLA. ST. U. L. REV. 285, 288 (2014).

[47] *Id.*

[48] Felicia C. Coleman & Christopher C. Koenig, *The Effects of Fishing, Climate Change,*

Declines in certain fish populations due to overfishing can disrupt the entire food chain.[49] For example, depletion of keystone species such as the goliath grouper can lead to explosions in the population of other species, causing significant shifts in ecosystem structure and function.[50]

Another major ecological challenge facing Florida's estuaries stems from the introduction of nonindigenous species.[51] Because nonnative species do not have natural predators in their new environment, many become invasive and cause severe harm to coastal habitats, including the extinction of native plants and animals, the reduction of biodiversity, the alteration of habitats, and increased competition with native organisms for limited resources.[52] A well-known example of a nonindigenous species being introduced to Florida's estuaries and causing major ecological consequences is the lionfish.[53] The lionfish, native to the Indo-Pacific region, was introduced to Florida's waters by people dumping unwanted lionfish into the ocean from home aquariums.[54] Because lionfish have very few predators in Florida, their populations soared, and the carnivorous fish, by feeding on juvenile commercial fish species like snapper and grouper, impacted the populations of economically important species and caused general ecosystem disruption.[55]

As with virtually every other ecosystem on earth, estuaries are experiencing the effects of climate change.[56] In fact, estuaries are particularly vulnerable to the sea level rise resulting from a warming climate.[57] Rising seas inundate shorelines and other low-lying coastal areas, including saltmarshes and mangrove swamps.[58] One of the most direct impacts of sea level rise to estuaries is "coastal squeeze," which refers to armored

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and Other Anthropogenic Disturbances on Red Grouper and Other Reef Fishes in the Gulf of Mexico, 50 INTEGRATIVE & COMP. BIOLOGY 201, 204–05, 207 (2010).

[49] *Id.*

[50] *Id.* at 204.

[51] Anna Milena Jurca, *An Unabated Nuisance: The Ecological Disaster of the Lionfish Invasion in the Atlantic*, GEO. INT'L ENV'T L. REV. ONLINE (2013).

[52] *See id.* ("Fearing no natural predators or competition for resources, feasting on a buffet of local fish, and outpacing reproduction of other species, lionfish have recently become an unabated aquatic nuisance.").

[53] *See* Connie McCarthy, *Bait and Switch: Taking Native Species on and off the List Due to Invasive Species*, 8 BARRY U. ENV'T & EARTH L.J. 95, 97 (2018).

[54] *Id.* at 100.

[55] *Id.* at 102–03.

[56] Michael J. Kennish, *Environmental Threats and Environmental Futures of Estuaries*, 29 ENV'T CONSERVATION 78, 100 (2002).

[57] *Id.*

[58] *Id.*

shorelines and other built structures blocking the ability of coastal habitat to migrate upslope as sea level rises.[59] Sea level rise is of particular concern to Florida because of its extremely low-lying coast and shorelines that stretch for more than 13,000 kilometers, as well as its porous limestone structure, which allows for underground salt water intrusion.[60] Other effects of climate change include increased tropical storm intensity and frequency, changes in precipitation patterns, and the warming of coastal waters and of coastal currents.[61] High carbon dioxide levels in the atmosphere not only contribute to a warming climate, but also lead to ocean acidification, which negatively affects calcifying oceanic organism such as corals.[62] As pH levels fall, coastal organisms will struggle to create calcium carbonate structures.[63] Loss of these organisms will cause cascading effects throughout the ecosystem.[64]

The myriad of environmental stressors, ranging from wetland destruction, hydrologic alteration, upstream agricultural and urban runoff, overfishing, pollution from boats, introduction of nonindigenous species, and rising and warming seas, demonstrates that any attempt to protect, manage, or restore estuaries must be multifaceted to take into account all of the effects of these stressors.[65] When coupled with the complexity and dynamism of estuarine ecosystems and the complex web of federal, state, and local agencies that govern various aspects of estuary health, it is clear that an integrated approach is needed.

II. MAJOR FEDERAL LAWS RELATED TO ESTUARY HEALTH

A large number of federal environmental laws, such as the ESA[66] and the regulatory programs of the CWA[67] and the CZMA,[68] have the

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[59] HINE ET AL., *supra* note 31, at 90–93.
[60] *Id.* at 83–88, 125.
[61] Massachusetts v. EPA, 549 U.S. 497, 522 (2007); Edward T. Sherwood & Holly S. Greening, *Potential Impacts and Management Implications of Climate Change on Tampa Bay Estuary Critical Coastal Habitats*, 53 ENV'T MGMT. 401, 401–02 (2013).
[62] Scott C. Doney, Victoria J. Fabry, Richard A. Feely, & Joan A. Kleypas, *Ocean Acidification: The Other CO2 Problem*, 6 WASH. J. ENV'T L. & POL'Y 212 (2016).
[63] *See id.*
[64] *Id.* at 236.
[65] *Ecological Stressors*, U.S. GEOLOGICAL SURV., https://www.usgs.gov/centers/wetland-and-aquatic-research-center-warc/science/ecological-stressors [https://perma.cc/6473-RYQF] (last visited Nov. 24, 2020).
[66] 16 U.S.C. §§ 1531–1544 (2018).
[67] 33 U.S.C. §§ 1251–1388 (2018).
[68] 16 U.S.C. §§ 1452–1466 (2018).

potential to provide some level of protection to certain estuary resources. In addition to the regulatory protections embodied in the CWA and the CZMA, both statutes establish programs explicitly aimed at estuary protection: the National Estuary Program ("NEP") of the CWA[69] and the National Estuarine Research Reserve System ("NERRS") of the CZMA,[70] which address estuary protection, management, and restoration in a more holistic and collaborative manner.

A. The Endangered Species Act

Estuaries provide habitat for a wide variety of fish and wildlife species, including many threatened and endangered species.[71] In fact, estuaries are home to dozens of federally listed threatened or endangered species.[72] For example, both the threatened West Indian Manatee and several species of threatened or endangered sea turtles inhabit Florida estuaries for at least some portion of their life cycle.[73] Accordingly, species protection laws are important components of protecting these estuary resources.

The ESA is intended to conserve and protect threatened and endangered animal and plant species and their habitats.[74] Section 7(a)(1) of the ESA imposes an obligation on federal agencies to use their existing authorities to conserve threatened and endangered species (together, "listed species").[75] To accomplish its goals, the ESA offers two primary regulatory protections. The first, found in section 9 of the ESA, is the prohibition of the "taking" of listed species.[76] The ESA broadly defines the term "take" to include "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct."[77] The term "harm" has been further interpreted by regulation and Supreme Court opinion to encompass acts that involve significant habitat modification or degradation, which actually kill or injure protected species by significantly impairing essential behavior patterns, such as breeding, feeding, or sheltering.[78]

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[69] 33 U.S.C. § 1330 (2018).
[70] 16 U.S.C. § 1461 (2018).
[71] *See* Barbier et al., *supra* note 18.
[72] De Freese, *supra* note 29, at 73.
[73] *Id.* at 77.
[74] 16 U.S.C. § 1531(b) (2018).
[75] *Id.* § 1536(a); Endangered Species Act of 1973, Pub L. No. 93-205, 87 Stat. 884, 892 (1973).
[76] 16 U.S.C. § 1538(a)(1) (2018); Pub L. No. 93-205, 87 Stat. 884, 893–95 (1973).
[77] 16 U.S.C. § 1532(19) (2018).
[78] Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or., 515 U.S. 687, 708 (1995).

Additional protection of a threatened or endangered species habitat is afforded where the habitat has been designated as "critical habitat" for that species.[79] Under section 10 of the ESA, "takes" may be authorized if the "taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" and "will not appreciably reduce the likelihood of the survival and recovery of the species in the wild."[80] A permit applicant seeking such an incidental take permit must develop a "habitat conservation plan" that minimizes and mitigates impact of the taking to the maximum extent practicable.[81]

The other ESA regulatory program is the consultation requirement set forth in section 7(a)(2) of the Act.[82] In contrast to the section 9 "take" prohibition, which applies to "any person," the consultation requirement applies only to federal agencies.[83] This section requires that federal agencies undergo a consultation process prior to undertaking action that may affect listed species to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical habitat] of such species."[84] The consultation process culminates in the issuance of a Biological Opinion ("BiOp"),[85] which includes "reasonable and prudent alternatives" ("RPAs") that if implemented would avoid jeopardy.[86] The BiOp may also include an incidental take statement ("ITS"),[87] describing actions that will not be considered a prohibited take and setting forth "reasonable and prudent measures," which must be complied with to receive coverage under the ITS.[88]

The ESA plays an important role in protecting threatened and endangered species that inhabit estuaries.[89] Nevertheless, the ESA is

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[79] 16 U.S.C. §§ 1532(5)–1533 (2018).
[80] *Id.* §§ 1539(a)(1)(B)–(2)(B)(iv).
[81] *See id.* § 1533(f); *see also* Endangered Species Act Amendments of 1982, Pub. L. No. 97-304, 96 Stat. 1411 (1982).
[82] 16 U.S.C. § 1536(a)(2) (2018).
[83] *Id.*
[84] *Id.*
[85] *What Is a Biological Opinion?*, FED. CAUCUS, https://www.salmonrecovery.gov/BiologicalOpinions.aspx [https://perma.cc/NUF3-C4NY] (last visited Nov. 24, 2020).
[86] 16 U.S.C. § 1536(b)(3) (2018); 50 C.F.R. § 402.14(g)(5)–(8), (h), (m) (2020).
[87] *ESA Implementation Overview*, U.S. FISH & WILDLIFE SERV., https://www.fws.gov/endangered/improving_ESA/index.html [https://perma.cc/8EAY-RWRF] (last updated Oct. 14, 2020).
[88] 16 U.S.C. § 1536(b)(4)(i)–(ii) (2018); 50 C.F.R. § 402.14(i) (2020).
[89] *See* Patrick Parenteau, *Rearranging the Deck Chairs: Endangered Species Act Reforms in*

extremely limited in its ability to protect estuary resources as a whole.[90] Most significantly, the ESA operates on a species-by-species basis and does not address estuary ecosystems in a holistic manner.[91] Unless a particular human activity results in an actual "take" of a listed estuary species or its critical habitat, section 9 is of little utility in protecting estuary resources.[92] Similarly, section 7 only applies to federal agency actions that may affect a listed species, and ultimately all that is required is engagement in a consultation process.[93] Accordingly, most human activities that degrade water quality or alter hydrology in ways that may have profound effects on the estuary ecosystem as a whole are beyond the reach of the ESA.[94] Thus, while the ESA remains an important tool in protecting imperiled species, it is not, in itself, particularly useful in addressing the broad range of human activities that result in the multifaceted problems affecting ecosystem health.

B. The Coastal Zone Management Act

The CZMA[95] has a direct bearing on estuary restoration, management, and protection. The stated purpose of the CZMA is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone for this and succeeding generations."[96] The CZMA is comprised of three programs. The National Coastal Zone Management Program empowers states to ensure that federal actions are consistent with a state's federally approved program.[97] The Coastal and Estuarine Land Conservation Program ("CELCP")[98] provides matching funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements.[99]

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an Era of Mass Extinction, 22 WM. & MARY. ENV'T L. & POL'Y REV. 227, 274–75 (1998) (discussing the success of the ESA in recovering the Whooping Crane and American Alligator).
[90] *Id.* at 279.
[91] *Id.*
[92] 16 U.S.C. § 1538(a) (2018).
[93] *Id.* § 1536(a).
[94] *See* Fredrico Cheever, *The Road to Recovery: A New Way of Thinking About the Endangered Species Act*, 23 ECOLOGY L.Q. 1, 12–13 (1996) (discussing the "one-threat" approach to ESA jurisprudence).
[95] 16 U.S.C. §§ 1451–1464 (2018).
[96] *Id.* § 1452(1).
[97] *Id.* § 1456(c); 15 C.F.R. § 930.1 (2020).
[98] *The Coastal and Estuarine Land Conservation Program*, NOAA, OFF. COASTAL MGMT., https://coast.noaa.gov/czm/landconservation/ [https://perma.cc/RA8Q-9VKS] (last visited Nov. 24, 2020).
[99] 16 U.S.C. § 1456(d) (2018).

Of particular significance to estuary protection, management, and restoration is the CZMA's third program, the National Estuarine Research Reserve System ("NERRS").[100] This system is in some respects similar to the CWA's NEP, discussed in more detail below, but with some significant differences.[101] NERRS represents a partnership between the National Oceanic and Atmospheric Administration ("NOAA"),[102] coastal states, state agencies, nonprofit groups, universities, and members of the local community.[103] The CZMA established the "Reserve System" to help address the growing problem of coastal resource degradation and the lack of scientific understanding regarding estuarine processes.[104] Prior to the creation of NERRS, there was little national coordination and no mechanisms in place to detect trends in estuarine conditions, or to provide information about these trends and possible solutions to the increasing problems.[105] Currently, the reserve system protects more than 1,300,000 acres of estuarine habitat and dedicates that land to long-term research, education, training, water-quality monitoring, and coastal stewardship.[106]

NERRS has five primary goals. The first is to "ensure a stable environment for research through long-term protection of Reserve System resources."[107] The second is to "address coastal management issues identified as significant through coordinated estuarine research within the System."[108] The third goal is to "enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation."[109] The fourth goal is to "promote federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research."[110] The final goal is to "conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding

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[100] *Id.* § 1461.
[101] Ryan P. Kelly & Margaret R. Caldwell, *Ten Ways States Can Combat Ocean Acidification (and Why They Should)*, 6 WASH. J. ENV'T L. & POL'Y 287, 331–32 (2016).
[102] *About Our Agency*, NOAA, https://www.noaa.gov/about-our-agency [https://perma.cc/3YV3-TZVV] (last visited Nov. 24, 2020).
[103] Kelly & Caldwell, *supra* note 101, at 332–33.
[104] *Id. See also* 16 U.S.C. § 1461(b)(2) (2018).
[105] U.S. DEP'T INTERIOR, THE NATIONAL ESTUARINE POLLUTION STUDY 4, 8, 19–20 (1970).
[106] *NERRS Overview*, NOAA, https://coast.noaa.gov/nerrs/about/ [https://perma.cc/F9P9-85RH] (last visited Nov. 24, 2020). *See also* 15 C.F.R. § 921.1 (2020).
[107] 15 C.F.R. § 921.1 (2020).
[108] *Id.*
[109] *Id.*
[110] *Id.*

and management of estuarine areas."[111] Guided by these goals, the Reserve System provides for research, education, and resource stewardship programs, which serve as tools to help fill gaps in knowledge and guide decision-making so that the nation's estuaries can continue to be productive ecosystems in the future.[112] To accomplish the Reserve System's goals, NOAA provides funding,[113] coordination, national guidance for program implementation, and technical assistance, while each site is managed by a lead state agency or university with input from local partners.[114] Coastal states are responsible for managing reserve resources and staff, providing matching funds, and implementing local programs.[115]

As part of the Reserve System, individual reserves themselves are charged with stewardship, research, training, and education.[116] Each reserve must implement initiatives designed to improve and sustain the environmental health of the estuary.[117] The research conducted and data recorded by each reserve aids conservation and management efforts both locally and on a national level.[118] The training programs implemented at the reserves allow for local and state offices to be better informed with local data when participating in the decision-making process.[119] Finally, the reserves act as hands-on laboratories, allowing students to become better informed and connected to their local environment.[120]

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[111] *Id.*
[112] Kelly & Caldwell, *supra* note 101, at 332.
[113] Federal funds are available for pre-designation activities, such as site selection, document drafting, composing environmental impact statements, and basic characterization studies. 15 C.F.R. §§ 921.1(f), 921.10(a) (2020) (Additionally, each designated reserve is eligible for up to a total of $5 million of Federal funding for land acquisition). Federal funding is also available for the management and operation of each reserve as well as the construction of facilities, and the development of educational activities. *Id.* States and even private individuals may also receive federal funding for their efforts that support research and monitoring within a reserve. *Id.*
[114] *Id.* §§ 921.2(d), 921.10(b), 921.13, 921.32; Donald C. Baur, W. Robert Irvin, & Darren R. Misenko, *Putting "Protection" into Marine Protected Areas*, 28 VT. L. REV. 497, 513 (2004).
[115] 15 C.F.R. §§ 921.2(d), 921.10, 921.13, 921.32 (2020).
[116] Kelly & Caldwell, *supra* note 101, at 332.
[117] 15 C.F.R. § 921.1(b)(1) (2020).
[118] Michael J. Kennish, *NERRS Research and Monitoring Initiatives*., 45 J. COASTAL RSCH. 1, 2, 5 (2009).
[119] GINGER HINCHCLIFF, NOAA, OFF. OCEAN & COASTAL RES. MGMT., COASTAL DECISION-MAKERS TRAINING: A SUMMARY DOCUMENT OF WORKSHOPS SPONSORED BY THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM AND THE COASTAL MANAGEMENT PROGRAMS, 1994–1996 (1997).
[120] *See* David M. Burdick, *'How To' Guide for Synthesizing NERRs Marsh Monitoring Data*, UNIV. N.H. (2020) ("Reserves serve as 'living laboratories', providing long-term

An important aspect of the NERRS system is the information network created between reserves.[121] One of the main purposes behind the Reserve System is to ensure stable long-term research and address management issues through coordinated estuarine research.[122] The Reserve System accomplishes these goals by providing a framework by which management approaches, research results, and techniques for estuarine education and interpretation can be circulated and shared with other programs across the country.[123] One way in which the Reserve System collects and shares this information is through the System Wide Monitoring program.[124] Established in 1995, the program collects data regarding water quality, habitat changes, and weather conditions.[125] Programs like this facilitate information exchange not only between reserves but also between federal, state and local agencies.[126] While the NERRS program provides crucial infrastructure for research, education, and information sharing,[127] it is not designed to provide for the comprehensive protection, management, and restoration of estuaries.

C. The Clean Water Act

The Clean Water Act ("CWA") is the primary federal statute designed to protect the quality of the nation's waters.[128] The CWA has been credited with significantly improving water quality from point sources of water pollution.[129] Unfortunately, due to limited authority in the CWA to address nonpoint sources of pollution, many of the nation's waterbodies, including many estuaries, lack good water quality.[130] A major environmental challenge to estuary health is high nutrient levels due in

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monitoring data of water quality and habitats as well as research opportunities to professionals and students.").

[121] *Id.*

[122] 16 U.S.C. § 1461(d) (2018).

[123] 15 C.F.R. § 921.52 (2020). *See also* Burdick, *supra* note 120.

[124] *See generally* NOAA, NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM 10TH ANNIVERSARY REPORT ON THE SYSTEM-WIDE MONITORING PROGRAM (SWMP) DATA APPLICATIONS: 1995–2005 (Beth Owens & Susan White eds., 2005).

[125] *Id.* at 2–17.

[126] *Id.*

[127] *About the NERRS*, NAT'L ESTUARINE RSCH. RSRV. ASS'N, https://www.nerra.org/about-the-nerrs/ [https://perma.cc/99RB-P547] (last visited Nov. 24, 2020).

[128] U.S. GOV'T ACCOUNTABILITY OFF., GAO-10-165T, CLEAN WATER ACT, LONGSTANDING ISSUES IMPACT EPA'S AND STATES' ENFORCEMENT EFFORTS 1 (2009).

[129] *Id.*

[130] David Zaring, *Agriculture, Nonpoint Source Pollution, and Regulatory Control: The Clean Water Act's Bleak Present and Future*, 20 HARV. ENV'T L. REV. 515, 517–21 (1996).

large part to agricultural and urban/suburban nonpoint source runoff.[131] These nonpoint source discharges of pollution are not directly regulated under the CWA.[132]

The most comprehensive regulatory program in the CWA is the National Pollutant Discharge Elimination System ("NDPES") permitting program found in section 402 of the Act.[133] The CWA prohibits "the discharge of any pollutant" to navigable waters from point sources unless the discharge is in accordance with an NPDES permit under section 402.[134] Most agricultural and urban/suburban runoff is not considered to be a point source under the CWA[135] and thus, is not regulated under the NPDES program. While the CWA does not provide for any direct regulation of nonpoint source pollution, it does mandate that states adopt water quality standards that inform state-based nonpoint source regulatory programs.[136] Accordingly, while the CWA's NPDES program has utility in regulating point sources, such as industrial or sewage treatment facilities, that discharge pollutants directly into estuaries or waterbodies that ultimately feed into estuaries, it has limited utility in addressing many of the agricultural and urban/suburban stormwater water pollutant contributions that comprise the bulk of many estuary impacts.[137]

The second major regulatory program in the CWA is found in section 404 and is designed to reduce and mitigate impacts to the nations wetlands, which includes salt marshes, mangrove swamps, and other wetlands that comprise estuary systems.[138] Section 404 specifically regulates the discharge of dredged or fill material into "waters of the United States," a term which includes wetlands adjacent to navigable waters.[139]

The CWA requires each state to establish water quality standards ("WQS"), comprised of designated uses and water quality criteria, for

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[131] *Id.* at 518.
[132] *Id.* at 521.
[133] Federal Water Pollution Control Act *amended by* The Clean Water Act of 1972, Pub. L. No. 92-500, § 402, 86 Stat. 816, 880 (1972); 33 U.S.C. § 1342 (2018).
[134] Pub. L. No. 92-500, § 301, 86 Stat. 816, 845–46 (1972); 33 U.S.C. § 1311 (a), (b) (2018).
[135] Pub. L. No. 92-500, § 502(14), 86 Stat. 816, 887; 33 U.S.C. § 1362(14) (2018).
[136] 33 U.S.C. § 1313 (2018).
[137] *See* Zaring, *supra* note 130, at 521–28.
[138] Pub. L. No. 92-500, § 404, 86 Stat. 816, 884; 33 U.S.C. § 1344 (2018).
[139] The exact parameters of wetlands jurisdiction under the federal CWA are in flux due to a series of recent regulatory amendments. Most recently, the Trump administration proposed an amendment to existing regulations that protected certain wetlands and intermittent streams. Coral Davenport, *Trump Removes Pollution Controls on Streams and Wetlands*, N.Y. TIMES (Jan. 22, 2020), https://www.nytimes.com/2020/01/22/climate/trump-environment-water.html [https://perma.cc/88QY-ASA2].

each water body within its jurisdiction.[140] Water quality criteria for particular pollutants are established to protect the designated uses (e.g., drinking water, shellfish harvesting, fishing and swimming) established for the particular water body.[141] Frequently, water quality criteria are expressed numerically (e.g., a concentration limitation for a particular pollutant necessary to ensure the waterbody is "clean" enough for its designated use).[142] Nevertheless, for nutrient pollutants, in particular, many states have adopted narrative criteria, which merely describe in non-numeric terms the types of environmental impacts to be avoided, such as algae blooms.[143]

In addition to requiring the establishment of WQS, the CWA requires each state to identify the waterbodies not meeting WQS and to establish for them total maximum daily loads ("TMDLs").[144] The TMDL is to be set at "a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."[145] TMDLs are the means by which water quality criteria can be translated into pollution limitations under state regulatory programs or pollutant reduction goals under nonregulatory programs.[146] Significantly, TMDLs must include both point source and nonpoint source discharges.[147]

Florida has developed a comprehensive program for the implementation of TMDLs.[148] Once TMDLs for a particular waterbody are established, Florida implements them through Basin Management Action Plans ("BMAPs").[149] BMAPs act as a blueprint for restoring impaired

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[140] 33 U.S.C. § 1313 (2018).
[141] *Id.* § 1251(a)(2); Upper Mo. Waterkeeper v. EPA, 377 F. Supp. 3d 1156, 1161 (D. Mont. 2019).
[142] 33 U.S.C. § 1313(c)(2) (2018); Anacostia Riverkeeper, Inc. v. Wheeler, 404 F. Supp. 3d 160, 186 (D.D.C. 2019).
[143] *See, e.g.*, PUD No. 1 of Jefferson Cnty. v. Washington Dep't of Ecology, 511 U.S. 700, 701 (1994) ("Moreover, the Act permits enforcement of broad, narrative criteria based on, for example, 'aesthetics.'").
[144] 33 U.S.C. § 1313(d) (2018); 40 C.F.R. § 130.7 (2020).
[145] 33 U.S.C. § 1313(d)(1)(c) (2018).
[146] Melissa Thorme, *Clean Water Act Section 305(b): A Potential Vehicle for Incorporating Economics into the "TMDL" and Water Quality Standards-Setting Processes*, 13 TUL. ENV'T L.J. 71, 72, 83 (1999).
[147] *See* Pronsolino v. Nastri, 291 F.3d 1123, 1132–33 (9th Cir. 2002).
[148] *See* FLA. STAT. § 403.067 (2020); *see also* Douglas H. MacLaughlin, *Will Basin Management Action Plans Restore Florida's Impaired Waters?*, 89 FLA. B.J. 31 (2015).
[149] FLA. STAT. § 403.067(7) (2020).

waters by reducing pollution to meet the established TMDL.[150] BMAPs are developed by the Department of Environmental Protection ("DEP")[151] staff with extensive local stakeholder participation and input.[152] Other state agencies such as the Water Management Districts, Department of Transportation, Department of Health, and Department of Agriculture and Consumer Services are typically involved in the development.[153] BMAPs include a range of regulatory and nonregulatory approaches geared toward meeting TMDLs in a particular watershed.[154] They typically include a combination of regulatory permit limits on wastewater facilities, voluntary best management practices, educational programs, and other practices which help to reduce discharges of water pollutants.[155]

Perhaps the most salient program in the CWA related to estuary protection, management, and restoration is the National Estuary Program ("NEP").[156] Added to the CWA in 1987, the NEP is a non-regulatory, collaborative, and place-based program designed to protect and restore the water quality and ecological integrity of estuaries of national significance.[157] Although created by federal statute and operated with oversight, guidance, technical assistance, and funding from the U.S. Environmental Protection Agency ("EPA"),[158] the NEP envisions a major role for state and local governments, universities, business interests, non-governmental organizations, and other stakeholders in the region.[159]

The governor of any State may nominate any in-state estuary as an "estuary of national significance" to be included in the NEP, thus calling for a management conference to develop a comprehensive management plan for the estuary.[160] The EPA determines which nominees warrant entry into the NEP.[161] Twenty eight estuaries currently are part of the NEP.[162] An individual NEP is set up for each of the designated

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[150] MacLaughlin, *supra* note 148, at 31.
[151] *About DEP*, FLA. DEP'T ENV'T PROT., https://floridadep.gov/about-dep [https://perma.cc/HXK6-Q4DF] (last visited Nov. 24, 2020).
[152] FLA. STAT. § 403.067(7)(a)3. (2020).
[153] *Id.* §§ 403.067(7)(a)(3)–(9)(b).
[154] MacLaughlin, *supra* note 148, at 31.
[155] *Id.*
[156] Water Quality Act of 1987, Pub. L. No. 100-4 §§ 317, 320, 101 Stat. 7 (1987); 33 U.S.C. § 1330 (2018).
[157] *Id.*
[158] *Id.*
[159] 33 U.S.C. § 1330(c) (2018).
[160] Pub. L. No. 100-4 § 320(a)(1); 33 U.S.C. § 1330(a)(1) (2018).
[161] 33 U.S.C. § 1330(a)(1) (2018).
[162] The location of the 28 NEPs are as follows: Albemarle-Pamlico NEP in North Carolina;

estuaries, encompassing the estuary itself as well as the surrounding watersheds.[163] Additionally, each NEP forms a "Management Conference"[164] comprised of the EPA Administrator, state representatives, local government representatives, federal agency representatives, and members of affected industry and the general public to develop a Comprehensive Conservation and Management Plan ("CCMP") for that estuary.[165] A CCMP must address water quality, living resources challenges, and priorities set by local, city, state, federal, private, and nonprofit stakeholders.[166]

Moreover, section 320 authorizes EPA to provide cost share grants to fund, develop, and implement CCMPs while also requiring EPA to report to Congress at least every two years regarding the state of the health of the Nation's estuaries, a description of the pollution problems facing these estuaries, an evaluation of the management measures already employed, and a list of high priority monitoring and research needs.[167]

An important aspect of the NEP is its facilitation of collaboration between multiple federal, state, and local agencies, as well as a broad range of private stakeholders, to identify and prioritize the challenges facing an estuary.[168] EPA serves as a conduit for information exchange among individual NEPs by sharing the experiences and management

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Barataria-Terrebonne NEP in Louisiana; Barnegat Bay Partnership in New Jersey; Buzzards Bay NEP in Massachusetts; Casco Bay Estuary Partnership in Maine; Charlotte Harbor NEP in Florida; Coastal Bend Bays and Estuaries Program in Texas; Delaware Center for the Inland Bays in Delaware; Galveston Bay Estuary Program in Texas; Indian River Lagoon NEP in Florida; Long Island Sound Study in New York and Connecticut; Lower Columbia Estuary Partnership in Oregon; Maryland Coastal Bays Program in Maryland; Massachusetts Bay NEP in Massachusetts; Mobile Bay NEP in Alabama; Morro Bay NEP in California; Narragansett Bay Estuary Program in Rhode Island; New York–New Jersey Harbor Estuary Program in New York and New Jersey; Partnership for the Delaware Estuary in Delaware; Peconic Estuary Program in New York; Piscataqua Region Estuaries Partnership in New Hampshire; Puget Sound Partnership in Washington; San Francisco Estuary Partnership in California; San Juan Bay Estuary Partnership in Puerto Rico; Santa Monica Bay Restoration Foundation in California; Sarasota Bay Estuary Program in Florida; Tampa Bay Estuary Program in Florida; and Tillamook Estuaries Partnership in Oregon. Links to each of the individual NEPs' websites can be found at: https://www.epa.gov/nep/local-estuary-programs#tab-1 [https://perma.cc/TC53-XLVX]. *Local Estuary Programs*, EPA, https://www.epa.gov/nep/local-estuary-programs#tab-1 [https://perma.cc/TC53-XLVX] (last visited Nov. 24, 2020).

[163] Matthew W. Bowden, *An Overview of the National Estuary Program*, 11 NAT. RES. & ENV'T 35, 35 (1996).

[164] *Id.*

[165] Pub. L. No. 100-4 § 320(a)(1), (b)(4); 33 U.S.C. § 1330(a)(1), (b)(4) (2018).

[166] 33 U.S.C. §§ 1330(b)(4)–(b)(5) (2018).

[167] Pub. L. No. 100-4 § 320(j)(2)(A)–(D); *Id.* at § 1330(j)(2)(A)–(D).

[168] Bowden, *supra* note 163, at 36.

lessons learned by each program.[169] The formation of collaborative partnerships and circulation of information are considered to be some of the most powerful aspects of the NEP.[170]

Measuring the success of a nationwide program like NEP is a challenging task. Each of the twenty eight individual NEPs have their own goals and face their own unique challenges.[171] EPA's approach to measuring NEP success is to evaluate the extent to which each NEP achieves the goals identified in EPA's Strategic Plan.[172] The NEP target set by EPA's most recent Strategic Plan was the protection or restoration of an additional 600,000 acres of habitat within the study areas for the twenty-eight NEPs by 2015.[173] The total acreage protected or restored by the NEP from 2010 through 2014 was 561,114.8 acres, just shy of the 600,000 acre goal.[174] Since 2000, however, the NEPs combined have protected or restored over 2,000,000 acres.[175]

III. INTEGRATED ESTUARY GOVERNANCE

Integrated Estuary Governance represents a merging of several developments in environmental law and policy theory that emerged at roughly the same time with many shared themes, overlapping strategies, and goals. These include the concepts of ecosystem management, collaborative governance, integrated watershed management, and adaptive management and law.[176]

A. Ecosystem Management

During the 1990s, scholars were focused on the need to transition to a new model of environmental management that took into account the complexities, interrelationships, and dynamic nature of ecosystems.[177]

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[169] *Id.*
[170] *Id.* at 5.
[171] *See id.* at 37 ("[E]ach estuary in the NEP has its own specific combination of problems[.]").
[172] *National Results from the National Estuary Program*, EPA, https://www.epa.gov/nep/national-results-national-estuary-program [https://perma.cc/K6KT-RDSJ] (last visited Nov. 24, 2020).
[173] EPA, FISCAL YEAR 2011–2015 EPA STRATEGIC PLAN ACHIEVING OUR VISION 47 (2010).
[174] *National Results from the National Estuary Program*, *supra* note 172.
[175] *Id.*
[176] *See generally* Kofi Akamani, *Adaptive Water Governance: Integrating the Human Dimension into Water Resource Governance*, 158 J. CONTEMP. WATER RES. & EDUC. 2 (2016).
[177] 65 DARRYLL R. JOHNSON & JAMES K. AGEE, *Introduction to Ecosystem Management,* ECOSYSTEM MGMT. FOR PARKS & WILDERNESS 3–13 (1988).

Scholars advocated for an "ecosystem management" approach that could address environmental concerns at the ecosystem scale and that addressed a wide range of issues affecting the ecosystem rather than singularly focusing on individual resources or species or specific environmental pollutants or disturbances.[178] A hallmark of ecosystem management is its focus on the whole ecosystem rather than its component parts or limited geographic regions based on political boundaries or other considerations.[179] Another fundamental aspect of ecosystem management is that it rejects previously held beliefs that nature was static and "in balance," and instead incorporates more recent scientific thinking that acknowledges the complexity and dynamic nature of natural systems.[180] Professor Bradley Karkkainen has summed this up as follows: "[g]iven the complex interdependencies of ecosystem components and processes they must be managed as systems, employing an integrated, holistic, 'place-based, ecosystem-specific management approach."[181]

Although its roots can be traced back to the 1930s,[182] it was not until the 1990s that ecosystem management gained significant traction in both the academic and policy realms.[183] In its simplest form, ecosystem management can be seen as a shift away from a single species or single resource approach towards a whole systems common multispecies management approach.[184] While this is certainly part of ecosystem management, the concept also embodies a number of other important elements. In one of the most widely cited publications on ecosystem management, *What is Ecosystem Management*, R. Edward Grumbine tracks the history of the development of ecosystem management.[185] He concludes that the dominant theme that emerges from the existing literature is the need for

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[178] *Id.*
[179] *Id.* at 7.
[180] Annecoos Wiersema, *A Train Without Tracks: Rethinking the Place of Law and Goals in Environmental and Natural Resources Law*, 38 ENV'T L. 1239, 1246–48 (2008).
[181] Bradley Karkkainen, *Marine Ecosystem Management & A "Post-Sovereign" Transboundary Governance*, 6 SAN DIEGO INT'L L. J. 113, 122 (2004); *see also* ROBIN K. CRAIG, COMPARATIVE OCEAN GOVERNANCE: PLACE-BASED PROTECTIONS IN AN ERA OF CLIMATE CHANGE (2012) (making the case for place-based approaches to ocean governance).
[182] R. E. Grumbine, *What Is Ecosystem Management*, 8 CONSERVATION BIOLOGY 27 (1994).
[183] *Id.* For further discussion of how legal scholars have argued that ecosystem management should play an integral role in environmental law and policy, *see generally* THE LAWS OF NATURE: REFLECTIONS ON THE EVOLUTION OF ECOSYSTEM MANAGEMENT LAW & POLICY (2013); JOHN C. NAGEL & J.B. RUHL, THE LAW OF BIODIVERSITY AND ECOSYSTEM MANAGEMENT (2002); A. D. Tarlock, *The Nonequilibrium Paradigm in Ecology and the Partial Unraveling of Environmental Law*, 27 LOY. L.A. L. REV. (1994).
[184] Grumbine, *supra* note 182, at 27.
[185] *Id.*

a "systems-based" approach that addresses the connections between all hierarchical levels (genes, species, populations, ecosystems, landscapes) rather than focusing on any one particular level of the "biodiversity hierarchy."[186] The second, which Grumbine refers to as "ecological boundaries," highlights the need to work across administrative and political boundaries.[187] Here, he gives the example of addressing grizzly bear management based on the bear's actual distribution and habitat needs, rather than limiting its management to the federally owned Yellowstone National Park.[188] The third feature he identifies is a need to manage for "ecological integrity," which includes protecting all native diversity as well as the patterns and processes that maintain it.[189] The next two features identified stress the need for both research and data collection to support ecosystem management efforts as well as ongoing monitoring to track the successes and failures of management in a quantitative manner.[190] The sixth feature, "Adaptive Management," "assumes that scientific knowledge is provisional and focuses management as a learning process or continuous experiment where incorporating the results of previous actions allows managers to remain flexible and to adapt to uncertainty."[191] Recognizing that ecological boundaries can span multiple local, state, and federal jurisdictions, the seventh feature stresses the need for cooperation among governmental units, as well as private parties.[192] The eighth feature focuses on the need for changes in the structure of management agencies and the way they operate, which could include simple structural changes such as forming interagency committees.[193] The final two features recognize that humans cannot be separated from nature and that, regardless of science, human values will play an integral role in ecosystem management.[194]

After describing the ten key features of ecosystem management, Grumbine goes on to develop a working definition of ecosystem management that incorporates these ten dominant themes: "ecosystem management integrates scientific knowledge of ecological relationships within a complex socio-political and values framework toward the general goal of

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[186] *Id.* at 29.
[187] *Id.* at 29–30.
[188] *Id.* at 30.
[189] *Id.* at 30–31.
[190] Grumbine, *supra* note 182, at 31.
[191] *Id.*
[192] *Id.*
[193] *Id.*
[194] *Id.*

protecting native ecosystem integrity over the long term."[195] In this seminal work, Grumbine also stresses the critical roles that scientists, policymakers, managers, and citizens must play in implementing ecosystem management and describes the importance of cooperation among these four groups of actors.[196] Although Grumbine's 1994 definition remains viable, it has been refined over the years.[197] For example, a more recent definition in the coastal and marine realm defines "ecosystem-based management" as "an integrated, place-based management approach that focuses on maintaining the integrity or enhancing the resilience of an entire ecosystem, including its structure, functioning processes, and dynamics"[198] and stresses the that the approach is adaptive and "engages multiple stakeholders in a collaborative process to define problems and find solutions."[199]

Ecosystem management has been promoted or applied in virtually every ecosystem type, including coastal and estuarine systems.[200] Despite the widespread promotion of the idea, evidence of the success of ecosystem management is hard to come by,[201] and there have been ongoing debates over the exact parameters of ecosystem management and its usefulness to protect and restore the natural environment.[202] Nevertheless,

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[195] *Id.*

[196] Grumbine, *supra* note 182, at 32–34.

[197] *See, e.g.*, Porter Hoagland, *A (Social) Scientific Look at Ecosystem-Based Management*, 15 OCEAN & COASTAL L.J. 167, 167–68 (2010) (citing ECOSYSTEM-BASED MANAGEMENT FOR THE OCEANS (2009)); *see also* Andrew A. Rosenberg, *Regional Governance and Ecosystem-Based Management of Ocean and Coastal Resources: Can We Get There from Here?*, 16 DUKE ENV'T L. & POL'Y F. 179 (2006) (arguing in favor of an ecosystem-based management approach for ocean and coastal resources).

[198] Hoagland, *supra* note 197.

[199] *Id.*

[200] *See, e.g.*, *id.* at 168–69.

[201] *See, e.g.*, *id.* (describing the maturation of ecosystem management and its spread, including into marine and coastal environments); *see also* J.B. Ruhl, *Ecosystem Management, The ESA, and the Seven Degrees of Relevance*, 14 NAT. RES. & ENV'T 156, 156 (2000) (concluding that "I can't find much law for ecosystem management.").

[202] One well-known debate is recorded in the following series of publications: J.B. Ruhl, *The Myth of What is Inevitable Under Ecosystem Management: A Response to Pardy*, 21 PACE ENV'T L. REV. 315 (2004), Bruce Pardy, *Ecosystem Management in Question: A Reply to Ruhl*, 23 PACE ENV'T L. REV. 209 (2005–06), J.B. Ruhl, *The Pardy-Ruhl Dialogue On Ecosystem Management, Part IV: Narrowing and Sharpening the Questions,* 24 PACE ENV'T L. REV. 25 (2007), Bruce Pardy, *The Pardy-Ruhl Dialogue On Ecosystem Management Part V: Discretion, Complex-Adaptive Problem Solving and the Rule of Law*, 25 PACE ENV'T L. REV. 341 (2008); *see also* Wiersema, *supra* note 180 (arguing that, while the

ecosystem management continues to be an important concept in the scientific and policy realms.

B. Integrated Water Resources Management

A relative of ecosystem management, "Integrated Water Resources Management" ("IWRM") is an approach that seeks to coordinate the management of water resources taking into account economic, social welfare, and environmental sustainability.[203] Scholars and policymakers have long recognized the need for a more integrated approach to water management, not just for estuary management, but for all watersheds.[204] Scholars have criticized water management in the U.S. as suffering from two forms of fragmentation.[205] First, in many locales, a jumble of federal, state, and local government agencies handle different aspects of water management, frequently in a piecemeal fashion that creates gaps and overlaps in coverage.[206] Second, water management suffers from "geographic fragmentation with watersheds and water basins divided among multiple [governmental jurisdictions]."[207] In some cases, these watershed boundaries divide cities or counties. One of the hallmarks of IWRM is that it is implemented at the watershed scale and is not limited by political boundaries.[208] Watersheds typically span multiple political jurisdictions, frequently crossing local government, state, and even national borders.[209] IWRM recognizes that watersheds are multi-jurisdictional and that therefore meaningful attempts to manage water resources must occur at the watershed scale.[210]

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principles of ecosystem management and the science of ecosystem complexity and dynamism can play an important role in effective environmental protection, they must be supplemented with substantive environmental law goals).

[203] Asit K. Biswas, *Integrated Water Resource Management: Is it Working?*, 24 INT'L J. WATER RES. & DEV. 5, 7 (2008).

[204] *See generally* Jon Cannon, *Choices and Institutions in Watershed Management*, 25 WM. & MARY. ENV'T L. & POL'Y REV. 379, 379–81 (2000).

[205] *Id.* at 387–89.

[206] *Id.*; *see also* Barton H. Thompson, Jr., *A Federal Act to Promote Integrated Water Management: Is the CZMA a Useful Model?*, 42 ENV'T L. 201, 201–02 (2012).

[207] *Id.*

[208] Bruce Mitchell, *Integrated Water Resource Management, Institutional Arrangements, and Land Use Planning*, 37 ENV'T & PLAN. 1335, 1348 (2005).

[209] *Id.* at 1340–41.

[210] David A. Strifling, *Integrated Water Resources Management and Effective Intergovernmental Cooperation on Watershed Issues*, 70 MERCER L. REV. 399, 399 (2019). Even outside of the IWRM framework, many scholars have argued in favor of watershed-based

Industry experts have long understood that the appropriate scale for water resources management is at the watershed or ecosystem level.[211] In fact, the state of Florida was one of the early adopters of a watershed-based approach to water management when, in 1972, it enacted the Florida Water Resources Act.[212] This allocated both regulatory and nonregulatory water management authority among five regional water management districts, each representing a major watershed of the state.[213] As far back as 1998, EPA adopted a watershed approach in its Clean Water Action Plan.[214] More recently, EPA, together with a number of state and federal partners, developed the Healthy Watersheds Initiative.[215] This initiative "acknowledges that our waters and aquatic ecosystems are dynamic systems that are interconnected in the landscape."[216] Organizations including the U.S. Army Corps of Engineers ("ACOE"),[217] the EPA, and the American Water Resources Association ("AWRA") have all acknowledged the benefits of watershed scale approaches.[218]

IWRM seeks to address a number of shortcomings associated with traditional centralized command and control political boundary-based approaches. These shortcomings include: 1) fragmented decision-making and planning; 2) inconsistencies among different agencies or government units; 3) duplication of resources and effort efficiency; 4) dispersed governmental capacity; and 5) lack of private stakeholder contribution.[219] In addition to adopting the watershed as the appropriate scale for water management, IWRM recognizes the need for a multidisciplinary approach that consciously includes all private and public stakeholders in planning

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management. *See generally* Keith H. Hirokawa, *Driving Local Governments to Watershed Governance*, 42 ENV'T L. 157, 157 (2012) (promoting a watershed planning and management approach for local governments); Craig A. Arnold, *Adaptive Watershed Planning and Climate Change*, 5 ENV'T & ENERGY L. & POL'Y J. 417, 419–20 (2010) (demonstrating how climate change warrants and ecosystem management watershed management based approach); J.B. Ruhl et al., *Proposal for a Model State Watershed Management Act*, 33 ENV'T L. 929, 929 (2003) (arguing that the watershed is the appropriate unit of governance for water management efforts).

[211] Strifling, *supra* note 210, at 399, 404–05.

[212] Florida Water Resource Act of 1972, FLA. STAT. §§ 373.013–.813 (2020).

[213] FLA. STAT. § 373.069 (2020).

[214] Cannon, *supra* note 204, at 380.

[215] EPA, OFFICE OF WATER, HEALTHY WATERSHEDS INITIATIVE: NATIONAL FRAMEWORK AND ACTION PLAN (2011).

[216] *Id.* at v.

[217] ENV'T L. INST. & NATURE CONSERVANCY, WATERSHED APPROACH HANDBOOK (2014).

[218] Strifling, *supra* note 210, at 406–08.

[219] *Id.* at 405.

and decision-making.[220] In 1999, The National Research Council of the National Academies published a report entitled *New Strategies for America's Watersheds*, which among other things, highlighted the importance of broad stakeholder engagement, collaborative approaches, and intergovernmental agreements in carrying out effective watershed management.[221] Others have noted additional factors that are necessary for successful IWRM: collaboration; research and innovation; coalition building; communication; the ability to identify needed regulatory reforms; and the need for ongoing monitoring.[222]

Professor Barton Thompson proposed a new statute, the Sustainable Water Integrated Water Management ("SWIM") Act,[223] which would incorporate a version of IWRM. The proposed SWIM Act seeks to address several forms of fragmentation that exist in current water management (e.g., different governmental agencies responsible for surface water versus groundwater, water quality versus water quantity, water management versus land use planning, and geographic fragmentation) and seeks to tackle water management in a holistic, integrated fashion.[224] One issue that Thompson seeks to tackle is whether the watershed is the appropriate scale at which the SWIM Act should operate.[225] Recognizing that watersheds are "nested" (i.e., many small watersheds are nested within larger watersheds) and that managing large numbers of small watersheds could be unruly and resource intensive, Thompson rejects a one-size-fits-all approach in favor of a rebuttable presumption in favor of the watershed, while granting discretion to the states to determine the appropriate scale based on an area's ability to promote improved water management.[226]

Despite the widespread acknowledged benefits of IWRM, it has been slow to be put into practice. According to Strifling, the reasons for

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[220] *See* Anthony Perko, Note, *Watershed Management: A Comparison Between Efforts in the United States and the European Union*, 16 UNIV. DENV. WATER L. REV. 166, 169 (2012) (describing the 1992 International Conference on Water and the Environment's focus on a participatory approach as a key tenet of water management); *see also* Sean T. McAllister, *The Confluence of a River and a Community: An Experiment with Community-Based Watershed Management in Southwest Colorado*, 3 UNIV. DENV. WATER L. REV. 287, 305–06 (2000) (providing support for the argument that conservation efforts are more effective when they have the buy-in of affected citizens).

[221] Cannon, *supra* note 204, at 380 (citing NAT'L RSCH. COUNCIL, NEW STRATEGIES FOR AMERICA'S WATERSHEDS, at 15 (1999)).

[222] *Id.* at 380–81, 395–96, 408.

[223] Thompson, Jr., *supra* note 206, at 201–02.

[224] *Id.* at 205–10.

[225] *Id.* at 229–30.

[226] *Id.* at 230–31.

the lag include agencies and regulators' reluctance to share or cede authority, increased transaction costs to overcome "siloed" entities and coordinate among them, and regulations that constrain agency flexibility.[227] As Strifling points out, the AWRA has identified three categories of "lessons learned" from a review of case studies of IWRM.[228] First, for IWRM to succeed there must be an "enabling environment."[229] This includes having policies in place that facilitate modification to government agency regulations, policies, and practices needed to further the goals of IWRM.[230] In addition, without an adequate financing structure, IWRM is unlikely to succeed.[231] Finally, to implement IWRM, it is critical that tools be developed to create greater management capacity.[232] These tools include assessments of existing conditions, adaptive plans, conflict resolution processes, and financing plans.[233] As with ecosystem management, despite widespread promotion of IWRM and some attempts to put it into practice, the concept has been criticized in large part because it remains "exceptionally vague."[234]

C. Collaborative Governance

Around the same time that ecosystem management was gaining traction in the scientific, policy, and legal arenas, a broader yet related concept of governance was taking hold.[235] Legal scholars began to circle around the belief that traditional approaches to government decision-making had significant limitations and that new innovative approaches based on the concept of private-public governance were warranted.[236] Professor Jody Freeman, in a series of articles in the late 1990s and early 2000s, evaluated the shortcomings of traditional regulatory systems and advanced the idea of a private-public governance collaboration as a more

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[227] Strifling, *supra* note 210, at 414.
[228] *Id.* at 415.
[229] *Id.* at 411–15.
[230] *Id.* at 415.
[231] *Id.*
[232] *Id.* at 416.
[233] Strifling, *supra* note 210, at 416.
[234] Thompson, Jr., *supra* note 206, at 217; *see also* Jamie Konopacky, *Battling the (Algae) Bloom: Watershed Policies and Plans in Wisconsin*, 44 B.C. ENV'T AFF. L. REV. 253, 254 (2017) (describing the watershed approach in general as being unclear and stymied by the combination of confusion and regulatory, financial, and political obstacles).
[235] Chris Ansell & Alison Gash, *Collaborative Governance in Theory and in Practice*, 18 J. PUB. ADMIN. RES. & THEORY 543, 543 (2007).
[236] Orly Lobel, *The Renew Deal: The Fall of Regulation and the Rise of Governance in Contemporary Legal Thought*, 89 MINN. L. REV. 342, 414, 425 (2004).

workable model.[237] Freeman proposed, "a conception of governance as a set of negotiated relationships between public and private actors" wherein policy decisions are negotiated in a decentralized process.[238] Freeman highlighted the critiques of command and control government regulation as inefficient and ineffective, arguing instead in favor of a model that focuses on problem solving, in which the state is only one of many potential actors.[239] Freeman rejected the traditional formal "hierarchical approach to accountability" in favor of what she referred to as "'aggregate'" accountability produced through horizontal negotiation.[240] Freeman's article *Collaborative Governance in the Administrative State* explored several examples of recent developments in multi-stakeholder decision-making processes, such as negotiated rulemaking, and concluded that involving private actors in administrative decision-making, although not without some limitations, has the potential to result in better outcomes with increased accountability.[241] In a later article, Freeman explored the role of private actors in administrative decision-making in health care, incarceration, and regulation, through a number of theoretical lenses, including public choice theory and critical legal studies.[242] Freeman argued that it is impossible to separate the private from the public in administrative decision-making and in fact, decisions are made by "a variety of actors making collections of decisions in a web of relationships."[243]

Other scholars have made that case that a governance model either has already or should have supplanted the traditional government regulatory model. Professor Orly Lobel, argued in favor of what she referred to as the "renew deal" model of governance, envisioned as a "hybridization" of the regulation, market, and governance approaches.[244] Lobel described how New Deal administrative law was premised on the idea that administrative agencies were best suited to regulate due to their "superior knowledge, information, and expertise."[245] This belief in agency expertise

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[237] *See* Jody Freeman, *Collaborative Governance in the Administrative State*, 45 UCLA L. REV. 1, 2 (1997) [hereinafter *Collaborative Governance*]; Jody Freeman, *The Private Role in Public Governance*, 75 N.Y.U. L. REV. 543, 543 (2000) [hereinafter *Private Role*]; & Jody Freeman & Jim Rossi, *Agency Coordination in Shared Regulatory Space*, 125 HARV. L. REV. 1131, 1133 (2012).
[238] *Private Role*, *supra* note 237, at 543.
[239] *Collaborative Governance*, *supra* note 237, at 2, 13–14.
[240] *Private Role*, *supra* note 237, at 544.
[241] *Collaborative Governance*, *supra* note 237, at 97.
[242] *Private Role*, *supra* note 237, at 543–44.
[243] *Id.* at 673.
[244] Lobel, *supra* note 236, at 349–50.
[245] *Id.* at 373.

led to the creation of legal doctrines permitting broad delegation of authority and deference to administrative agencies.[246] The governance model is skeptical of these beliefs and argues in favor of involving more actors, from the private and public sectors, valuing a greater diversity of expertise and experience, thereby empowering a broad range of actors in the decision-making process.[247] After taking a deep dive into the "dimensions and organizing principles of the governance model," Lobel identified the key features of the model, which include among other things, "increased participation of non-state actors, stakeholder collaboration, . . . decentralization and subsidiarity, integration of policy domains, flexibility and noncoerciveness, [and] adaptability and dynamic learning."[248]

In a similar vein, and more narrowly targeted on environmental concerns, Professor Bradley Karkkainen has explored the concept of "collaborative ecosystem governance," which he describes as "recogniz[ing] the need for [an] integrated, holistic management of ecosystems as systems, and grappl[ing] with questions of scale and complexity in ecosystem management, emphasizing locally or regionally tailored solutions within broader structures of coordination and public accountability."[249] Key elements of this model include private-public governance, collaborative problem solving, and appropriate scale.[250] Karkkainen specifically identifies several existing programs that attempt to employ this model, including the Chesapeake Bay Program and the NEP.[251] After undertaking a review of the strengths and shortcomings of this model, Karkkainen concludes that the ecosystem governance model has significant advantages over more conventional approaches.[252] He cites as evidence the fact that by the early 2000s, there was a general trend in state and federal government toward a governance model and away from more traditional top-down regulation.[253] Other scholars have explored examples of collaborative governance approaches used in a variety of different watersheds, as well as marine and coastal ecosystems.[254]

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[246] *Id.*
[247] *Id.*
[248] *Id.* at 348, 371–404.
[249] Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENV'T L.J. 189, 193 (2002).
[250] *Id.* at 193–94.
[251] *Id.* at 190–92.
[252] *Id.* at 194.
[253] *Id.* at 202–03.
[254] *See, e.g.*, Kyla Wilson, *Governing the Salish Sea*, 26 HASTINGS ENV'T L.J. 169, 169–70 (2020); Anne T. Wessells, *Place-Based Conservation and Urban Waterways: Watershed Activism in the Bottom of the Basins*, 50 NAT. RES. J. 539, 539–40 (2010).

Collaborative governance and ecosystem management are closely related and share many of the same attributes.[255] As one scholar describes it, ecosystem-based management is "about the governance of large-scale environments or ecosystems, which may be defined on the basis of their distinctive ecological features."[256]

D. Adaptive Management and Adaptive Law

The concept of "adaptive management" has been a mainstay of environmental management and restoration efforts for decades.[257] The concept can be traced back to Charles Lindblom's article *The Science of "Muddling Through"* published in 1959, which was expounded upon in the works of C.S. Holling and Carl Walters in the 1970s and 1980s, respectively.[258] Walters advocated using an adaptive management process "where management activities themselves are viewed as the primary tools for experimentation."[259] Adaptive management is not only considered a principle of ecosystem management[260] but has become synonymous with ecosystem management.[261] Often referred to as "learn[ing] while doing" or "learning while restoring," adaptive management relies on phased field experimentation allowing early tests to inform later tests, and for management and restoration activities to be continually adjusted as new information becomes available.[262]

Legal scholars have promoted the concept of adaptive management, or at a minimum ensuring adaptive capacity in ecosystem management efforts, as a means to achieve environmental goals.[263] As Professor

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[255] *See* Hoagland, *supra* note 197, at 172.
[256] *Id.* at 169, 172 (opining that "[s]elf governing common-pool resources management is a logical progenitor of the [ecosystem management] concept.").
[257] A full discussion of adaptive management is beyond the scope of this Article. For a comprehensive review of adaptive management, *see* CARL J. WALTERS, ADAPTIVE MANAGEMENT OF RENEWABLE RESOURCES (1986).
[258] Charles E. Lindblom, *The Science of "Muddling Through,"* 19 PUB. ADMIN. REV. 79, 80–81 (1959); C.S. HOLLING, ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT (1978); WALTERS, *supra* note 257.
[259] WALTERS, *supra* note 257, at 2–3.
[260] Alan Haney & Rebecca L. Power, *Adaptive Management for Sound Ecosystem Management*, 20 ENV'T MGMT. 879, 879 (1996).
[261] *Id.*
[262] Joy B. Zedler, *What's New in Adaptive Management and Restoration of Coasts and Estuaries*, 40 ESTUARIES & COASTS 1, 1, 15 (2017) (reviewing the current state of adaptive management in a number of ongoing coastal and estuary restoration projects throughout the world).
[263] Alejandro E. Camacho, *A Learning Collaboratory: Improving Federal Climate Change Adaptation Planning*, 2011 B.Y.U. L. REV. 1821, 1821, 1823 (2011).

Karkkainen has articulated, the "[c]omplexity in ecosystem processes . . . demands that managers eschew reliance on fixed rules" in favor of more flexible and adaptive approaches.[264] Adaptive management allows for ongoing experimentation and the ability to nimbly adjust based on experience, as new information becomes available, or as conditions change.[265] Climate change is contributing to the need for adaptive approaches to enable policy-makers and managers to adjust quickly to changing circumstances and new scientific understandings.[266]

As a response to the scientific community's call for adaptive management, legal scholars have advocated for "adaptive law" as a means for the law to address the inherent dynamism and uncertainty of the natural world, as well the need to nimbly adapt law and policy as new information becomes available.[267] Professor Tony Arnold has advocated for a system of adaptive water law that would build resilience by incorporating three primary characteristics.[268] First, risk must be shared among stakeholders within a watershed.[269] Second, there must be conditional and flexible standards.[270] And third, there must be integrated water governance.[271] With regard to shared risk, Arnold explains that while a strategy to reduce risk is an important component of a resource management system, risk can never be completely avoided.[272] Accordingly, an important component of an adaptive watershed management system is the use of multi-participant watershed governance systems to share risk among stakeholders.[273] He explains that shared risk management approaches tolerate more uncertainty, involve greater flexibility, and facilitate cooperation among multiple participants.[274]

Arnold also argues for conditional and flexible standards, rather than the rigid rules that historically have applied in environmental

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[264] Karkkainen, *supra* note 181, at 122.
[265] *Id.*
[266] *See generally* Christopher Koliba et al., *The Lake Champlain Basin as a Complex Adaptive System: Insights from the Research on Adaptation to Climate Change ("RACC") Project*, 17 VT. J. ENV'T L. 533, 534 (2016) (discussing usefulness of adaptive system in responding to climate change on the Lake Champlain Basin).
[267] Craig A. Arnold & Lance H. Gunderson, *Adaptive Law and Resilience*, 43 ENV'T L. REP. 10426, 10426–28 (2013).
[268] Craig A. Arnold, *Adaptive Water Law*, 62 KAN. L. REV. 1043, 1070 (2014).
[269] *Id.*
[270] *Id.*
[271] *Id.*
[272] *Id.*
[273] *Id.* at 1074.
[274] Arnold, *supra* note 268, at 1075.

law.[275] Further, he posits that a more flexible standard allows institutions to more readily adapt to change, to take into account the broad ecological and social contexts of their decisions, and to experiment and learn from such experimentation.[276] Finally, Arnold argues that integrated water governance is critical for adaptive watershed management.[277] He points out, among other things, that involvement of all stakeholders, whether public or private, individual or organization, regulators or regulated, leads to more institutional legitimacy and facilitates opportunities for creative solutions and capacity to adapt.[278]

The above review of relevant literature on ecosystem management, integrated water resource management, collaborative governance, and adaptive law reveals a number of common themes that are widely understood as being critical to the effective management of ecosystem resources: 1) a place-based approach at the ecosystem or watershed scale;[279] 2) a multidisciplinary approach that integrates science, law, economic, and social concerns;[280] 3) collaboration among local, state, and federal government agencies, as well as private stakeholders, including representatives from industry, the business community, educational institutions, environmental organizations, recreational interests, and concerned citizens;[281] 4) mechanisms for ongoing financial resources;[282] 5) ongoing research, assessment, and monitoring;[283] 6) clear restoration targets;[284] 7) adaptive capacity.[285] We draw on these common themes as the basis of Integrated Estuary Governance.

Of course, Integrated Estuary Governance, like the other conceptions of environmental management outlined above, is not without its challenges. Perhaps most significant among those challenges is the difficulty and expense associated with scaling up management efforts to

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[275] *Id.*
[276] *Id.*
[277] *Id.* at 1078.
[278] *Id.*
[279] CRAIG, *supra* note 181, at 328.
[280] Arnold & Gunderson, *supra* note 267, at 10427; Arnold, *supra* note 268, at 1065, 1081.
[281] 33 U.S.C. § 1330(c) (2018).
[282] TAMPA BAY ESTUARY PROGRAM, CHARTING THE COURSE: THE COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN FOR TAMPA BAY (2017) [hereinafter TBEP CCMP].
[283] SALAH DARGHOUTH ET AL., WATERSHED MANAGEMENT APPROACHES, POLICIES, AND OPERATIONS: LESSONS FOR SCALING UP, WORLD BANK, WATER SECTOR BD. DISCUSSION PAPER SERIES NO. 11 (2008).
[284] *Id.*
[285] Arnold & Gunderson, *supra* note 267, at 10426–29.

include not only all ecological, social, and economic concerns within an entire ecosystem, but also to coordinate among agencies with different legal mandates, missions, and cultures, as well as a range of private stakeholders with varying interests and values.[286] Adding to that challenge, is the need for an ongoing commitment to sufficient resources to do the needed data collection and monitoring necessary for sound decision making, stakeholder confidence, and the ability adapt as new data becomes available.[287] Nevertheless, Integrated Estuary Governance, at least in some form, has been occurring for years in the NEP. The next Part of this Article explores in depth two case studies from the NEP in Florida through the lens of integrated estuary management.

IV. THE NEP AND INTEGRATED ESTUARY GOVERNANCE: CASE STUDIES

The almost simultaneous convergent evolution of concepts surrounding a shift from a purely regulatory approach to models of ecosystem management, integrated water resource management, collaborative governance, and adaptive management, evidenced a recognition in the scientific, policy-making, and legal realms that traditional top-down government agency-directed regulation was lacking.[288] The quick review of these developments provided above reveals a general consensus of the common themes shared by these conceptual models as well as a number of features that are integral to each of them.

Given the pervasive critiques outlining the shortcomings of traditional regulatory approaches and the convergent evolution of ecosystem management, governance, integrated resource management, and adaptive law that occurred in the 1990s and 2000s, it is not surprising that elements of these approaches found their way into estuary protection and restoration programs.[289] In particular, the creation of the National Estuary Program in itself represents a shift toward a place-based, multidisciplinary, and more collaborative governance approach, which involves a broad range of privet and public actors and acknowledges the desirability of flexibility and adaptation.[290]

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[286] *See generally* DARGHOUTH ET AL., *supra* note 283, at IX, XI, XIV, 36.
[287] *Id.* at 59, 72–73, 79.
[288] *Id.* at 11, 37, 134.
[289] *Id.* at IX, XI, XII, 10, 90.
[290] EPA, COMMUNITY-BASED WATERSHED MANAGEMENT: LESSONS FROM THE NATIONAL ESTUARY PROGRAM (2005).

In 2005, the U.S. EPA made a more conscious and overt move in the direction of an integrated collaborative governance approach to the NEP when it published, *Community-Based Watershed Management: Lessons from the National Estuary Program*.[291] In this document, EPA highlights the four fundamental principles that guide the NEP: 1) A focus on watersheds; 2) Integration of science into the decision-making process; 3) Fostering collaborative problem solving; and 4) Involving the public.[292] EPA recognizes that these guiding principles have broader applicability beyond their use in the NEP and could be useful in many other watershed protection and restoration efforts.[293] EPA's approach to community-based watershed management under the NEP includes many of the attributes that form our conception of Integrated Estuary Management. In fact, the NEP as a whole appears, at least on its face to embrace this conception.

We offer the conception of Integrated Estuary Governance as an approach that incorporates the salient aspects of ecosystem management, integrated water resources management, collaborative governance, and adaptive management, into a multidisciplinary holistic approach to protecting, managing, and restoring estuarine systems. Specifically, we offer the following framework to guide the implementation of Integrated Estuary Governance:

(1) A place-based approach taken at the scale of the estuarine system;
(2) A multidisciplinary holistic approach that integrates ecological, social, and economic concerns, as well as all pertinent federal, state, and local legal regimes;
(3) A participatory collaborative approach that draws on the expertise, interests, and values of all relevant public and private stakeholders, including federal, state, and local governmental agencies, environmental organizations, business interests, educational institutions, and citizens from local communities;
(4) Adaptive capacity to enable collaborating participants to learn from experimentation and nimbly adapt decision-making as new scientific understandings or changed circumstances emerge;

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[291] *See id.*
[292] *Id.*
[293] *Id.*

(5) Ongoing research and monitoring to inform sound decision-making to support adaptive capacity;
(6) Clear restoration targets;
(7) Ongoing financial resource commitments to ensure the necessary support to carry out research, monitoring, and other activities needed to bring participants together and make sound decisions.

While each of these concepts has garnered widespread support among scholars and policy makers, the true value of each has also been called into question in large part because the concepts are perceived as vague, and it is difficult to evaluate their success in real world settings.[294] For example, the Chesapeake Bay is frequently cited as an example of a watershed management success story.[295] While there are many lessons to be learned from the innovations of this program, actual measurable environmental success remains elusive.[296] Of course, Integrated Estuary Governance, like the other conceptions of environmental management outlined above, is not without its challenges. Perhaps most significant among those challenges is the difficulty and expense associated with scaling up management efforts to include not only all ecological, social, and economic concerns within an entire ecosystem, but also to coordinate among agencies with different legal mandates, missions, and cultures, as well as a range of private stakeholders with varying interests and values. Adding to that challenge, is the need for an ongoing commitment to sufficient resources to do the data collection and monitoring necessary for sound decision making, stakeholder confidence, and the ability adapt as new data becomes available. Nevertheless, Integrated Estuary Governance, at least in some form, has been occurring for years in the NEP.[297]

In this Part of the Article, we explore in depth two case studies from the NEP in Florida through the lens of Integrated Estuary Management. Through these case studies, we seek to partially test whether, and to what extent, the NEP actually puts into practice the core features of Integrated Estuary Management and the extent to which such practice has contributed to success in estuary protection, management, and restoration.

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[294] EPA, WATERSHED PROTECTION: A PROJECT FOCUS (1995).
[295] CHESAPEAKE CONSERVATION P'SHIP, MARKING MILESTONES: PROGRESS IN CONSERVING LAND IN THE CHESAPEAKE BAY WATERSHED (2019).
[296] Cannon, *supra* note 204, at 394–407.
[297] *Frequently Asked Questions on National Estuary Program (NEP) Governance*, CAL. ENV'T PROT. AGENCY (2018), https://www.smbrc.ca.gov/about_us/orientation/docs/usepa_nep_governance_faq.pdf [https://perma.cc/2U2L-8PYU].

Since its inception in 1987, the NEP has experienced decades of at least some aspects of Integrated Estuary Management, carried out in different manners by different NEP programs.[298] It is only with this long-term implementation, and its concomitant successes and failures, that it is possible to evaluate whether this approach is viable and what attributes of it appear to provide the most benefits. Accordingly, this Part seeks to assess the value of Integrated Estuary Governance through two case studies under the NEP: 1) The Tampa Bay Estuary Program;[299] and 2) The Indian River Lagoon Estuary Program.[300]

A. Place-Based Estuary Scale and Multidisciplinarity

By its very design, the NEP is place-based, is carried out at the estuary scale, and is multidisciplinary, integrating ecosystem concerns with social and economic considerations.[301] Understanding how NEP multidisciplinary programs operate in a particular estuary necessitates an understanding of the geography, land uses, and environmental stressors that exist in each particular estuary.

1. Tampa Bay Estuary Program ("TBEP")

Established in 1991, the TBEP governs Tampa Bay, Florida's largest open-water estuary, spanning 400 square miles with a drainage basin of approximately 2,200 square miles.[302] Despite its size, the estuary is relatively shallow, with an average depth of eleven feet.[303] The estuary itself is considered as having five sections: Old Tampa Bay, Middle Tampa Bay, Lower Tampa Bay, Hillsborough Bay to the East, and McKay Bay to the Northeast.[304] Many small tributaries and large rivers drain into the Tampa Bay, the most prominent being the Hillsborough, Alafia, Little

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[298] *The National Estuary Program: Congressional Establishment of a Non-Regulatory "Core Water" Program*, ASS'N NAT'L ESTUARY PROGRAMS, https://nationalestuaries.org/legislation/ [https://perma.cc/GLD6-WDA5] (last visited Nov. 24, 2020).
[299] *About TBEP*, TAMPA BAY ESTUARY PROGRAM, https://tbep.org/about-tbep/ [https://perma.cc/M4MH-CQQ6] (last visited Nov. 24, 2020).
[300] *The Importance*, ONE LAGOON, https://onelagoon.org/importance/ [https://perma.cc/YS9D-U3WY] (last visited Nov. 24, 2020).
[301] *Overview of the National Estuary Program*, EPA (last updated Oct. 26, 2018), https://www.epa.gov/nep/overview-national-estuary-program [https://perma.cc/K7AL-5VLH].
[302] *Bay Snapshot: Fast Facts*, TAMPA BAY ESTUARY PROGRAM, https://tbep.org/estuary/bay-snapshot/ [https://perma.cc/4GNA-89SK] (last visited Nov. 24, 2020).
[303] TBEP CCMP, *supra* note 282, at 5–7.
[304] *Id.* at 5, 49.

Manatee, and Manatee Rivers.[305] In total, the watershed hosts "about 1,400 linear miles of tributaries, creeks and rivers."[306] These tributaries provide critical habitat for juvenile snook and contribute to the biodiversity in the region.[307] In fact, the bay itself contains more than 200 fish species.[308] Moreover, the mangrove-blanketed islands support twenty-nine species of colonial water birds.[309] Finally, the TBEP jurisdiction contains seven Outstanding Florida Waters ("OFW") and four state aquatic preserves.[310]

However, the TBEP has faced the challenge of preserving the balance while supporting a booming population. In fact, approximately 2,700,000 people live within the watershed, which spans portions of Hillsborough, Manatee, and Pinellas County.[311] In order to function as a major shipping port and recreation hub, over eighty miles of channels have been dredged to accommodate movement of ships.[312] As a result, Tampa Bay's three flourishing seaports rank among the busiest in the nation, bringing an estimated $15,000,000,000 to the local economy.[313]

Consequentially, the dredging to maintain these nautical highways generate from 1 to 1.5 million cubic yards of material annually.[314] Dredging to maintain and expand these channels began in the 1880s in attempts to make Tampa a commercial center.[315] However, dredging projects greatly expanded in response to both the boom in phosphate production and the rise of recreational cruise ships.[316] Despite public opposition and a noted impact on the health of the bay, dredging projects continue to this day.[317]

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[305] *Id.* at 5.
[306] *Id.* at 67.
[307] *Id.* at 87.
[308] *Tampa Bay Estuary Program, Fast Facts About Tampa Bay*, TAMPA BAY TIMES (Sept. 27, 2005), https://www.tampabay.com/archive/2000/09/08/fast-facts-about-tampa-bay/ [https://perma.cc/J28F-VLSS].
[309] *Id.*
[310] *Tampa Bay Aquatic Preserves*, FLA. DEP'T ENV'T PROT. (last modified Jan. 3, 2020), https://floridadep.gov/rcp/aquatic-preserve/content/tampa-bay-aquatic-preserves [https://perma.cc/U4TS-8AR8].
[311] *Tampa Bay*, *supra* note 6.
[312] TBEP CCMP, *supra* note 282, at 5; *Our Estuary*, TAMPA BAY ESTUARY PROGRAM, https://web.archive.org/web/20200707175257/https://tbep.org/m/a_portrait_of_the_tampa_bay_estuary.html [https://perma.cc/95NU-GVEU] (last visited Nov. 24, 2020).
[313] *Id.*
[314] TBEP CCMP, *supra* note 282, at 111.
[315] Brad Massey, *Port Tampa's Current Dredging Project Has Deep Connection to Our Past*, 83DEGREES (Feb. 12, 2019), https://www.83degreesmedia.com/features/current-dredging-of-Tampa-channel-has-deep-ties-to-past-021219.aspx [https://perma.cc/GUS5-73P3].
[316] *See id.*
[317] *See* Richard Danielson, *Port Tampa Bay Wants to Create More Land by Dredging East Bay Estuary*, TAMPA BAY TIMES (Feb. 12. 2019), https://www.tampabay.com/business/port

In fact, dredging and subsequent increased traffic on the bay may have stunted the health and recovery of seagrasses, presenting problems for maintaining a successful NEP.[318]

While urban development is the largest land use,[319] agriculture still represents 20% of total land use in the highly urbanized watershed.[320] Despite its relative percentage to total land use in the region, agriculture is an important economic driver.[321] In fact, three counties in the watershed are among the top six producers in the state.[322] The primary agricultural activities are cattle production, citrus orchards, and vegetable crops.[323] Yet agriculture puts a considerable strain on the watershed, accounting for 20% of total nitrogen loading into the bay.[324]

While agriculture generates consistent nutrient loading via fertilizer runoff, the impact of the phosphate industry in the bay deserves considerable notice.[325] Beyond the implied nutrient loads created by fertilizer, a radioactive byproduct of fertilizer's manufacturing process is stored in large stacks throughout the watershed, creating a public health risk.[326] In 2004, a stack was overwhelmed by the winds of Hurricane Francis, causing 65,000,000 gallons of acidic process water to pour into the bay.[327] It took eight years before responsible parties began restoration projects

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-tampa-bay-seeks-permit-for-dredge-and-fill-project-to-create-new-cargo-and-container-capacity-20190212/ [https://perma.cc/XY97-35RT] (discussing a $63 million dredging project and the public opposition by Tampa Bay Waterkeepers).

[318] Victoria Parsons, *Running Out of Room? Dredged Material Poses Challenges*, BAY-SOUNDINGS, http://baysoundings.com/legacy-archives/spring03/dredge.html [https://perma.cc/5UN5-PRJG].

[319] TBEP CCMP, *supra* note 282, at 4.

[320] *Id.* at 5.

[321] *Id.* at 24.

[322] *Id.*

[323] STEVEN H. WOLFE & RICHARD D. DREW, DEP'T OF INTERIOR, AN ECOLOGICAL CHARACTERIZATION OF THE TAMPA BAY WATERSHED 193 (1990).

[324] *See* TBEP CCMP, *supra* note 282, at 24 ("Based on 2010–2014 estimates from the Tampa Bay Estuary Program's Nitrogen Management Consortium, agriculture accounts for about 20% (approximately 655 tons of the 3294 tons per year average) of total nitrogen loading to the bay.").

[325] Mike Salinero, *Mosaic Co. Environmental Project to Revive Ecological Disaster Area*, TAMPA TRIBUNE (Sept. 2, 2012), https://archive.is/20130204054623/http://www2.tbo.com/news/news/2012/sep/02/mosaic-co-environmental-project-to-revive-ecologic-ar-481009 [https://perma.cc/GR54-C82F].

[326] Craig Pittman, *The Clock is Ticking on Florida's Mountains of Hazardous Phosphate Waste*, SARASOTA MAG. (Feb. 26. 2017), https://www.sarasotamagazine.com/news-and-profiles/2017/04/florida-phosphate/ [https://perma.cc/N5DY-Z83G].

[327] *Mosaic*, NOAA, https://darrp.noaa.gov/hazardous-waste/mosaic [https://perma.cc/6DKH-3MAR] (last visited Nov. 24, 2020).

designed to restore and improve mangroves, wetlands, and surrounding waters.[328] Thus, while phosphate mining remains profitable, the bay remains at risk of an environmental emergency.[329]

Furthermore, the Tampa Bay is a hub for tourism and recreation in the region, attracting nearly 5,000,000 visitors a year.[330] The regions beaches and parks attract fishing, boating and kayaking among both residents and visitors.[331] In addition, Port Tampa receives around 900,000 cruise ship passengers per year.[332] As such, maintaining water quality is critical to the economy of the region.[333] Unfortunately, the same activity that relies on a healthy estuary also exists as a stressor to overall health of the bay. For one, fecal contamination from pet waste produces 125 tons of waste daily.[334] Additionally, recreational boaters and liveaboard vessels produce significant pollution.[335] However, it is the rising presence of harmful algal blooms in the bay that could drastically damage both the health of the economy and the estuary. While harmful algal blooms of pyrodinium occur regularly in Old Tampa Bay, they have yet to produce serious harmful ecological impacts and have been more accurately characterized as a nuisance.[336] Yet recently, red tide and blue-green algae have been detected in the TBEP jurisdiction.[337] Unchecked, these nuisance blooms may transition to a chronic stressor or shock to the estuary's health.

Ultimately, the Tampa Bay watershed is a productive, shallow estuarine system that supports a major population and agricultural industry while still conserving the fragile characteristic of estuaries for the

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[328] Salinero, *supra* note 325.
[329] *See id.* ("It was one of the worst local environmental disasters in years, a '10 on a scale of 10,' one spokesman for the old Cargill Phosphate company called it."); *see also* Betsy Calvert, *Mosaic Gypstack Leak Still Not Fixed in Bartow, Finalizing Repair Plans*, ARCADIAN (Dec. 14, 2019), https://www.yoursun.com/arcadia/mosaic-gypstack-leak-still-not-fixed-in-bartow-finalizing-repair-plans/article_01286478-2089-11ea-a362-a378dba3f4fa.html [https://perma.cc/F3W4-3CHJ] (discussing a 100-gallon per minute leak of acidic water from a gypsum stack retention pond).
[330] TAMPA BAY ESTUARY PROGRAM, *supra* note 312.
[331] *Id.*
[332] TBEP CCMP, *supra* note 282, at 111.
[333] *Id.* at 55.
[334] *Id.* at 90.
[335] *Id.* at 58–59.
[336] *Id.*
[337] Nano Riley, *A New Report Says Harmful Algae Blooms are on the Rise in Florida and Across the Nation*, CREATIVE LOAFING (Aug. 15, 2019), https://www.cltampa.com/news-views/environment/article/21082690/a-new-report-says-harmful-algae-blooms-are-on-the-rise-in-florida-and-across-the-nation [https://perma.cc/X2RS-L9UP].

purposes of tourism.[338] While the Tampa Bay has been dredged and damaged, this has not stopped a boom in population and a bustling eco-tourism industry.[339] Understanding the estuaries geographical situation and land usage is critical to understanding the context of the TBEP's success and failures.

2. Indian River Lagoon National Estuary Program ("IRLNEP")

The IRLNEP, established in 1990, addresses the Indian River Lagoon ("Lagoon"), which extends 156 miles from Ponce de Leon Inlet to Jupiter Inlet, running parallel to the coast of Florida and spanning 353 square miles.[340] The Lagoon is divided into three distinct estuaries: the Indian River Lagoon, Banana River Lagoon, and Mosquito Lagoon.[341] The system encompasses seven counties and 38 incorporated cities in its 2,284-square-mile watershed.[342] Additionally, the length of the Lagoon spans from temperate to tropical climate zones, encompassing almost 40% of the east coast of Florida.[343] Accordingly, the expansiveness of the Lagoon supports extreme biodiversity, with approximately 4,000 species documented.[344] The Lagoon also serves as a major fishery, providing around 50% of east coast fish annually.[345] The combination of diverse habitat and variety of species have caused the Lagoon to have been cited as among the most biologically diverse estuaries in North America.[346]

Unlike TBEP open-water estuary, the Lagoon system is non-tidal enclosed system characterized by restricted exchange with the Atlantic Ocean through five main inlets.[347] The hydrology of the Lagoon is unique

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[338] TBEP CCMP, *supra* note 282, at 111.
[339] *Strong Growth Continues in Tampa Bay*, U.S. DEP'T HOUS. & URB. DEV., https://www.huduser.gov/portal/pdredge/pdr-edge-spotlight-article-081318.html [https://perma.cc/LF89-4TDH] (last visited Nov. 24, 2020).
[340] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, LOOKING AHEAD TO 2030: A 10-YEAR COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN FOR THE INDIAN RIVER LAGOON, FLORIDA 3–5 (2019) [hereinafter IRLNEP 2019].
[341] *Id.* at 3.
[342] *Id.*
[343] *Id.*
[344] *See id.* ("More than 2,000 species of plants, 600 species of fish, 300 species of birds, and 50 threatened or endangered species inhabit the IRL for at least some portion of their lives.").
[345] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, INDIAN RIVER LAGOON: AN INTRODUCTION TO A NATURAL TREASURE 5 (2007).
[346] FLA. ATL. UNIV., *Indian River Lagoon—Facts and Figures*, https://www.fau.edu/hboi/irlo/docs/IRL.Fact.Sheet.pdf [https://perma.cc/6C3V-322Q] (last visited Nov. 24, 2020).
[347] *See* IRLNEP 2019, *supra* note 340, at 3 (The five inlets are "Ponce de Leon, Sebastian, Fort Pierce, St. Lucie, and Jupiter" inlets.).

not only in its brackish content, but because of its limited exchange of water with the open ocean.[348] Exchange is limited due to the micro or nontidal range of the Lagoon, as well as the large distances between the five inlets.[349] While tidal currents drive circulation and mixing, the Lagoon is complex in that, dependent on the segment of the Lagoon, circulation could be accomplished by wind-generated currents, freshwater discharge, and even evaporation.[350] Yet in areas near tributaries or by the inlets, circulation is accomplished by either discharge or tidal currents.[351] Furthermore, flow and exchange are complicated by the shallowness of the Lagoon, averaging 4 feet across its entirety.[352] In combination, these features result in a Lagoon that is extremely sensitive to the amount and timing of freshwater and pollutants discharged to it from the watershed.[353]

Yet in recent years, the value of the IRL has been negatively impacted by anthropogenic activities, including agricultural use, urban development, and algal superblooms.[354] Extreme land use changes have upset the natural balance of the Lagoon ecosystem.[355] Land use in the watershed is predominantly citrus agriculture and cattle pasture, accounting for approximately 25% and 23% of total land area respectively.[356] Between 2004 and 2015, urban land uses grew from 17% to 39% of total land area.[357] Consequentially, the population has grown to almost 1.76 million in 2017, leading to an increase in urbanization and coastal development in the region.[358] The resulting change and size of drainage patterns in the watershed has led to a greater nutrient loading from stormwater runoff.[359] Additionally, the population increase has caused an increased load from fertilizers by both agricultural and residential

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[348] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, *supra* note 345, at 14.
[349] *Id.* at 14–15.
[350] *Id.* at 15.
[351] *Id.*
[352] *Id.* at 14–15.
[353] *Id.* at 15.
[354] KERI A. SMITH, AN OVERVIEW OF THE INDIAN RIVER LAGOON 1, https://soils.ifas.ufl.edu/media/soilsifasufledu/sws-main-site/pdf/technical-papers/Smith_Keri_Six_Month_Embargo.pdf [https://perma.cc/MQQ5-4PLQ].
[355] IRLNEP 2019, *supra* note 340, at 4.
[356] Gregory A. Graves et al., *Water Quality Characteristics of Storm Water from Major Land Uses in South Florida*, 40 J. AM. WATER RES. ASS'N 1405, 1407 (2004).
[357] *Id.*; Brian E. Lapointe, Laura W. Herren, David D. Debortoli & Margaret A. Vogel, *Evidence of Sewage-Driven Eutrophication and Harmful Algal Blooms in Florida's Indian River Lagoon*, 43 HARMFUL ALGAE 82, 83 (2015).
[358] IRLNEP 2019, *supra* note 340, at 30.
[359] *Id.*

stakeholders.[360] Finally, urban residential land use in the region is responsible for an increased use in harmful septic tanks leaching nutrients into the Lagoon.[361]

Along with stressors from increased urbanization, the Lagoon is also impacted by freshwater releases from Lake Okeechobee during times of high water.[362] In the early part of the last century, an enormous canal was constructed to connect Okeechobee to the Lagoon.[363] During high water, large freshwater discharges into the Lagoon are made to control water levels and offer flood protection.[364] Billions of gallons of freshwater were released to the Lagoon during the summers of 2013, 2016, and 2018.[365] These releases drastically alter the normal salinity of the Lagoon, while conveying loads of sediment, nutrients, and algae into the watershed.[366]

This discharge of freshwater, high nutrients, sediments, and algae from Lake Okeechobee combined with the restricted hydrology and nutrient loads of the lagoon has contributed to significant harmful algal blooms.[367] In fact, the 2011 "superbloom" of pico-cyanobacteria dramatically changed the overall health of the bay, shifting from benthic vegetation to an environment dominated by micro-algae.[368] The "new normal" for the Lagoon consists of "intense, recurring, and long-lasting algal bloom conditions of multiple species, widespread loss of seagrass habitat, and episodic wildlife mortality events."[369] Ultimately, the freshwater discharges and HABs have acted as a chronic shock and stressor to the Lagoon, highlighting a tipping point in efforts to restore and protect the watershed.[370]

Moreover, efforts to restore the Lagoon to pre-2011 levels have been impeded by the presence of muck accumulation on the lagoon bottom, which increases legacy loading of nutrients.[371] In fact, "muck flux" deposits

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[360] *Id.*
[361] Lapointe et al., *supra* note 357, at 84.
[362] IRLNEP 2019, *supra* note 340, at 9–10.
[363] *Id.* at 80.
[364] *Id.*
[365] *Id.* at 9–10.
[366] *Id.* at 10.
[367] *Id.*
[368] IRLNEP 2019, *supra* note 340, at 9.
[369] *Id.*
[370] Jim Waymer, *Indian River Lagoon Reaches a Tipping Point*, FLA. TODAY (Aug. 18, 2015), https://www.floridatoday.com/story/news/local/environment/from-the-water/2015/04/25/indian-river-lagoon-brevard-county-reaches--tipping-point/26306273/ [https://perma.cc/RP28-XULX].
[371] IRLNEP 2019, *supra* note 340, at 39–41.

almost as much nutrients as external loading from groundwater and stormwater combined.[372] Furthermore, the anoxic nature of muck destroys valuable benthic habitats like seagrass.[373] In the end, substantial progress on restoring the Lagoon cannot be accomplished without removing legacy muck loads and reducing anthropogenic impacts on the watershed.[374] While the IRLNEP has recently made strides in governance and restoration, significant harm has already befallen the Lagoon as a result of anthropogenic impacts and mismanagement.[375]

B. Participatory Collaborative Governance

The NEP is by deliberative design intended to be participatory and collaborative.[376] While the NEP envisions significant participation by a broad range of public and private stakeholders, each NEP has the discretion to develop unique and innovative approaches to carry out this objective.[377] The EPA guidelines for NEP governance structure allow each program to develop a governing forum that brings together diverse stakeholders to identify issues and develop at management plan.[378] However, all Management Conferences should establish core committees to carry out their work, including a policy and management committee, and advisory committees for both technical and citizen input.[379] Typically, a NEP program or Management Conference is governed by a Policy Committee comprised of EPA and state agency directors overseeing a Management Committee of environmental managers for participating federal, state, and interstate agencies.[380] The Management Committee typically oversees a Scientific or Technical Advisory Committee and Citizen Advisory Committee.[381] While the NEP provides basic guidance on governing structures, some programs create additional committees or utilize novel governing structures.[382]

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[372] *Id.* at 39.
[373] *Id.*
[374] *Id.* at 39–40.
[375] FLA. ATL. UNIV., *supra* note 346.
[376] EPA, *supra* note 290, at 4–5.
[377] *Id.*
[378] *See id.* at 2–5.
[379] *Id.* at 8.
[380] *Id.* at 8–9.
[381] *Id.* at 8–9.
[382] *See* EPA, *supra* note 290, at 10 (comparing a traditional NEP management conference with the organizational structure for the Lower Columbia River Estuary Partnership).

1. TBEP: Expanded Roles for Local Governments and the Private Sector

In 1991, the Tampa Bay watershed was recognized by the EPA as an "estuary of national significance" under the EPA's national estuaries program.[383] The first CCMP was approved in 1996 by the local partners, the Governor, and the EPA administrator, with the latest update to the CCMP occurring in 2017.[384] The traditional governing structure is comprised of a Policy Board advised by a Management Board of representative officials, a Technical Advisory Committee of scientists, and a Community Advisory Board of engaged citizens all working to support the TBEP mission.[385] However, TBEP has gone well beyond the traditional model and created an expanded role for local governments through a binding interlocal local agreement and a robust model of participatory collaboration through the Tampa Bay Nitrogen Management Consortium, which includes dozens of representatives from local municipalities, industry, and agriculture.[386]

Unique to the governing history of the TBEP was the first ever *binding* interlocal agreement between participants in the NEP program.[387] The TBEP's Interlocal Agreement binds local governments, counties, and agencies to achieve habitat targets in local comprehensive plans, meet nitrogen loading goals, and attempt to curb vehicle emissions in policy making.[388] Additionally, local governments and counties in the TBEP jurisdiction "agree that the Goals for Tampa Bay described in the CCMP are approved and adopted by each of them."[389] Ultimately, this agreement both incentivizes and demands compliance with the CCMP.

In order to implement to goals of the agreement, the TBEP has created the "Crosswalk Project."[390] According to the CCMP, the Crosswalk Project seeks to: "1) prioritize CCMP goals suitable for inclusion in local government comprehensive plans, 2) identify relevant elements,

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[383] TAMPA BAY ESTUARY PROGRAM, PROGRAM ACCOMPLISHMENTS: 2016–2018 3 (2019).
[384] *See* TBEP CCMP, *supra* note 282, at 6.
[385] The representatives of TBEP consist of "Hillsborough, Manatee, Pasco and Pinellas counties; cities of Clearwater, St. Petersburg and Tampa; the Southwest Florida Water Management District; the Florida Department of Environmental Protection; and the U.S. Environmental Protection Agency." TAMPA BAY ESTUARY PROGRAM, *supra* note 383.
[386] *Id.* at 3, 5.
[387] *See* TBEP CCMP, *supra* note 282, at 151.
[388] *Id.*
[389] TAMPA BAY ESTUARY PROGRAM, TAMPA BAY ESTUARY PROGRAM AMENDED AND RESTATED INTERLOCAL AGREEMENT 8 (2015).
[390] *See* TBEP CCMP, *supra* note 282, at 149.

regulatory frameworks to serve as the most appropriate vehicle for incorporating CCMP priority goals, and 3) provide model language based on CCMP goals and actions for local government consideration."[391] While the program is ambitious, the process of drafting model language for local governments to include in their long-range planning is still ongoing, with past meetings being hosted at the Tampa Bay Regional Planning Council.[392]

The interlocal agreement also established the TBEP as an Independent Special District under the Uniform Special District Accountability Act.[393] Originally, the TBEP attempted to form as an "interlocal entity," attempting to evade classification as an Independent Special District and thus bypass reporting requirements.[394] According to the Department of Community Affairs—the state land planning agency at the time—"the functions performed by the Estuary Program are clearly governmental in nature, because the United States Congress and the Florida Legislature have declared management of the coastal waters and estuaries an essential public function."[395] Additionally, the TBEP was determined to be a special purpose entity, limited to developing and implementing the CCMP.[396] Therefore, the TBEP was shown to have no power of taxation, regulation or eminent domain.[397] However, as a special district, the TBEP may manage, own, operate, construct, and finance basic capital infrastructure, facilities, and services with private and public sections across jurisdictional boundaries.[398] In addition, the TBEP is subject to mandatory reporting requirements.[399]

In addition to the interlocal agreement, TBEP has engaged a broad range of stakeholders through the Tampa Bay Nitrogen Management Consortium ("TBNMC").[400] TBNMC has been praised by the EPA as a "catalyst

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[391] *Id.*
[392] TAMPA BAY ESTUARY PROGRAM POLICY BOARD, NOVEMBER 22ND POLICY BOARD MEETING: MEMORANDUM 9 (Nov. 22, 2019).
[393] TBEP CCMP, *supra* note 282, at 151; Uniform Special District Accountability Act, FLA. STAT. § 189.01–189.082 (2020).
[394] TAMPA BAY ESTUARY PROGRAM, INTERLOCAL AGREEMENT 1.3(y), 4 (1998), https://www.tbeptech.org/DATA/Special_District_Docs/1998_TBEP_Interlocal_Agreement.pdf [https://perma.cc/AT8L-8RJU]; *In re* Tampa Bay Estuary Program, No. DCA00-DEC-227 at 4 (Dep't Cmty. Aff's. 2000), https://www.tbeptech.org/DATA/Special_District_Docs/2000_Special_District_Final_Order.pdf [https://perma.cc/58W3-6FYS].
[395] *In re* Tampa Bay Estuary Program, No. DCA00-DEC-227 at 4.
[396] *Id.* at 3.
[397] *Id.* at 4.
[398] Fla. Stat. §§ 189.03(2)(a)–(4) (2020).
[399] *Id.*
[400] Vicki Parsons, *TBEP Receives National Award for Reducing Nitrogen Pollution*, BAY

for bringing diverse and previously contentious groups together in a strong alliance dedicated to the achievement of specific, measurable goals for bay improvement."[401] The TBNMC brings together more than 50 representatives from local municipalities, industries, and agriculture to engage with the mission of the TBEP.[402] This innovative model of environmental governance represents a shift from traditional command and control model to a localized approach to decision making.[403] Accordingly, stakeholders throughout the watershed may voluntarily participate in the TMDL allocation process.[404] Stakeholders attend representative meetings, propose innovative methods to achieve desired discharges, and catalogue important data for dissemination to the public.[405] As such, the TBNMC represents an innovative and veritable model of governance that maximizes private and public participation.[406]

The TBNMC, overseen by the TBEP, is responsible for creating equitable allocations for all 189 sources within the watershed to meet the TMDLs for the Tampa Bay.[407] The TBNMC is unique in that it encourages participatory dialogue and deliberation through a voluntary framework that effectively gives private and public stakeholders a voice in the allocation rather than a centralized approach.[408] Local government and regulatory members include:

> [T]he Cities of Tampa, Clearwater, and St. Petersburg; the counties of Manatee, Hillsborough, and Pinellas; and the regulatory entities of FDEP, the EPA, and SWFWMD. Pasco County . . . in 2016 . . . other public partners . . . included Manatee County Agricultural Extension Service, the Environmental Protection Commission of Hillsborough County, the Tampa Bay Regional Planning Council, the

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SOUNDINGS (Aug. 28, 2017), http://baysoundings.com/tbep-receives-national-award-reducing-nitrogen-pollution/ [https://perma.cc/BYS8-H49L].

[401] EPA, EPA News Release, EPA Region 4 Honors Environmental Merit Award Recipients (2000) *available at* 2000 WL 34398535.

[402] *See Tampa Bay Nitrogen Mgmt. Consortium*, TAMPA BAY NUTRIENT MANAGEMENT STRATEGY 2017 REASONABLE ASSURANCE UPDATE DOCUMENT 14 (2017).

[403] Travis M. Hearne, *From Category 4b to Category 2: How Local Stakeholders in the Tampa Bay Nitrogen Management Consortium Battled Nutrient Pollution to Improve the Bay*, 48 STETSON L. REV. 647, 680 (2019).

[404] *Id.*

[405] *Id.* at 680–81.

[406] *Id* at 680.

[407] TBEP CCMP, *supra* note 282, at 15.

[408] Hearne, *supra* note 403, at 680.

> Florida Fish and Wildlife Commission, the U.S. Army Corps of Engineers, the Tampa Port Authority, the Florida Department of Transportation, and the Florida Department of Agriculture and Consumer Services. [. . .] MacDill Air Force Base, Tampa Bay Water, and the cities of Bradenton, Gulfport, Lakeland, Largo, Mulberry, Oldsmar, Palmetto, Plant City, and Safety Harbor.[409]

Additionally, the TBNMC includes private partners that represent fertilizer manufacturers, electrical utilities, and agricultural interest such as: "Mosaic, Cargill Fertilizer, the Florida Phosphate Council, CSX Transportation, and Florida Strawberry Growers Association . . . SeaWorld Parks, Busch Gardens, Lowry Park Zoo, Tampa Electric Company, Duke Energy, Tropicana Products, and a handful of private developers."[410]

Another aspect of a participatory model is citizen engagement in volunteerism. Volunteerism not only is a means to accomplish specific tasks in a cost-effective manner, but also motivates and empowers citizens to be actively engaged in restoration efforts.[411] The TBEP places a premium on engaging the citizens to volunteer in restoring the Tampa Bay.[412] In line with this philosophy, the TBEP has implemented multiple initiatives to increase and incentivize volunteerism in the Bay.[413] For one, the TBEP funds a mini-grant program to citizen groups for environmental education, restoration, and pollution prevention projects.[414] In 2018, the TBEP awarded more than $73,000 to 19 community groups for Tampa Bay restoration and improvement projects that directly involve citizens.[415] These projects range from habitat restoration and imperiled bird monitoring to experiential learning and outreach events.[416] In addition to monetary funding, the TBEP incentivizes projects by honoring successful projects annually.[417] Ultimately, the mini-grant program

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[409] *Id.* at 669.
[410] Hoornbeek et al., *supra* note 39, at 84; Hearne, *supra* note 403, at 669–70.
[411] TBEP CCMP, *supra* note 282, at 129.
[412] *Id.*
[413] *Id.* at 129–30.
[414] *Id.* at 129.
[415] Jeff Donnelly, *Saving Tampa Bay Waterways One License Plate at a Time*, NE. J. (Dec. 4, 2019), https://northeastjournal.org/saving-tampa-bay-waterways-one-license-plate-at-a-time/ [https://perma.cc/3S3R-H4YF].
[416] *Bay Mini-Grants*, TAMPA BAY ESTUARY PROGRAM, https://tbep.org/our-work/restoration-research/bay-mini-grants/ [https://perma.cc/AZ57-JYNP] (last visited Nov. 24, 2020).
[417] *See* TBEP CCMP, *supra* note 282, at 129 ("'Golden Mangrove Award' is given every

is one the TBEP's most innovative and successful programs promoting public involvement in the watershed.[418]

In addition, the TBEP has organized "workday" volunteer programs to directly involve the citizenry.[419] For one, the TBEP's "Give a Day for the Bay" has resulted in tremendous success, bringing in up to 250 volunteers annually.[420] In 2015, the program resulted in the restoration of 12 acres, removal of 2000 lbs. of invasive species, planting of 15,000 plants, and restoration of over 1,600 square feet of oyster beds.[421] Additionally, the TBEP has sponsored the "Great Bay Scallop Search," a one-day event where volunteer snorkelers searched for keystone scallops in select areas.[422] Organized in part by local non-profit Tampa Bay Watch, the event hosts approximately 200 snorkelers to carry out this important resource monitoring program.[423]

Furthermore, the TBEP promotes public education about key issues impacting the Bay through the Community Advisory Committee ("CAC").[424] The TBEP's approach to outreach and engagement focuses on closing the gaps of existing programs, while emphasizing cost-effective campaigns that maximize private partnerships.[425] In 2006, the TBEP launched "Pooches for the Planet" to encourage dog owners to properly dispose of dog waste.[426] Additionally, the "Be Floridian" initiative funded a regional campaign to support local fertilizer ordinances.[427] The campaign implemented widespread marketing to reduce use of nitrogen lawn and landscape fertilizers in the summer rainy season over a five-year period.[428] Finally, TBEP developed the Wild and Wonderful Tampa Bay—a one-week module to bring hands-on activities about the local environment to

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year to the outstanding Mini-Grant project, as determined by the TBEP Community Advisory Committee.").

[418] Parsons, *supra* note 400.

[419] *Get Involved*, TAMPA BAY ESTUARY PROGRAM, https://www.tampabay.wateratlas.usf.edu/get-involved/ [https://perma.cc/G4XQ-UUH6] (last visited Nov. 24, 2020).

[420] TBEP CCMP, *supra* note 282, at 129.

[421] *Id.*

[422] *Id.* at 99.

[423] Craig Pittman, *Fear of Red Tide Prompts Tampa Baywatch to Cancel Annual Scallop Search*, TAMPA BAY TIMES (Aug. 21. 2018), https://www.tampabay.com/news/environment/wildlife/Fear-of-Red-Tide-prompts-Tampa-Baywatch-to-cancel-annual-scallop-search_171095176/ [https://perma.cc/P3MR-X7RW].

[424] TBEP CCMP, *supra* note 282, at 132.

[425] *Id.* at 132–33.

[426] *Id.* at 133.

[427] *Id.* at 132.

[428] *Id.* at 132–33.

disadvantaged children.[429] As a result, the TBEP program can boast an engaged citizenry in addition to other laudable achievements.

From the onset, the TBEP has been innovative in incorporating as a special district and fostering binding participation through updated interlocal agreements.[430] Although the governing structure is similar to the EPA Model, cooperation with private and public industries through a management consortium is an innovative example of environmental governance.[431] Active engagement of the citizenry through a variety of volunteer programs has enhanced community participation in protection of the estuary.[432]

2. IRLNEP: A Reorganized Approach

Unlike the TBEP's proactive approach to estuary management, the IRLNEP's history of collaborative governance has been slow to evolve.[433] The IRLNEP first convened as a Management Conference in 1991, with the first CCMP adopted in 1996.[434] Originally, the IRLNEP was primarily governed by the Indian River Lagoon Advisory Board.[435] This board was established as an advisory body to both the South Florida Water Management District ("SFWMD") and St. Johns River Water Management District ("SJWMD"), the latter of which primarily oversaw implementation of the program pre-2015.[436] The Board met only three times a year and regularly reported to the EPA.[437]

However, the dramatic changes to the Lagoon caused heightened concern regarding the management of the estuary.[438] In 2013, the Indian River Lagoon Counties Collaborative met in response to harmful algal blooms to create uniform regulation across the estuary.[439] The result was

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[429] *Id.* at 133.
[430] TBEP CCMP, *supra* note 282, at 6, 151.
[431] *Id.* at 6–7, 15; EPA, *supra* note 290, at 9.
[432] *Volunteer*, TAMPA BAY ESTUARY PROGRAM, https://tbep.org/get-involved/volunteer/ [https://perma.cc/6TZV-BQ3F] (last visited Nov. 24, 2020).
[433] IRLNEP 2019, *supra* note 340, at 5.
[434] The Lagoon was designated as an "estuary of National significance" on Earth Day 1990 by President George W. Bush. *Id.*
[435] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, COMPREHENSIVE CONSERVATION AND MGMT. PLAN UPDATE 2008 89 (2008) [hereinafter IRLNEP 2008].
[436] *See id.* ("This 19-member board includes many of the members of the former IRLNEP Policy and Management committees and oversees implementation of the IRL CCMP.").
[437] *Id.* at 89–90.
[438] IRLNEP 2019, *supra* note 340, at 4.
[439] *Id.* at 5.

the creation of a new independent organization to host the IRLNEP—the IRL Council.[440] Formed on February 19, 2015, via interlocal agreement, the IRL Council reorganized as an independent special district.[441] Like the TBEP, each member of the interlocal agreement made annual funding contributions to the IRLNEP program.[442] Moreover, the CCMP postulates the creation of model language to implement the goals of the program into the comprehensive plans of member cities.[443] However, the main impetus in this reorganization was the creation of a unified response to the new threats facing the Lagoon.[444]

Collectively, the governance structure of the IRLNEP is referred to as the Management Conference.[445] The Management Conference serves as a consensus-driven, collaborative, non-regulatory entity dedicated to a unified effort among citizens and stakeholders in restoring the watershed.[446] In fact, the IRLNEP recognizes that a balance between public and private participation was missing for many years from the CCMP.[447] Therefore, involvement of the private sector has been a strategic consideration in the reorganization of the IRLNEP.[448]

Under the new organization, a Management Board was created to be overseen by IRL Council Board of Directors.[449] In addition, the Management Board host a financial oversight subcommittee.[450] Moreover, the Management Board oversees two technical committees: the Science, Technology, Engineering, and Modeling Advisory Committee

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[440] *Id.*
[441] The interlocal agreement became effective on February 24, 2015. The partners to the interlocal agreement are the DEP, St. Johns River Water Management District, South Florida Water Management District, Volusia County, Brevard County, St. Lucie County, and Martin County. On September 8, 2015, an amended interlocal agreement was executed to include the Indian River County Lagoon Coalition, representing Vero Beach, Sebastian, and Fellsmere. On June 9, 2017, a second restated and amended interlocal agreement transferred representation from the Indian River County Lagoon Coalition to Indian River County Board of County Commissioners. *See id.* at 5.
[442] *Id.*
[443] *Id.* at 131.
[444] IRLNEP 2019, *supra* note 340, at 5–6.
[445] *Id.* at 7.
[446] *Id.*
[447] *Id.* at 113.
[448] *See id.* ("The new IRLNEP Management Conference structure and network governance model was designed to encourage and cultivate increased participation from private-sector business and industry throughout the five-county IRL region.").
[449] *Id.* at 6.
[450] IRLNEP 2019, *supra* note 340, at 6.

("STEMAC") and the Citizens Advisory Committee.[451] Furthermore, IRLNEP staff work directly with industry partners and staff through the IRL Innovator and Investor Network ("IRLI2").[452] Although the concrete success of the IRLI2 has not been analyzed, the program has brought in the largest private-sector employer in Brevard County—Harris Corporation.[453] Regardless, reorganization of the Management Conference shows a concern for adapting to realities of Lagoon stewardship.[454]

In fact, to allow for a more holistic approach to estuarine management, the IRLNEP has amended the boundaries to incorporate an additional 198,678 watershed acres.[455] In 2015, the Volusia County Council requested the IRLNEP to reevaluate planning boundary to include the southern section of the Halifax River, thus extending the northern boundary 25 miles.[456] In response, the IRLNEP incorporated the requested area in the IRL-Halifax Boundary Amendment.[457] Ultimately, the decision was based on the need for integrated estuarine management, considering the integrity of the entire system in ensuring the success of the Lagoon.[458]

Although the IRLNEP system was originally myopic in scope, the response to dramatic conditions and reorganization of the IRLNEP display important characteristics of adaptive management.[459] While the IRLNEP has taken steps to incorporate private entities, the scale is nowhere on par with the TBEP's implementation.[460] Yet, the IRLNEP's governance reorganization and boundary amendments are dramatic steps in holistic management of the Lagoon. With the 2019 CCMP being a dramatic overhaul, the next few years will represent important data on the effectiveness of these steps.[461]

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[451] *Id.*
[452] *Id.*
[453] *See* Press Release, Harris Corp., Harris Corporation Joins Indian River Lagoon Innovators and Investors Network (Sept. 12, 2016), https://www.harris.com/press-releases/2016/09/harris-corporation-joins-indian-river-lagoon-innovators-and-investors-network [https://perma.cc/Y2TP-87GL] ("Partnership with industry leaders like Harris Corporation provides exciting opportunities for innovation, technology development and employee volunteer initiatives.").
[454] IRLNEP 2019, *supra* note 340, at 6.
[455] *Id.* at 80; Volusia Cty. Council, Res. 2015-133 1 (2015) (on file with Volusia County) ("[T]he study area for a successful ecosystem based management program should include connecting estuarine environments").
[456] *See* Volusia Cty. Council, *supra* note 455, at 2.
[457] IRLNEP 2019, *supra* note 340, at 80.
[458] *Id.*
[459] *Id.* at 4, 6.
[460] *Id.* at 8.
[461] *Id.* at 16.

Prior to the algal superblooms, education and outreach in the lagoon was limited to programs targeted at minimizing potential impacts boaters and marinas have on the Lagoon.[462] Other initiatives were fostered through partner agencies' plans, not standing as wholly independent IRLNEP action.[463] However, the blooms have brought national attention to the Lagoon, inspiring both environmental groups and public agencies to educate and involve the public.[464] Although Lagoon-wide response is still problematic because of the complex biodiversity and size of the Lagoon, the 2019 update seeks to incorporate a "one voice" approach to foster collective response.[465]

Although implemented primarily by Brevard County, the "Blue Life" program aimed at providing information to the public about sources of pollution and what lifestyle choices people can make to protect and improve water quality.[466] Unlike the TBEP, the "Blue Life" campaign's effectiveness has been quantitatively measured, showing that participants in it were more informed about stormwater issues and behavior that affects water quality.[467] Similar to the TBEP "Be Floridian" program, the IRLNEP initiated a campaign called "Be Floridian Now," which also focuses on individual choices and their beneficial effect on the Lagoon.[468] This action is complemented by the "Lagoon-Friendly" educational campaign, which promotes the unified mission of the IRLNEP.[469] The program promotes beneficial use of landscaping, proper use of fertilizer, appropriate trash disposal, and clean boating practices.[470]

In addition to IRLNEP funded programs, many conservation groups and government agencies engage citizens for data collection and habitat restoration.[471] More importantly, the use of development taxes for competitive grants opens new avenues for citizen involvement.[472] Regardless, the IRLNEP is still developing a robust base of outreach, as interest

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[462] IRLNEP 2008, *supra* note 435, at 36.
[463] IRLNEP 2019, *supra* note 340, at 158.
[464] *Id.* at 146.
[465] *Id.* at 18.
[466] *Id.* at 146.
[467] *See* Lesley C. Garner & Michael A. Gallo, *Field Trips and their Effect on Student Achievement and Attitudes: A Comparison of Physical Versus Virtual Field Trips to the Indian River Lagoon*, 34 J. COLL. SCI. TEACHING 14 (2015).
[468] IRLNEP 2019, *supra* note 340, at 159.
[469] *Id.*
[470] *Id.*
[471] *Id.*
[472] *Id.* at 148.

in restoring the Lagoon must be maintained beyond the point of superblooms.[473] In addition, the large area of the Lagoon causes trouble for a unified and comprehensive volunteer response. Ultimately, the IRLNEP has acknowledged that funding education and outreach will inevitably benefit the Lagoon.[474] Thus, consistently engaging the citizenry will be important to the health of the Lagoon.

C. Clear Restoration Targets

The restoration goals of the TBEPs and IRLNEP include water quality improvement and habitat restoration.[475] Each of these NEPs has taken a somewhat different approach to defining and achieving these targets.[476] In the Tampa Bay, water quality has drastically improved from "impaired" to "no use threatened" for nitrogen.[477] Meanwhile, the Lagoon has degraded in quality due to septic leakage, superblooms, and freshwater discharges.[478] Yet regardless of external stressors, it is important to look at how the TBEP and IRLNEP manage nutrient loading and watershed management when analyzing the overall success of a NEP program.

1. TBEP: Tampa Bay Nitrogen Management Consortium

As described above, the TBEP has established the Tampa Bay Nitrogen Management Consortium ("TBNMC") to take on the challenge of nutrient pollution to the estuary.[479] The TBNMC has been lauded for working toward the achievement of specific, measurable goals for bay improvement.[480] The TBNMC has accepted responsibility for maintaining nitrogen loads at specific levels necessary to support seagrass recovery in the Tampa Bay.[481] These threshold levels were created by determining the environmental requirements of seagrass, including required water clarity, chlorophyll-a concentrations, and nutrient loadings to maintain

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[473] *Id.* at 146, 148.
[474] IRLNEP 2019, *supra* note 340,at 162.
[475] *Id.* at v.
[476] *Id.* at 16–17; TBEP CCMP, *supra* note 282, at 9–10.
[477] Hearne, *supra* note 403, at 647.
[478] IRLNEP 2019, *supra* note 340, at 4, 53, 80, 81.
[479] TBEP CCMP, *supra* note 282, at 6.
[480] EPA, EPA REGION 4 HONORS ENVIRONMENTAL MERIT AWARD RECIPIENTS (2000), *available at* 2000 WL 34398535.
[481] Edward T. Sherwood, Holly S. Greening, Anthony J. Janieki & David J. Karlen, *Tampa Bay Estuary: Monitoring Long-Term Recovery Through Regional Partnerships*, 4 REG'L STUD. MARINE SCI. 1, 7 (2016).

necessary chlorophyll-a concentrations.[482] Accordingly, meeting these targets is primarily accomplished by a compliance framework that evaluates the frequency and duration of exceeding the specific thresholds established for chlorophyll-a concentrations in each Tampa Bay segment.[483]

If these specific thresholds are exceeded for two consecutive years and the federally recognized TMDL is not exceeded, then a reevaluation of both the TMDL and nitrogen load targets are conducted.[484] Since adoption of this framework, specific cholorophyll-a concentrations have not been exceeded for two consecutive years.[485] In fact, efforts by the TBNMC have consistently reduced nitrogen allocations and maintained historic levels of nitrogen loads.[486] Ultimately, this compliance framework using specific water quality targets has been a successful model to repair and restore the water quality of the Tampa Bay.[487]

The TBNMC distributes nitrogen allocations through a voluntary deliberative process so that the sum of individual allocations does not exceed the TMDL for nitrogen.[488] Historically, the largest allocations belong to agricultural interests with large municipal governments following behind.[489] Moreover, the TBNMC uses a multifaceted approach to reduce impacts to the Tampa Bay by considering stormwater treatment retrofits, atmospheric deposition reduction, industrial and fertilizer manufacturing process upgrades, and wastewater discharge and reuse among others.[490] Through these voluntary loading targets and a combined investment of $639 million paid by TBNMC partners, the group has not only prevented 537 tons of nitrogen yearly from entering the bay, but has moved that status of Tampa Bay from "impaired or threatened" to "no use threatened."[491] Using equitable pollutant allocations and strategic

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[482] Holly Greening & Bruce D. DeGrove, *Implementing a Voluntary, Nonregulatory Approach to Nitrogen Management in Tampa Bay, FL: A Public/Private Partnership*, 1 SCI. WORLD J. 378, 379 (2001).
[483] Sherwood et al., *supra* note 481.
[484] *Id.*
[485] *Id.*
[486] *Id.* at 8.
[487] Letter from Julie Espy, Program Adm'r, Water Quality Assessment Program, Florida Dept. of Envtl. Prot., to Holly Greening, Executive Director, Tampa Bay Estuary Program, *Approval of the Nitrogen Management Consortium's Reasonable Assurance Plan* (Nov. 15, 2017), http://www.tbeptech.org/NitrogenMgmtConsort/ReasonableAssurance/2017_Submittal/FDEP_2017_RA_Update_Approval_Letter_11152017.pdf [https://perma.cc/7TZ4-826H].
[488] Hearne, *supra* note 403, at 670.
[489] *Id.* at 671.
[490] TBEP CCMP, *supra* note 282, at 14.
[491] *Id.* at 15; Hearne, *supra* note 403, at 647–48.

project implementation, the TBNMC has been a crucial factor in reducing immense amounts of nonpoint pollution from infiltrating the watershed.[492] Ultimately, the TBNMC acts as a model for how localized effort is often more effective than centralized legislation, as a collaborative group of private and public entities have been able to restore water quality in the Tampa Bay despite the pressures of a growing population.

2. IRLNEP: Indian River Lagoon Act

As more people moved to the Indian River Lagoon region, concerns for public health prompted the construction of wastewater treatment plants ("WWTPs") to collect and treat wastewater.[493] In response to the growing population and waste discharge, the 1990 Indian River Lagoon Act ("Lagoon Act") sought to prohibit "new discharges or increased loadings from existing sewage treatment facilities into the Indian River Lagoon System; requiring elimination of existing discharges of treated effluent into the system before July 11 1995."[494] While no new discharges were permitted and existing discharges were meant to halt, the Act carved out exceptions for any application that either:

> (a) If the applicant conclusively demonstrates that no other practical alternative exists and the discharge will receive advanced waste treatment or a higher level of treatment: or
> (b) If the applicant conclusively demonstrates that the proposed discharge will not result in violation of state water quality standards, either by itself or in combination with other discharges and will not hinder efforts to restore the water quality of the Indian River Lagoon System: or
> (c) If the applicant's discharge is an intermittent surface water discharge occurring during wet weather conditions . . . .[495]

However, the Lagoon Act does not address industrial discharges in any manner, and as of 2008, there are more than fifty permitted industrial

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[492] *See* Hearne, *supra* note 403, at 673 ("Ninety-five percent of the projects implemented addressed nonpoint sources (accounting for 71% of expected TN reductions), and the projects were split evenly between public and private entities.").
[493] IRLNEP 2008, *supra* note 435, at 10.
[494] Ch. 90-262, 1990 Fla. Laws 1890 (1990) [hereinafter Indian River Lagoon Act].
[495] *Id.* § 2(3).

waste discharges.[496] Additionally, it has been recognized that the Lagoon Act does not appropriately cover large inputs that affect water quality and, in turn, seagrasses.[497] Furthermore, the Lagoon Act's central concern has been deemed to be the centralization of septic, rather than the reduction of concrete discharge from the Lagoon.[498]

In fact, when confronted with issue of preventing actual discharge or centralizing existing septic, the court found that the overriding concern of the Lagoon Act was to connect septic and remove problematic package plants rather than numeric discharge.[499] In *Biddulph v. Volusia County*, an administrative judge ordered that although a facility in question would increase discharge to the river, since it had been previously permitted for a higher amount, the new discharge would be preferable to septic.[500] Moreover, the court held that it was not the purpose of the Lagoon Act to modify existing permits when WWTPs were functioning below permitted capacity.[501] Thus, the judge held that the "clear intent of the Indian River Lagoon Act is to get areas presently served improperly by septic tank or package plant sewage disposal to connect up as soon as possible to centralized collection and treatment systems" regardless of increased loading from centralized plants so long as permit limits are still observed.[502]

The Petitioner argued that allowing discharge interprets the Lagoon Act as a "none means some" game, the court stated that increased loadings are presumed by the Lagoon Act as preferable to improper discharge from septic and package plants, so long as the central treatment facilities do not "exceed permitted discharge limits and loadings . . . ."[503] Package plants have been defined as "[f]acilities with percolation ponds, absorption fields, or other sub-surface disposal; systems located within 100 feet of the shoreline or within 100 feet of any canal or drainage ditch that discharges or may discharge to the Lagoon System

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[496] IRLNEP 2008, *supra* note 435, at 10.
[497] Endangered and Threatened Species; Threatened Status for Johnson's Seagrass, 63 Fed. Reg. 177 (proposed September 15, 1993) (to be codified at 50 C.F.R. pt. 277) ("[T]he Florida Indian River Lagoon Act of 1990 does not cover other large inputs that will affect water quality, which in turn could affect seagrasses (e.g., industrial discharges, brine disposal, canals, processing plants).").
[498] *See* Indian River Lagoon Act § 4.
[499] Biddulph v. Volusia County, No. 92-1388 (Fla. DOAH Mar. 22, 1993) (Final Order No. 92-5033).
[500] *Id.* at *1.
[501] *Id.* at *2.
[502] *Id.*
[503] *Id.* at *3, ¶ 40.

during wet periods."[504] Originally, package plants were determined to be harmful to the Lagoon by virtue of their proximity and disposal method. Therefore, fifty-three package treatment plants have been eliminated after being identified as threats by the Lagoon Act.[505] However, the broad exceptions carved out in the Lagoon Act became a way for package plants to subsist even after being identified as harmful to the health of the Lagoon.[506]

A recent administrative hearing involved a "dilapidated" WWTP that was brought into compliance, until it was identified as a package plant by virtue of its location 100 feet from a Lagoon tributary.[507] A 1999 order determined that the plant lacked reasonable assurance documentation and was a threat to water quality, requiring that it be centralized within 150 days or provide appropriate reasonable assurances of discharges.[508] In 2003, the plant operator was notified of the ability to connect to a central plant. In response, the plant operator asserted that he intended to instead provide reasonable assurance documentation and submitted a permit renewal.[509]

Despite being identified as a package plant and ordered into compliance four years prior, the operator still sought an exception under the Act by "conclusively demonstrat[ing]" that the plant's discharge would not violate water quality standards or hinder efforts to restore the Lagoon.[510] Despite the policy prohibition against package plants, the court found that the mere fact that the plant was within 100 feet of the Lagoon did not create a legal presumption that it would violate water quality.[511] In fact, there were no direct discharges and no proof of failure or seepage.[512] Regardless of the Lagoon Act's supposed intent to enforce water quality standards and centralize package plants, the plant was approved as an exception to the Lagoon Act.[513] Thus, the noble goals of the Lagoon Act in restoring water quality have been undermined by broad exceptions. In contrast to the participatory approach to nutrient reduction and improved water quality taken by Tampa Bay Nitrogen Management Consortium, IRLNEP's reliance on a top-down regulatory approach has proved of limited value.

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[504] Laniger Enters. of America, Inc. v. Dept. of Env't Prot., No. 05-0726 at 3 (Fla DOAH Nov. 1, 2006) (Final Order No. 05-1599).
[505] Martin Cnty. Land Co. v. Martin Cnty., No. 15-0300GM at 15 (Fla. DOAH Sep. 1, 2015).
[506] *See Laniger Enters. of America*, No. 05-0726 at 9.
[507] *Id.* at 1–4.
[508] *Id.* at 4.
[509] *Id.* at 5.
[510] *Id.* at 9.
[511] *Id.* at 11.
[512] *Laniger Enters. of America*, No. 05-0726 at 9.
[513] *See id.*

3. TBEP: Great Strides in Habitat Restoration

The TBEP has agreed that protection and restoration of seagrasses are of primary importance in managing the estuary.[514] Seagrasses are vital indicators of the health of shallow estuaries primarily because of their sensitivity to submarine light and water clarity.[515] In addition, seagrasses support coastal food chains, serve as fish nurseries, reduce wave impacts, help stabilize sediments, and play an integral role in nutrient cycling.[516] In many estuarine systems, seagrass is a central component in evaluating the productivity and effectiveness of a NEP program.[517] In fact, the importance of seagrass was determined very early in the history of the NEP program.[518] Further, damage to seagrass results in severe loss of essential ecological services that maintain the integrity of the bay.[519] Ultimately, the TBEP's inclusion of seagrass as a metric of success is motivated in part by the resource-based approach initiated in managing the watershed.[520]

In 1995, the TBEP adopted goals of restoring seagrass coverage to historic levels after years of decline caused by dredging and nutrient inputs.[521] Much progress was already made prior to 1990 via the Grizzle-Figg Act, which required WWTPs to greatly reduce nitrogen inputs.[522] Regardless, the goal of restoring seagrass acreage to 1950s levels was not just met, but surpassed.[523] By 2015, seagrasses stretched more than 41,655

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[514] J.O. R. JOHANSSON & HOLLY S. GREENING, *Seagrass Restoration in Tampa Bay: A Resource Based Approach to Estuarine Management*, *in* SEAGRASSES: MONITORING, ECOLOGY, PHYSIOLOGY, AND MANAGEMENT 291 (2000).
[515] *Id.* at 280.
[516] *Id.*
[517] *Id.*
[518] EPA, OFF. OF WATER, EPA503/9-92/007, THE NATIONAL ESTUARY PROGRAM AFTER FOUR YEARS—A REPORT TO CONGRESS (1992) ("Seagrass and SAV are prime habitat for many important species and good indicators of the overall health of the lagoon.").
[519] Consent Decree, United States v. Tsacaba Shipping Co., Inc. (No. 96-1556-CIV-T-23E, M.D. Fla., Jan. 28, 1999) at *142–43, available as 1999 EPA Consent LEXIS 58.
[520] JOHANSSON & GREENING, *supra* note 514, at 285; TBEP CCMP, *supra* note 282, at 14 ("Seagrasses were selected as a metric by which efforts to improve the bay are measured because of their overall importance as a bay habitat and nursery, and because they are an important barometer of water quality.").
[521] TBEP CCMP, *supra* note 282, at 14.
[522] Hannah Waters, *Bringing Back Tampa's Seagrass*, SMITHSONIAN OCEAN (Jan. 2017), https://ocean.si.edu/ocean-life/plants-algae/bringing-back-tampa-bays-seagrass [https://perma.cc/Z86U-EUT6].
[523] *See generally Tampa Bay Seagrasses Meet—and Exceed—Recovery Goal*, TAMPA BAY ESTUARY PROGRAM (May 13, 2015), http://web.archive.org/web/20160325121946/http://

acres of the Tampa Bay, vastly surpassing the restoration target of 38,000 acres.[524] Moreover, this coverage set a record for the highest seagrass coverage documented since 1950.[525] Regardless, the TBEP's seagrass recovery progress is one of the first large-scale systems to see dramatic recovery.[526] The rejuvenation of Tampa Bay has been hailed as a model for NEPs seeking to restore critical coastal habitat, proving that large scale restoration is possible.[527] However, scientist caution that the methodology for aerial surveys may have skewed results, and that sewer overflows during heavy rainfalls may damage existing coverage.[528] Former TBEP Director Holly Greening cautioned against becoming complacent about seagrass restoration efforts, especially with accelerated growth in the Tampa Bay watershed.[529] Nevertheless, the TBEP management of the watershed in collaboration with the TBNMC has resulted in critical success in habitat restoration.[530]

Seagrass restoration has been incorporated in a bay-wide habitat restoration master plan, which also includes protection targets for mangroves, salt marshes, and salt barrens.[531] The current plan is based on restoring habitats to historical proportions (circa 1950) to restore the "full mosaic of habitats necessary to support fish and wildlife . . . ."[532] While the Habitat Master Plan has made tremendous progress in restoring habitat, the science behind the plan must be updated and revised.[533]

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tbep.org/pdfs/press/tampa-bay-seagrasses-meet-restoration-goal.pdf [https://perma.cc/YE7P-FCFZ].

[524] Waters, *supra* note 522; TBEP CCMP, *supra* note 282, at 14.

[525] Victoria Parsons, *Tampa Bay Seagrasses Continue to Surpass Recovery Goal*, BAYSOUNDINGS (Feb. 10, 2017), http://baysoundings.com/tampa-bay-seagrasses-continue-to-surpass-recovery-goal/ [https://perma.cc/R3GD-Y6H9].

[526] Waters, *supra* note 522.

[527] Letitia Stein, *In Tampa Bay, Rare Environmental Win Measured in Seagrass*, REUTERS (June 9, 2015), https://uk.reuters.com/article/us-usa-environment-tampabay/in-tampa-bay-rare-environmental-win-measured-in-seagrass-idUKKBN0OP13Z20150609 [https://perma.cc/LY62-DQNJ].

[528] Parsons, *supra* note 525.

[529] TAMPA BAY ESTUARY PROGRAM, *supra* note 523 ("Greening cautioned against becoming complacent about our success and slowing bay restoration and protection efforts. With growth accelerating, 'it will be a challenge to sustain this momentum and these types of gains in the coming years.'").

[530] TBEP CCMP, *supra* note 282, at 15.

[531] These targets include: (1) Seagrass—38,552 acres; (2) Mangrove Forest—15,139 acres; (3) Salt Marsh—6,313 acres; (4) Salt Barren—1,287 acres. TAMPA BAY ESTUARY PROGRAM, TAMPA BAY ESTUARY PROGRAM HABITAT MASTER PLAN UPDATE 80 (2010).

[532] TBEP CCMP, *supra* note 282, at 65.

[533] Susan Ladika, *Habitat Plan Focuses on Restoring the Balance*, BAYSOUNDINGS (2010),

For example, the Habitat Master Plan's last update in 2010 failed to include various hard bottom communities, while also failing to explain why mangroves outcompeted other coastal habitats.[534] In response, research is underway to better understand tidal creeks and the historic and current areal extents of tidal flats, oyster reefs and hard bottom habitats.[535] Regardless, provisional targets for these habitats are included in the 2010 update.[536] Yet, with a growing population and climate, the TBEP may consider reevaluating the paradigm of restoring to historical levels, thereby demonstrating a need to revise restoration targets.[537]

The Habitat Master Plan also recommended the creation of similar restoration targets for freshwater wetlands, another critical habitat type.[538] As such, the TBEP has incorporated a Freshwater Habitat Master Plan into the CCMP by adopting specific restoration targets for freshwater wetlands.[539] Since the 1950s, the watershed has lost approximately 33 percent of wetland coverage.[540] Building off the *Restoring the Balance* paradigm, the plan bases restoration targets off restoring this lost coverage to historical levels.[541] This philosophy of restoration seeks "to provide adequate diversity of habitats for the suite of fish and wildlife species that inhabit them."[542] Although the goal is lofty, the plan contemplates that targets are achievable through a combination of publicly financed restoration and privately funded compensatory mitigation.[543] In addition, the CCMP contemplates a bay wide protection target of 229,958 acres, encompassing the existing 149,683 acres of forested and 80,275 acres of non-forested freshwater wetlands within the watershed.[544]

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http://www.tampabay.wateratlas.usf.edu/upload/documents/Habitat-Plan-Focuses-on-Restoring-the-Balance.pdf [https://perma.cc/4AQB-PD7W].

[534] *Id.*

[535] TAMPA BAY ESTUARY PROGRAM, *supra* note 531, at 85.

[536] These provisional targets include: (1) Oyster Bar ~44 acres; (2) Tidal Tributaries ~1,400 linear miles; (3) Coastal Uplands ~12,929 acres; (4) Flatwoods Marshes ~27,243 acres. *Id.*

[537] TBEP CCMP, *supra* note 282, at 68.

[538] TAMPA BAY ESTUARY PROGRAM, MASTER PLAN FOR THE PROTECTION AND RESTORATION OF FRESHWATER WETLANDS IN THE TAMPA BAY WATERSHED, FLORIDA 2 (2014).

[539] The targets include a total of 18,703 acres of freshwater wetlands, consisting of 17,088 acres of non-forested and 1,615 acres of forested wetlands. TBEP CCMP, *supra* note 282, at 91.

[540] TAMPA BAY ESTUARY PROGRAM, *supra* note 538, at ix.

[541] TBEP CCMP, *supra* note 282, at 90.

[542] TAMPA BAY ESTUARY PROGRAM, *supra* note 538, at ix.

[543] *Id.*; TBEP CCMP, *supra* note 282, at 90.

[544] TBEP CCMP, *supra* note 282, at 91.

Finally, TBEP proactively created the Critical Coastal Habitat Assessment Program to track the long-term changes of habitat due to sea level rise.[545] Holistically, the program seeks to combat the effects of climate change on the health of the estuary by ensuring habitat migration may naturally occur.[546] The program has led to the purchase and restoration of 19 out of 28 identified critical sites threatened by "coastal squeeze."[547] Additionally, the TBEP has sought to mitigate sea level rise by expanding its living shorelines programs.[548] Examples of shoreline restoration in Tampa Bay include the Ulele Springs restoration in downtown Tampa (rock revetment and native plants);[549] the MacDill Air Force Base living shoreline project (oyster reefs and salt marsh grass);[550] and the oyster reef/breakwater along the Alafia Bank Bird Sanctuary.[551]

Ultimately, the TBEP has done remarkably well at habitat restoration—especially considering the restoration of seagrass to historical levels.[552] While the TBEP must remain vigilant about maintaining this progress, the continued focus on preserving sensitive habitat in light of an expanding population, works as a hallmark for a successful program. Accordingly, the TBEP's habitat restoration deserves praise as a model for habitat restoration.[553]

4. IRLNEP: The Need for Strategy

Habitat restoration in the Lagoon has taken a far different approach than that in the TBEP, especially with regard to seagrass. In the 2008 CCMP, seagrass degradation was recognized and monitored, but a comprehensive strategy for restoring seagrass had not been created.[554] In the 11 years since the 2008 update, the IRLNEP has still not created

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[545] *Id.* at 68.
[546] Zac Taylor, *Climate Change: Across Tampa Bay, Environmental Organizations Mobilize Around Sea Level Rise*, 83DEGREES (Apr. 12, 2016), https://www.83degreesmedia.com/features/climatechange041216.aspx [https://perma.cc/2A28-FVX2].
[547] *See* TBEP CCMP, *supra* note 282, at 68, 143 ("Coastal squeeze occurs when upslope migration of habitat is impeded by development.").
[548] *Id.* at 81.
[549] TBEP CCMP, *supra* note 282, at 82.
[550] *Id.*
[551] *Id.*
[552] Stein, *supra* note 527.
[553] *Id.*
[554] IRLNEP 2008, *supra* note 435, at 49–50.

a comprehensive seagrass restoration strategy, while degradation has only increased lagoon-wide.[555] To date, seagrass restoration within the Lagoon has been limited, small in scale, and costly.[556] For example, pilot projects have involved the physical planting of seagrass to improve water quality, not to meet a specific restoration goal.[557] Moreover, the size of restoration may change in the future based on seagrasses' response to changing conditions.[558] In fact, while seagrass is reviving in some areas, researchers are informally comparing restoration efforts to a baseline from before the 2011 superblooms instead of the historical baseline seen in the TBEP efforts.[559] However, seagrass may not be the most appropriate method for gauging the health of the Lagoon, as seagrass acreage was actually increasing prior to the 2011 superbloom.[560] According to Duane De Freese, evaluating the success of the IRLNEP and the health of the Lagoon may be better analyzed by looking at the accumulation of macroalgae, temperature, and nutrient cycling in the waters.[561] Regardless, the IRLNEP has not developed a seagrass restoration program akin to the TBEP's Habitat Master Plan.

Moreover, specific listed estuarine habitat is receiving little individual consideration, as the IRLNEP has not yet created or listed habitat restoration targets for specific ecosystems.[562] While Brevard County has begun to make strides in targeted restoration with subject matter consultation from the IRLNEP, the IRLNEP is still evaluating data in creating Lagoon-wide restoration targets.[563] However, the IRLNEP philosophy of

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[555] IRLNEP 2019, *supra* note 340, at 60.
[556] *Id.* at 54.
[557] News Release, Dawn Harris-Young, EPA, EPA and Indian River Lagoon National Estuary Program Recognize Earth Day in Stuart, Florida (Apr. 24, 2019), https://www.epa.gov/newsreleases/epa-and-indian-river-lagoon-national-estuary-program-recognize-earth-day-stuart-florida [https://perma.cc/N8NL-4U3S].
[558] IRLNEP 2019, *supra* note 340, at 61.
[559] *See Seagrass Beds Are Starting To Revive Along The Indian River Lagoon; But For How Long?*, FLA. OCEAN (Oct. 15, 2019), https://www.floridaocean.org/news/seagrass-beds-are-starting-revive-along-indian-river-lagoon-how-long [https://perma.cc/P89Z-LRFQ] ("To see what seagrass in the lagoon should be like, you'd have to go back to 2012 or early 2013, before the 'lost summer' brought on by massive Lake O discharges to the St. Lucie River.").
[560] *See* Lori J. Morris & Robert W. Virnstein, *The Demise and Recovery of Seagrass in the Northern Indian River Lagoon, Florida*, 27 ESTUARIES 915 (2004); *see also* Dafforn et al., *supra* note 23, at 207.
[561] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, WORKPLAN INDIAN RIVER LAGOON NATIONAL ESTUARY PROGRAM FISCAL YEAR 2017–2018 44 (2017).
[562] IRLNEP 2019, *supra* note 340, at 65.
[563] *See* BREVARD CNTY., NAT. RES. MGMT. DEPT., SAVE OUR INDIAN RIVER LAGOON PROJECT

habitat restoration differs from the TBEP in that it seeks to consider the biodiversity in their restoration goals instead of mere historical levels.[564] In 1995, the IRLNEP hosted a symposium to address the lack of a comprehensive habitat restoration plan based on a synthesis of currently available information.[565] While the symposium never produced results, the 2020 symposium seeks to reassess the biodiversity of the river and make progress towards a habitat restoration plan backed by science.[566] In fact, the IRLNEP 2008 CCMP committed to a policy of expanding research initiatives to create a habitat identification and inventory, as well as increased monitoring.[567] Regardless of these conversations, the IRLNEP lacks targeted habitat restoration.[568]

Alternatively, the IRLNEP has made great strides in restoring and reconnecting the 40,000 acres of wetland impounded or ditched for mosquito control purposes.[569] A total of 27,033 acres have been completely reconnected to the watershed, with 7,004 acres are targeted for restoration.[570] Moreover, the IRLNEP's Blueway project has "acquired approximately 8,800 acres of land in the watershed" with mangrove replanting helping to restore critical habitat.[571]

Yet one of the most innovative strategies regarding proactive restoration stems from the decision of the IRLNEP to amend their boundary to include the Halifax River.[572] In doing so, the IRLNEP postulates that ecosystem-wide restoration will require the program to "communicate, cooperate, and coordinate with regional restoration initiatives on connected and adjacent waters and watersheds."[573] This cooperation between the IRLNEP, SFWMD, and the ACOE has spurred the implementation of the IRL-South project.[574] Regarding habitat restoration, this

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PLAN 2020 UPDATE FOR BREVARD COUNTY, FLORIDA viii, ix (June 2020) (IRLNEP Executive Director Duane De Freese has been consulted as a subject matter expert in developing the restoration plan).

[564] INDIAN RIVER LAGOON SYMPOSIUM, http://www.indianriverlagoon.org/Symposium.html [https://perma.cc/QQ56-MG9U] (last visited Nov. 24, 2020).

[565] *Id.*

[566] *Id.*

[567] IRLNEP 2008, *supra* note 435, at 70–72.

[568] IRLNEP 2019, *supra* note 340, at 55.

[569] *Id.* at 67.

[570] *Id.* at 75.

[571] EPA, *supra* note 290, at 94.

[572] IRLNEP 2019, *supra* note 340, at 80.

[573] *Id.*

[574] *Id.* at 81.

program will restore approximately 92,100 acres of upland and wetland habitat, remove 7.9 million cubic yards of muck, install 900 acres of oyster shells, and install artificial submerged vegetation near muck removal sites for habitat improvement.[575] Ultimately, the CCMP broadly states that it will consider the extended boundary and Everglades restoration in all future actions.[576]

Generally, the EPA suggests that success may be measured by simplifying and defining goals into "readily measured, unambiguous terms."[577] Thus, it seems appropriate that the future Habitat Restoration Plan is mentioned throughout the CCMP as a critical piece necessary for managing the estuary.[578] However, time will tell if the IRLNEP follows through with the lofty goals of the CCMP to achieve both defining its goals and comprehensive restoration.

D. Ongoing Financial Commitments

It is not possible to successfully protect, manage, and restore any ecosystem without significant financial resources.[579] However, equally important to access to financial resources are mechanisms put in place to ensure funding will be regular, consistent, and safe from disappearing with changing priorities of each new agency administration or as a result of political whim. Without ongoing consistent funding, it is impossible to plan for the future.[580] Ongoing financial commitments are critical to ongoing research and monitoring, which is necessary to measure success and engage in effective adaptive management. Rather than relying on one, or a limited number of funding mechanisms, it may be prudent to seek out a diverse array of financial support so that redundancies are built into the system and even if one funding source disappears, others are in place to fill the void.

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[575] *Id.*
[576] *Id.* at 81–82.
[577] *See* EPA, *supra* note 290, at 45 ("Measuring success can be simplified by defining goals and objectives in readily measured, unambiguous terms.").
[578] TBEP CCMP, *supra* note 282, at 62, 66, 70, 71, 81, 100, 107.
[579] Tommie Herbert, Rebecca Vonada, Michael Jenkins & Ricardo Bayon, *Environmental funds and payments for Ecosytems Services*, FOREST TRENDS 5 (2010).
[580] *Federal Support Needed to Fully Implement CERP*, S. FLA. WATER MGMT. DIST., https://www.sfwmd.gov/our-work/cerp-project-planning/cerp-implementation [https://perma.cc/F5US-W8WG (last visited Nov. 24, 2020).

1. TBEP: Diverse and Varied Funding

The mission in funding the TBEP is to develop dedicated sources to sustain operations (such as personnel, community outreach, environmental monitoring, and technical support) while utilizing both dedicated and variable sources to fund actions that enhance and implement the goals of the CCMP.[581] In line with this ideal, the TBEP considers the following as a comprehensive list of potential funding sources to accomplish action items: funding from CWA section 320, EPA grants, local government and industry funds, programmatic funds, SWFWMD and Tampa Bay Water, FDACCS, UF IFAS, external grants, FDEP, contributions from TBNMC members, Environmental Protection Commission of Hillsborough County ("EPCHC"), Bay Mini-grants funded through license plate sales, Tampa Bay Environmental Restoration Fund ("TBERF"), EPA Climate Ready Estuaries and Brownfield grants, NOAA, USGS, National Institute of Health, National Institute of Science, Clean Vessels Act and the FWC, Wetland Protection Development Grants, boater registration fees, Deepwater Horizon settlement funds, USFWS Community Grants, Sea Grant, Sports Fish Restoration Act, USACE, Hillsborough County Pollution Recovery Fund, Coast Guard, RESTORE Act grants, and the Florida Land Acquisition Trust Fund.[582] However, the working budget produced by the TBEP splits funding sources into five broad groups.[583]

First, the TBEP receives $600,000 in dedicated funding from EPA NEP program under CWA section 320.[584] These funds come from the EPA's Clean Water State Revolving Fund ("CWSRF"), which is used to implement projects so long as they are approved in a CCMP.[585] The federal funding is matched with $600,000 in funding from local governments, SWFWMD, and in-kind donations from Pinellas County for a total of $1.2 million in cooperative funding.[586] These matched donations are generated via funding schedules calling for due payments from the local partners designated in the interlocal agreement.[587]

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[581] TBEP CCMP, *supra* note 282, at 151.
[582] *Id.* at 17, 20, 23, 26, 27, 30, 33, 34, 37, 47, 51, 53, 57, 64, 68, 73, 76, 78, 82, 89, 103, 113, 119, 122, 131, 140.
[583] *See* TAMPA BAY ESTUARY PROGRAM, 2018–2019 FINAL EPA WORKPLAN AND BUDGET (2018).
[584] *Id.*
[585] EPA, EPA PUBLICATION 832F19003, FUNDING CLEAN WATER STATE REVOLVING FUND PROJECTS UNDER CLEAN WATER ACT SECTION 320 AUTHORITY (NATIONAL ESTUARY PROGRAM) 1 (2019).
[586] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 52.
[587] TBEP CCMP, *supra* note 282, at 152.

Second, the TBERF funds objectives of the CCMP through a competitive annual grant program for eligible conservation projects.[588] TBERF is managed through a strategic partnership between TBEP and Restore America's Estuaries ("RAE"), and has received more than $4.4 million to support 56 projects throughout the Tampa Bay watershed since its inception in 2013.[589] TBERF was founded by TBEP, RAE, SWFWMD, and The Mosaic Company, but has since expanded to encompass over fourteen public and private sector partners.[590] Through the grant program, TBERF uses its considerable funding to finance specific objectives that help to both restore and protect vital wetland habitat as well as improve stormwater management.[591] Although funded proposals are not listed in the annual budget report, the TBERF generates around $30,000 to $40,000 for each fiscal year, with a total working allowance of $3.7 million as of 2019.[592]

Third, the TBEP has sought and received preliminary approval for approximately $2 million to fund "shovel ready" projects that have a regional or gulf-wide impact by virtue of the RESTORE Act.[593] In the wake of the Deepwater Horizon Settlement, the RESTORE act funded a trust from civil penalties in order to "makes funds available for the restoration and protection of the Gulf Coast Region[]."[594] Under the RESTORE Act's competitive funding application, the TBEP was selected to receive funding for both habitat restoration projects and greenhouse gas reduction projects.[595]

Fourth, the TBEP has been proactive in both pursuing and obtaining variable, short-term funding from external grants.[596] Over the last several years, these external sources have resulted in both an increase in projects and total funds directed at implementing the CCMP.[597] As of February 2018, the TBEP is managing approximately $3.9 million in external grant awards.[598]

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[588] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 58.
[589] *Tampa Bay Environmental Restoration Fund*, RESTORE AMERICA'S ESTUARIES, https://estuaries.org/initiatives/tberf/ [https://perma.cc/3NFC-NLPY] (last visited Nov. 24, 2020).
[590] *Id.*; TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 58.
[591] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 58–89.
[592] *Id.* at 59–61; TBEP CCMP, *supra* note 282, at 152.
[593] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 67.
[594] Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States, 84 Fed. Reg. 64, 12929 (Apr. 3, 2019) (to be codified at 31 C.F.R. pt. 34).
[595] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 67.
[596] TBEP CCMP, *supra* note 282, at 152.
[597] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 5.
[598] *Id.*

Finally, the TBEP has funded a competitive "mini-grant" program that helps to directly implement bay restoration goals by funding small local and community-driven projects.[599] Funds for the program come from the sale of TBEP-specific license plates.[600] Since its inception in 2000, the specialty license plate has generated more than $2 million.[601] Each year, the license plate is expected to generate at least $100,000, with $85,000 available for the mini-grant program.[602]

Ultimately, the TBEP has a diverse source of both federal, state, local, and private funding to fund a variety of projects throughout the region and implement the goals of the CCMP.[603] For example, although the TBEP EPA funding amounted to $1.2 million for the 2018–2019 fiscal year, the agency had a potential pool of approximately $10,885,000.[604] According to the State of the Bay Report, the TBEP agency-wide budget was an average of $2,091,603.[605] Yet for its geographical size and relative population, the TBEP has done a remarkable job of pooling financial resources from all sectors to create the largest possible outcome regardless of the lack of actual NEP funding.

2. IRLNEP: Similar Dedicated Funding, Larger Scope

In comparison to the TBEP, the IRLNEP has not secured reliable funding from diverse and varied sources.[606] In fact, the IRLNEP receives most of its funding from public entities, license plate sales, some private conservation groups, and few private entities.[607] Although the TBEP's fiscal budget is comparable to the IRLNEP, the problems across the Lagoon are of much larger scale and scope.[608] Moreover, while the total watershed is comparable to that of the TBEP, the jurisdictional scope spans an entire coast rather than an open estuary.[609] Regardless, the IRLNEP has sought to fund "shovel-ready" projects throughout the Lagoon through

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[599] *Id.* at 62.
[600] TBEP CCMP, *supra* note 282, at 152.
[601] *Id.*
[602] TAMPA BAY ESTUARY PROGRAM, *supra* note 583, at 65.
[603] TBEP CCMP, *supra* note 282, at 152.
[604] *See id.*
[605] TAMPA BAY ESTUARY PROGRAM, PROGRAM ACCOMPLISHMENTS 2016–2018: THE STATE OF THE BAY 3 (2018).
[606] IRLNEP 2019, *supra* note 340, at 22.
[607] *Id.* at 6, 22, 100, 160.
[608] IRL COUNCIL, FY 2019–2020 FINAL BUDGET 2 (2019).
[609] IRLNEP 2019, *supra* note 340, at 3.

federal funding, government partners, license plates sales, tax structures, grant programs, state funding, and various groups.[610]

Foremost, the IRL Council acts as the primary funding mechanism for the IRLNEP, crafting a budget through a combination of contributions from county governments, state government agencies, license plate sales, and dedicated federal funding from the CWSRF.[611] Since the IRL Council's reorganization in 2015, funding has rapidly increased from $600,000 to an annual budget to $2,100,000.[612] For one, the EPA contributes $600,000 in dedicated funding under section 320 of the CWA.[613] Additionally, the "annual funding commitments from each of the IRL Council partners include $250,000 from DEP, $500,000 from SJRWMD, $500,000 from SFWMD, and $50,000 from each of the five counties (Volusia, Brevard, St. Lucie, Martin, and Indian River)."[614] Finally, sales from the IRL license plate generate about $125,000 per year.[615] At first glance, it seems like the IRLNEP is actually better funded than the TBEP. However, the IRL Council's failure to include private parties, a lack of strong local non-profits, and short life span of the Council structure all have made funding projects in the Lagoon difficult.[616]

However, the IRLNEP and its partners have made significant progress in finding unique funding opportunities not sought by the TBEP, such as sales taxes, state legislature appropriations, and alternative grant programs.[617] First, local discretionary sales tax initiatives from Brevard, Indian River, and St Lucie County have begun to support Lagoon restoration, allocating millions for restoration projects in the coming years.[618] Additionally, changes to the Florida Statute in 2018 have changed how tourist development taxes may be spend.[619] Consequentially, the

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[610] *Id.* at 6, 21, 76, 160.
[611] *Id.* at 6; EPA, FUNDING CLEAN WATER STATE REVOLVING FUND PROJECTS UNDER CLEAN WATER ACT SECTION 320 AUTHORITY at 1 (2019).
[612] IRLNEP 2019, *supra* note 340, at v.
[613] *Id.* at 5.
[614] *Id.*
[615] *Id.*
[616] *See supra* Section IV.D.1.
[617] IRLNEP 2019, *supra* note 340, at 21, 46, 160.
[618] *Id.* at 21; *see also* Dave Berman, *Commissioners to Vote on Updated Plan to Clean Up Indian River Lagoon with Sales Tax Money*, FLA. TODAY (Mar. 9, 2020), http://www.floridatoday.com/story/news/local/environment/2020/03/09/commissioners-vote-updated-plan-clean-up-lagoon-sales-tax-money/4937033002/ [https://perma.cc/8UMP-5T42] ("The latest version . . . allocates $55.5 million of previously unallocated revenue to projects. It includes 43 new projects, bringing the total number of projects recommended for funding to 242.").
[619] IRLNEP 2019, *supra* note 340, at 160.

Brevard County Tourist Development Council created a grant program from the County's 5 percent development tax, awarding up to $900,000 in funding for "projects that demonstrate a benefit to the health of the IRL and a positive impact to Brevard County tourism."[620] Already, a total of $325,865 has been allotted to eight projects, including shoreline stabilization, litter removal, and restoration enhancement.[621] Finally, the Lagoon has been listed as a top priority for Florida Forever funding—a public land acquisition program to secure and conserve lands throughout the state.[622] Such a commitment may help the IRLNEP fund its habitat restoration and enhancement programs through legislative appropriations in addition to local funding.[623] Additionally, the IRL CCMP designates a variety of diverse sources of possible funding sources such as: USFWS, FWC, National Park Service, Florida Inland Navigation District, the Florida Land Acquisition Trust Fund, FDACS Rural Land Protection Program, private conservation groups like the Nature Conservancy, Seagrant, fundraising, and academia interest groups.[624] Yet in the end, the IRLNEP is unable to take advantage of RESTORE funding, and lacks the public and private monetary support seen in the TBEP.[625] Although the IRLNEP does fund more "shovel-ready" projects than the TBEP, securing reliable funding is a necessity. Hopefully, the IRLNEP will continue its recent trend of securing more funding, especially since the economic value of the Lagoon has been quantified at $7.6 billion.[626]

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[620] *Id.*

[621] Dave Berman, *Tourist Development Council Approves Grants for Eight Projects to Help Indian River Lagoon*, FLA. TODAY (Dec. 20, 2018), https://www.floridatoday.com/story/news/local/environment/2018/12/20/tourist-development-council-oks-grants-eight-projects-help-lagoon/2369872002/ [https://perma.cc/SZL9-ENLE].

[622] *See* Ali Schmitz, *Florida Forever Bill Approved in Senate, but Fate in House Uncertain*, TCPALM (Jan. 31, 2018), https://www.tcpalm.com/story/news/local/indian-river-lagoon/politics/2018/01/31/florida-forever-bill-approved-senate-but-fate-house-uncertain/1082462001/ [https://perma.cc/PTK2-J2DF] ("The state Department of Environmental Protection has listed the Indian River Lagoon Blueway as a top priority for Florida Forever funds. The state hopes to buy more than 19,400 acres to create habitat and a travel corridor for wildlife along the 156-mile lagoon.").

[623] TBEP CCMP, *supra* note 282, at 76 ("Over the last 20 years, 8,018 acres have been acquired at a cost of $45 million leaving 19,433 remaining to be acquired.").

[624] *Id.* at 58, 63, 76, 83, 98, 111.

[625] *About the RESTORE Act*, FLA. DEP'T ENV'T PROT. (Mar. 7, 2019), https://floridadep.gov/wra/deepwater-horizon/content/restore [https://perma.cc/D3ZD-V4AH].

[626] IRL COUNCIL, FY 2020–2021 AMENDED BUDGET 2 (2020) (showing a slight increase in total revenue of $2,287,500); EAST CENTRAL FLORIDA REGIONAL PLANNING COUNCILS, INDIAN RIVER LAGOON ECONOMIC VALUATION UPDATE (2016).

E. Ongoing Research, Assessment, and Monitoring

Monitoring and evaluation of nutrients, habitats, and ecosystems is an essential element of any estuary management program and is critical to being able to measure whether actions taken are successful and to engage in adaptive management.[627] However, the approach by which Florida's NEP programs implement monitoring differs greatly between the TBEP and the IRLNEP. While the TBEP has implemented rather extensive monitoring, the IRLNEP has admittedly both lacked consistent monitoring and availability of funded research.[628] Therefore, it is important to compare how NEP's implement and learn from monitoring to evaluate their effectiveness in watershed management.

1. TBEP: Extensive Monitoring

In comparison with the IRLNEP, the TBEP has implemented an extensive monitoring program for the benthic community, habitat restoration, fishery management, navigation safety, and ocean acidification.[629]

First, the TBEP has initiated bay-wide benthic monitoring. The Tampa Bay Benthic Monitoring Program was initiated by the TBEP "as part of a basin wide monitoring effort to provide data to area managers and to track long term trends in the Tampa Bay ecosystem."[630] Since 1993, the monitoring program has monitored biological and sediment contamination through a partnership between Hillsborough, Manatee, Pinellas Counties, and the Environmental Protection Commission of Hillsborough County ("EPCHC").[631] The monitoring program splits the estuary into six strata, utilizing sampling of hydrographic data, benthic macrofauna, sediment chemistry, and silt/clay sampling.[632] As a result, the partnership has analyzed over 1,500 samples to report on the benthic communities in Tampa Bay through the Tampa Bay Benthic Index ("TBBI").[633] According to the TBBI, Tampa Bay's benthic communities range from "fair" to

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[627] *See* Avril C. Horne et al., *Moving Forward: The Implementation Challenge for Environmental Water Management*, WATER ENV'T 649, 649–73 (2017).
[628] IRLNEP 2008, *supra* note 435, at 92.
[629] TBEP CCMP, *supra* note 282, at 48, 68, 102, 118, 142.
[630] DAVID J. KARLEN ET AL., TAMPA BAY BENTHIC MONITORING PROGRAM INTERPRETIVE REPORT: 1993–2004 ii (2008).
[631] *Id.*; TBEP CCMP, *supra* note 282, at 49.
[632] KARLEN ET AL., *supra* note 630, at 4.
[633] TBEP CCMP, *supra* note 282, at 49.

"poor," with some "good" conditions in middle and lower Tampa Bay.[634] Additionally, the TBBI has also been used to develop a Sediment Quality Action Plan ("SQAP") for the highest priority site—McKay Bay.[635] The SQAP produced initial steps to identify and control upland contaminants of concern from runoff and further assess the ecological and human health risks from contaminated sediments.[636]

Second, TBEP has implemented both habitat monitoring and research for the purpose of setting restoration and protection targets.[637] In 2016, the TBEP completed baseline habitat monitoring at transects throughout Tampa Bay as part of the Critical Coastal Habitat Assessment Program ("CCHA").[638] The CCHA was developed by the TBEP to monitor long-term habitat changes that may occur as a result of climate change and sea level rise.[639] Although not fully implemented, the program will use a hierarchal scale to identify specific changes in habitat.[640] The methodology and results of additional monitoring from the CCHA will be included in the next update to the Tampa Bay Habitat Master Plan.[641]

While it seems the 2019 Habitat Master Plan publication has been delayed until 2020, the science from the plan has been used by the TBEP to determine both restoration progress and targets.[642] Currently, the Habitat Master Plan has been used by the TBEP to set restoration and protection targets for seagrass, mangroves, salt marsh, and salt barrens.[643] Additionally, research is underway to better understand tidal creeks and the historic and current areal extents of tidal flats, oyster reefs, and hard bottom habitats.[644] Furthermore, the TBEP monitoring informed the adoption of specific restoration targets for freshwater wetlands.[645] Finally, seagrass monitoring has been conducted in conjunction with SWFWMD every two years to protect and identify both impacted and sensitive areas.[646]

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[634] *Id.*
[635] *Id.* at 50.
[636] *Id.*
[637] *Id.* at 65.
[638] *Id.* at 142.
[639] TBEP CCMP, *supra* note 282, at 68.
[640] *Id.*
[641] *Id.*
[642] TAMPA BAY ESTUARY PROGRAM, *supra* note 531, at 80.
[643] *Id.*
[644] *Id.* at 85.
[645] *Id.* at 90.
[646] TBEP CCMP, *supra* note 282, at 84.

Third, monitoring of fisheries and abundance varies depending on species within the watershed. On one hand, the Florida Fish and Wildlife's Conservation Commission's Fisheries Independent Monitoring program ("FIM") has successfully been used to evaluate the status and trends of key fisheries in Tampa Bay.[647] Each month, the FIM takes 108 samples are collected at randomly selected sites, with tidal creeks being selected as vital habitats for keystone species.[648] However, the TBEP itself has lacked proper evaluation of scallops, an important keystone species for the health of the bay that has been lacking in abundance since the 1960s.[649] Monitoring for scallops is limited to one-day volunteer events sponsored by the TBEP.[650]

Fourth, the TBEP has created a robust network of bay monitoring for the purpose of navigational safety.[651] Although navigational safety does not implicate the health of the bay, oil and chemical spills have directly impacted water quality in the bay.[652] Thus, proper monitoring of shipping and navigation is important to the overall health of the estuary. The TBEP has continually funded an intuitive system of monitoring to provide real time information about tides, winds, and currents in the Tampa Bay area.[653] The Physical Oceanographic Real-Time System ("PORTS") has been mainly funded through phosphate fees and implemented by NOAA.[654] While ongoing funding remains uncertain, the PORTS system has been continually upgraded over thirty years and received praise as a way to provide "real-time environmental observations, forecasts and other geospatial information to mariners when they need it the most."[655]

Finally, the PORTS system has been upgraded to help monitor the effects of climate change in the estuary.[656] While long-term water

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[647] *Id.* at 102.
[648] *Id.*
[649] Jeff Benoit, *Searching for Scallops in Tampa Bay*, RESTORE AMERICA'S ESTUARIES (Apr. 14, 2020), https://estuaries.org/searching-for-scallops-in-tampa-bay/ [https://perma.cc/D9U6-MSVT].
[650] *See* TBEP CCMP, *supra* note 282, at 99 (The TBEP has sponsored the Great Bay Scallop Search, a one-day event where snorkelers attempt to count the number of scallops).
[651] *Id.* at 118–19.
[652] *See, e.g.*, Salinero, *supra* note 325; *see also A Major Spill in Tampa Bay—21 Years Ago this Month*, NOAA (Aug. 7, 2014), https://response.restoration.noaa.gov/about/media/major-spill-tampa-bay-21-years-ago-month.html [https://perma.cc/JM8M-PPGZ].
[653] TBEP CCMP, *supra* note 282, at 118.
[654] *Id.*
[655] *What is the Physical Oceanographic Real-Time System?*, HYDRO INT'L (Apr. 21, 2020), https://www.hydro-international.com/content/news/what-is-the-physical-oceanographic-real-time-system [https://perma.cc/WA6Y-Z7A5].
[656] KIMBERLY K. YATES, CHRISTOPHER S. MOORE, NATHAN H. GOLDSTEIN & EDWARD T.

monitoring by the EPCHC has indicated that pH has steadily became more basic since the 1980s, further monitoring was necessary to determine the effect of seagrass restoration.[657] Thus in 2016, the TBEP initiated an extensive ocean acidification monitoring program by allocating ocean chemistry monitoring equipment at Tampa Bay PORTS stations.[658] The monitoring program is carried out as a partnership between the U.S. Geological Survey ("USGS"), the EPA, Florida Fish and Wildlife Commission, the University of South Florida, and the TBEP.[659] Through this intuitive partnership, the ocean acidification program examines high-resolution temporal changes in pH and carbon dioxide, dissolved oxygen, light climate, and physical water quality to determine the effect of seagrass restoration on ocean acidification.[660]

2. IRLNEP: A Need for More Monitoring

According to Dr. Duane De Freese, the Executive Director of the Indian River Lagoon Council, the IRLNEP requires more extensive monitoring than in years past.[661] This may be in part because much of the information gathered by NEP funded research had been scattered among agencies.[662] Regardless, the 2019 update to the IRL CCMP states the "need for integrated, systematic, and sustained monitoring, mapping, and modeling."[663] In fact, monitoring and data sharing is listed as a "serious" need to sustain the long-term health of the lagoon.[664] However, there is currently a lack of long-term funding and support to monitoring water quality targets and standards.[665] While money tends to be available for "shovel-ready projects," monitoring is necessary to provide the information to evaluate the effect and necessity for these projects.[666] The IRLNEP is different in this way from the TBEP, as monitoring has been of little focus in recent years in preference to the immediate benefit of concrete

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SHERWOOD, TAMPA BAY OCEAN AND COASTAL ACIDIFICATION MONITORING QUALITY ASSURANCE PROJECT PLAN 5 (2019).

[657] TBEP CCMP, *supra* note 282, at 145.

[658] *Id.* at 146; YATES ET AL., *supra* note 656, at 5.

[659] YATES ET AL., *supra* note 656, at 1–2; TBEP CCMP, *supra* note 282, at 149.

[660] YATES ET AL., *supra* note 656, at 5.

[661] Duane De Freese, *Indian River Lagoon Stewardship Requires "A Higher Standard,"* I4 BUS. (Mar. 31, 2017), https://www.i4biz.com/solutions/indian-river-lagoon-stewardship/ [https://perma.cc/7W4G-N2E2].

[662] IRLNEP 2008, *supra* note 435, at 92.

[663] IRLNEP 2019, *supra* note 340, at 11.

[664] *Id.* at 20–21.

[665] *Id.* at 28.

[666] *Id.* at 145.

projects.[667] Currently, monitoring is limited to that conducted in part by universities, research institutions, and government organizations.[668] Regardless, the IRLNEP has committed to monitoring, stating that the 2020 will begin the development of a comprehensive monitoring and habitat restoration plan.[669]

In 2018, the IRLNEP funded the only single continuous monitoring station for meteorological conditions and wet/dry deposition of total nitrogen and total phosphorus.[670] The station estimates nutrient loading via the atmosphere to help understand the nutrient loading into the lagoon, helping to set restoration targets and evaluate nitrogen and phosphorous loading.[671] Additionally, a collaborative project between the University of Florida ("UF") and Florida Atlantic University ("FAU") has sought to monitor the Lagoon for the presence of HAB plankton.[672] Such sampling is important to detect superbloom events and inform appropriate agencies to coordinate a response.[673] Finally, like the TBEP, the Florida Fish and Wildlife Conservation Commission has FIM sites in the Lagoon to "monitor trends in commercial and recreational fisheries throughout Florida."[674]

Ultimately, the IRLNEP has not produced any habitat restoration targets or monitoring on par with the TBEP. Due to the lack of monitoring, the IRLNEP has not been able to properly evaluate the effect of actions of overall quality of the lagoon.[675] However, local action by Brevard County has sought to restore both oyster beds and create living shorelines throughout the region.[676] Although this is an important step towards habitat restoration, a comprehensive, science-backed plan will be necessary to produce results throughout the lagoon.

F. Adaptive Management

A cornerstone of the NEP is the use of the CCMP as a flexible, adaptive management tool to permit estuaries to adapt to changed

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[667] *Id.* at 151.
[668] *Id.* at 132–33.
[669] IRLNEP 2019, *supra* note 340, at 18.
[670] *Id.* at 52.
[671] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, ANNUAL REPORT: 2019 27 (2019).
[672] *Id.*
[673] *Id.*
[674] IRLNEP 2019, *supra* note 340, at 101.
[675] *Id.* at 103.
[676] BREVARD CNTY. NAT. RES. MGMT. DEP'T, SAVE OUR LAGOON PROJECT PLAN FOR BREVARD COUNTY, FLORIDA 47–49 (2016).

circumstances and apply lessons learned by experience.[677] Essentially, a successful CCMP promotes adaptive management to assess estuary condition and develop solutions to changing conditions through scientific analysis.[678] Important concepts of successful adaptive management include water quality monitoring and science implemented to guide restoration and protection decisions.[679] Ultimately, adaptive management is important in evaluating both the success and credibility of an NEP program.[680]

1. TBEP: A Philosophy of Adaptive Management

The TBEP adopted an adaptive management approach to managing the watershed to address the inherent uncertainties and complexity of the bay's response to changing contaminant load and other environmental conditions.[681] A prominent example of adaptive management is the nutrient management strategy in collaboration with the TBEP, which includes annual evaluation of loading targets.[682] The CCMP ultimately postulates that annual monitoring will allow timely understanding of problems and for adaptive management of nutrient loads.[683] More specifically, the CCMP discusses the importance of standardized reporting of wastewater as "essential" to the adaptive management goals of the bay.[684] Finally, the CCMP notes the importance of adapting biodiversity restoration programs to new threats to the watershed , such as land use changes or climate change.[685]

Responding to climate change is critical to adaptive management, and the CCMP specifically indicates "planning for and adapting to a changing climate" as critical action.[686] Global climate change and sea level already have the potential to impact the TBEP's restoration goals at restoring historical acreage.[687] Therefore, maintaining current ecosystem

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[677] *See* EPA, *supra* note 290, at 72.
[678] *Id.* at 81.
[679] *Id.*
[680] *Id.*
[681] Kimberly K. Yates & Holly Greening, *An Introduction to Tampa Bay in* INTEGRATING SCIENCE AND RESOURCE MANAGEMENT IN TAMPA BAY, FLORIDA 1, 9 (2011).
[682] *Id.*
[683] TBEP CCMP, *supra* note 282, at 16.
[684] *Id.* at 44.
[685] *Id.* at 109.
[686] *Id.* at 4.
[687] Sherwood & Greening, *supra* note 61, at 404 ("Global climate change and the anticipated rise in sea level have the potential to impact the distribution and coverage of existing and restored critical coastal habitats in the Tampa Bay estuary.").

acreage is deemed critical for maintaining options to adapt bay-wide management to climate change stressors.[688] Moreover, the TBEP seeks to expand the philosophy of adaptive management to the community by encouraging actions by state and local entities to adapt to climate change, including developing polices for adaption and mitigation to climate change impacts.[689] Thus, while adaptive management seems to be a cornerstone of the TBEP program, concrete actions in response to sea level rise and changed conditions may evaluate the effectiveness of this philosophy.

2. IRLNEP: Realities of Adaptive Management

While reconciling the TBEP's philosophy on adaptive management requires reading between the lines, the IRLNEP's embodies it with the "One Lagoon—One Community—One Voice" philosophy.[690] In turn, the CCMP "encourages adaptive and strategic management decisions to be made at all levels" as the mission's success is "driven by local conditions, trends, and needs," with the need for decisions to be "data driven."[691] This philosophy is placed up front because, unlike Tampa Bay, the Indian River Lagoon has dealt with extreme changed conditions over the years, including harmful algal blooms and freshwater discharge.[692] As a result, the success of the Lagoon is dependent on how well the program can adapt to the changed conditions of the watershed.[693]

Generally, the CCMP "encourages adaptive and strategic management decisions be made at all levels to improve conditions" in the Lagoon.[694] Specifically, land conservation and acquisition is to consider coastal resilience and adaption planning.[695] Additionally, the adaptive management philosophy of the CCMP is to be extended when evaluating recovery plans for species of concern.[696] More importantly, the CCMP states a heavy focus on adapting to climate change.[697] Since climate change is a much

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[688] TBEP CCMP, *supra* note 282, at 136.
[689] *Id.* at 44.
[690] IRLNEP 2019, *supra* note 340, at 16.
[691] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, *supra* note 671, at 5.
[692] *Id.* at 27, 33.
[693] *See* INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, BUSINESS IMPLEMENTATION PLAN FY20–FY21, at 27 (2020) ("Achieving a healthy IRL by improving the design, implementation, *adaptation*, and accountability of many individual actions.") (emphasis added).
[694] INDIAN RIVER LAGOON NAT'L ESTUARY PROGRAM, *supra* note 671, at 5.
[695] IRLNEP 2019, *supra* note 340, at 76.
[696] *Id.* at 90.
[697] *Id.* at 109.

greater problem in scope than current chronic stressors, the IRLNEP recognizes that adaptive management in this situation will require much wider considerations.[698] In fact, the IRLNEP has already initiated risk-based assessments and an adaption planning program funded by Climate Ready Estuaries, thereby following the philosophy of data-driven actions in anticipation of changing conditions.[699] In seeking local compliance, the CCMP advocates for local governments including these findings in their comprehensive plans.[700] Ultimately, the IRLNEP recognizes that adaptive management will require long-term strategic planning and significant community involvement.[701] Accordingly, the IRLNEP achieves this goal by strategic implementation and consideration of data.[702]

G. Summary

The comparison of the TBEP and IRLNEP reveals that while both programs generally follow the Integrated Estuary Governance Model, each program exhibits a range of strengths and weaknesses in the implementation of each of the elements of the model. These differences may account for the differences in the relative success of the two programs. Of course, as pointed out above, there are inherent differences in the geography, land uses and anthropogenic impacts to the two estuarine systems that create different challenges that certainly influence the ability to achieve restoration success.[703] For example, unlike the Tampa Bay, the Lagoon is a closed system with limited ability for water to be circulated and flushed into the ocean.[704] Moreover, the IRL has the challenge of being a receiving body of water for highly polluted discharges from Lake Okeechobee, a problem that is complex and tied to the overwhelming challenge facing Everglades Restoration, and which the IRLNEP has limited ability to influence.[705] Nevertheless, the more robust approach to a participatory and collaborative approach via the interlocal agreement and nitrogen management consortium, the clear targets and strategy for habitat restoration, and the extensive monitoring program established by the TBEP are likely contributing factors to the relative success of that program.

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[698] *Id.*
[699] *Id.* at 110.
[700] *Id.*
[701] IRLNEP 2019, *supra* note 340, at 110.
[702] *Id.* at 16.
[703] *Id.* at 11.
[704] *Id.* at 3.
[705] *Id.* at 10.

CONCLUSION

As set forth in this Article, estuaries throughout the U.S. are significant natural resources that support critical ecosystems services and substantial economic activity, including commercial fisheries and a wide range of economically significant recreational activities.[706] Estuaries are experiencing decline due to a variety of anthropogenic factors ranging from excessive nutrient pollution from urban and agricultural runoff, wetland destruction for construction, overfishing, and sea level rise due to climate change.[707] Existing federal regulatory programs, such as those under the ESA and CWA, focus narrowly on particular resources such as individual species or specific activities, such as point source water pollution and are not well-suited to managing a complex natural system such as a estuaries, which typically span multiple political jurisdictions.[708] Moreover, because estuary resources are used by and impacted by a wide range of human activities, and because such resources play crucial roles in the economy and social structure of coastal communities, estuary management must involve participation by affected stakeholders to adequately take into account important social and economic considerations. Accordingly, to protect, manage, and restore critical estuary systems, it is necessary to employ a holistic system-based approach that includes opportunities for participation of all affected stakeholders.

Over the past few decades, scientific and legal academics, as well as policymakers, have called for more holistic participatory approaches to addressing environmental challenges. These include, among other things, Ecosystem Management, Integrated Water Resources Management, Collaborative Governance, and Adaptive Management.[709] In this Article, we have mined the literature on these approaches and identified a number of common themes that lend themselves to estuary protection, management, and restoration.[710] We offer a new approach, which we refer to as Integrated Estuary Governance, that incorporates aspects of the approaches outlined above that have been demonstrated to be crucial in managing natural systems in general, and that have particular applicability to estuarine systems. Specifically, we have constructed the concept of Integrated Estuary Governance to be comprised of: 1) a place-based

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[706] *See supra* Part I.
[707] *See supra* Part I.
[708] *See supra* Part II.
[709] *See supra* Part III.
[710] *See supra* Part III.

approach taken at the scale of the estuarine system; 2) a multidisciplinary holistic approach that integrates ecological, social, and economic concerns, as well as all pertinent federal, state, and local legal regimes; 3) a participatory collaborative approach that draws on the expertise, interests, and values of all relevant public and private stakeholders, including federal, state, and local governmental agencies, environmental organizations, business interests, educational institutions, and citizens from local communities; 4) adaptive capacity to enable collaborating participants to learn from experimentation and humbly adapt decision-making as new scientific understandings or changed circumstances emerge; 5) ongoing research and monitoring to inform sound decision-making to support adaptive capacity; 6) clear restoration targets; 7) ongoing financial resource commitments to ensure the necessary support to carry out research, monitoring, and other activities needed to bring participants together and make sound decisions.[711]

In this Article, we explore the extent to which the existing National Estuary Program under the federal CWA employs an Integrated Estuary Governance approach, though the use of case studies of two existing NEP programs. A careful examination of these programs reveals areas where a robust Integrated Estuary Governance approach has been employed and other areas where such an approach is cursory at best.[712] Most significantly, through the comprehensive review of two NEP programs, we conclude that contributing factors to the success of the TBEP are its robust participatory collaborative approach, its clear nutrient and habitat restoration targets, and its extensive program of environmental monitoring.[713] This Article posits that there is a strong link between successful estuary management and the employment of a robust integrated estuary approach. Extrapolation of successful Integrated Estuary Governance to other estuary management programs, and to other ecosystem management programs in general, in a deliberative and methodical fashion may result in greater success in protecting, managing, and restoring important ecological resources while, at the same time, ensuring that community social and economic values are protected.

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[711] *See supra* Part III.
[712] *See supra* Part III.
[713] *See supra* Part IV.