

An Anchor in Clean Water: The Roles of Anchor Institutions in Managing Great Bay

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Abstract

Anchor institutions, entities such as colleges and universities, hospitals, military bases, and local businesses that are deeply embedded in a community and could not easily move elsewhere, are increasingly being viewed as partners in social and economic development, particularly in inner city areas. This thesis looks at the roles that anchor institutions can play in environmental initiatives. Using Great Bay in New Hampshire and Maine as a case study and Plum Island Estuary in Massachusetts and Casco Bay in Maine as comparison cases, interviews with relevant stakeholders were used to identify the ways anchor institutions are involved in watershed initiatives. Using the Work Foundation's idea of “anchor coordinators,” the roles of umbrella organizations such as the U.S. Environmental Protection Agency's National Estuaries Program partnerships were studied in the ways that they bring together various stakeholders, including anchor institutions, in the watershed. As expected, the University of New Hampshire was found to be an influential anchor institution in Great Bay; this influence came from many departments and various projects. While other anchor institutions participated in various Great Bay protection initiatives, this participation was not found to be widespread. With the government cutting many services and unlikely to provide support to nonprofit watershed protection groups, anchor institutions can help to fill this gap. This study found that local businesses, in particular, may find that their participation in such initiatives creates mutual benefits and helps to create a more advantageous business climate. The study ends with recommendations for anchor institutions and watershed advocates.

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**AN ANCHOR IN CLEAN WATER:
THE ROLES OF ANCHOR INSTITUTIONS IN
MANAGING GREAT BAY**

Introduction

An anchor institution is a non-profit, public, or corporate entity that: (i) is a prominent employer, (ii) draws residents to an area, (iii) is so deeply rooted in its community that it would be extremely difficult for it to move elsewhere, and (iv) has an interdependent relationship with its community. While anchor institutions have recently received attention as important players in community development and revitalization efforts (Rutheiser 2011), particularly in inner cities (Maurasse 2007), less study has been directed toward the role of anchor institutions' involvement in other types of community partnerships.

As government funding diminishes on all levels, anchor institutions are increasingly receiving attention for their significant resources, financial and otherwise. Environmental initiatives, often seen as controversial or unnecessary, have been a popular target for funding cuts. At the same time, many environmental problems are worsening throughout the United States; habitat loss, air and water pollution, and climate change threaten global health and prosperity nationally and globally. As with many other social, political, and economic issues, anchor institutions are acting to help create solutions to these multi-faceted environmental challenges.

This thesis will examine the roles anchor institutions play in watershed policy issues, using the Great Bay Estuary in New Hampshire and Maine as a case study. This case is particularly contentious, with the watershed crossing many political lines and much attention being paid to the estuary's nitrogen loading issues, which are attributable to many different point and non-point sources. In

this watershed, one anchor institution, the University of New Hampshire, has been involved in watershed management on many different levels, with a handful of other community anchors playing small but significant roles. Casco Bay, in Maine, and Plum Island Sound, in Massachusetts, will serve as comparative case studies highlighting the dynamics of watershed policy in nearby areas with similar hydrogeology but very different anchor institution landscapes.

This research aims to answer a central question: What roles do anchor institutions play in natural resource protection? The Great Bay case study provides an example of an anchor institution involved in a controversial local issue. While this topic is narrow, the current study may offer findings applicable to anchor-community involvement in other realms of resource conservation. In a time of chronic government underfunding, when the strongest advocates for a natural resource may be small non-profits run by volunteers, anchor institutions present a significant opportunity to bring about positive change. The intended audience of this thesis consists of those concerned about watershed issues in those non-profit organizations and in anchor institutions. By uncovering some of the challenges and opportunities of anchor institution involvement in watershed issues, this thesis is intended to encourage environmental advocates and other stakeholders to consider including anchor institutions.

The next chapter provides a literature review that begins with a discussion of anchor institutions, including those that have intervened in environmental issues. The literature review then looks at some of the arguments for watershed protection on a holistic scale, in the forms of ecosystem-based management,

watershed-scale initiatives, and regional planning. The literature review is followed by a methodology of the case study. This is followed by a results section synthesizing the case study's findings, and a section presenting recommendations for future anchor-community partnerships.

Background

Throughout the United States, coastlines are the most populous areas. According to the National Oceanic and Atmospheric Administration, 39 percent of the U.S.'s population lives in coastal counties, which make up less than 10 percent of the country's total land area. Coastal populations are projected to increase by an additional 8 percent by 2020 (2013). This dense, and quickly growing, population has contributed to many environmental problems.

The Great Bay watershed encompasses about 50 square miles and contains 48 cities and towns, 39 in New Hampshire and nine in Maine. About a quarter of New Hampshire's residents live within the watershed, and the area's population is growing quickly (Piscataqua Region Estuary Partnership 2010). Table 1 compares basic characteristics of the watersheds in this study.

	Great Bay	Casco Bay	Plum Island Sound*
Watershed area (mi²)	1,023	1,214	231
Number of Municipalities	48	42	9
Population (2010)	377,427	254,116	102,000 (est.)
Population Density (people/mi², 2010)	368.94	209.32	250 (est.)
Percent Population Change, 1990-2010	19.00	15.27	<5%
Percent Impervious Surface Cover (2010)	9.60	6.00 (est.)	9.00 (est.)

*Table 1: Watershed Characteristics of the Primary and Secondary Case Studies. *Plum Island Sound has a much larger watershed, but these numbers reflect the coastal area managed by the Massachusetts Bays Program.*

Sources: Piscataqua Region Estuary Partnership 2013, Casco Bay Estuary Partnership 2010, Massachusetts Bays Estuary Program 2010, LTER nd.

One of the major threats to marine health is nitrogen loading of coastal waters. Increased fertilizer and automobile use has resulted in massive increases in the amounts of nitrogen that enter the nitrogen cycle. Nitrogen is also abundant in human and animal waste. This nutrient enters coastal waters through runoff from fertilizers, leaky sewer pipes, septic systems, and animal waste. Additional nitrogen enters the water through atmospheric deposition; nitrous oxide and other gaseous forms of nitrogen are produced by factories and automobiles (Piscataqua Region Estuary Partnership 2013).

Nitrogen is an essential nutrient in spurring biological production in coastal waters. However, overproduction can cause many problems. Atmospheric nitrogen contributes to acid precipitation, which can lead to both acidification and eutrophication (low oxygen) of bodies of freshwater. In marine water, nitrogen acts as a fertilizer, and the resulting algae consume dissolved oxygen. In more extreme cases, the algae formation will block light from the water column, further inhibiting marine life and preventing photosynthesis from occurring. Often the results of this process are hypoxia (low oxygen) or anoxia (no oxygen). Dissolved oxygen is crucial for marine species. Evidence shows that since the 1950s, anoxia and fish die-offs have become more common (Vitousek et al. 1997).

In Great Bay, nitrogen-triggered oxygen deprivation has likely contributed to the decline of eelgrass, which is a crucial breeding habitat for fish and shellfish as well as a key stabilizer of benthic sediments. In 2008, the New Hampshire Department of Environmental Services (NH DES) listed Great Bay as threatened

for eelgrass loss (Trowbridge 2008). Between 1990 and 2011, eelgrass cover in Great Bay declined by 38 percent; the Bay's tributaries saw less extreme but statistically significant losses as well (Piscataqua Region Estuary Partnership 2013).

In 1995, the Piscataqua Region Estuary Partnership (PREP) was founded to develop a comprehensive management plan for New Hampshire's estuaries. Today, it is part of the US Environmental Protection Agency (EPA)'s National Estuary Program, which was established by the Clean Water Act Amendments of 1987. The goal of the National Estuary program is to manage significant estuaries in the U.S. through a collaborative approach that considers stakeholders' points of view (Environmental Protection Agency 2013). PREP consists of representatives of local, state, and federal government entities in both Maine and New Hampshire. The organization is administered by the University of New Hampshire, a major anchor institution in the region. PREP's recommendations for improving estuarine health included major technological upgrades in several area wastewater treatment plants (Piscataqua Region Estuary Partnership 2010).

Legal Debate

In response to the concerns listed above, the EPA set limits on wastewater treatment effluent in the Great Bay watershed to 3 milligrams per liter, approximately the lowest concentration achievable by technology. This would require that all municipal wastewater treatment plants enact expensive upgrades, or completely rebuild (Sanborn 2013a). Some cities and towns hired lawyers and consultants to fight these standards. Originally, the communities claimed that

there was a lack of scientific data, and that more research was needed (Clark 2010). Later, towns used data showing that only 30 percent of nitrogen to Great Bay came from these wastewater treatment facilities to claim that plant upgrades would not have a significant enough impact on overall nitrogen levels (*Portsmouth Herald* Editorial Board 2011). Opponents of the measure used positive data from the last two years to attempt to show that nitrogen and eelgrass were actually rebounding.

In March, 2012, the Great Bay Municipal Coalition, a group of five municipalities (Dover, Portsmouth, Rochester, Exeter, and Newmarket), filed a lawsuit against the DES, alleging that the agency had not satisfied the Clean Water Act's public participation requirements. In November, 2012, the same coalition announced that it would sue the EPA as well, for allowing the DES to establish the standards (Sanborn 2012a). The lawsuit and subsequent appeals were dismissed by the Merrimack County Superior Court (Haddadin 2012). In June, 2012, the Coalition had managed to get a hearing by the U.S. House Committee on Oversight and Government Reform. This was simply an advisory hearing, and was not designed to force the EPA to change its actions. While this created a record of constituents' complaints, little else came of the hearing (U.S. House of Representatives 2012). The setbacks continued when the EPA's federal Office of Water dismissed a charge of misconduct leveled by Coalition lawyers at EPA Region 1, the field office that includes New England (Kingston 2012).

The Town of Durham, the home of UNH, became the first community to withdraw from the Municipal Coalition. In July, 2012, Durham announced that,

rather than fight the EPA and the DES, they would begin working with the EPA toward a stricter discharge permit. This reduction would likely be easier for Durham than for other communities—unlike others, which currently produce effluent with 20 or more milligrams of nitrogen per liter, Durham, which had recently upgraded its plant, was averaging only eight milligrams per liter. The EPA worked with the Town of Durham to set an agreement: Durham would gradually reduce its wastewater treatment plant effluent to five milligrams per liter of nitrogen, and would make up the additional to milligrams per liter through nonpoint source treatment such as rain gardens (Ramsdell 2012).

In early 2013, Newmarket and Exeter followed Durham's lead, accepting a limit of three milligrams of nitrogen per liter with a fifteen-year implementation period (Sanborn 2013a). The three remaining members of the Municipal Coalition—Dover, Portsmouth, and Rochester—responded by filing another lawsuit with the EPA, as well as appeals with the DES, on behalf of Newmarket (Haddadin 2012).

This issue is still developing, but it is unclear whether these lawsuits will go forward. In May, 2013, the DES signed an agreement with Dover, Portsmouth, and Rochester, calling for a new peer review of the DES's nutrient criteria that had served as justification for the new wastewater treatment plant requirements (Kingston 2013). This type of review is what the Coalition has requested since the beginning, and it is unclear whether they will continue to pursue litigation.

Additional Management Debate

In addition to these lawsuits, there are many smaller issues at stake in the

debate over how to manage Great Bay. Nonpoint source pollution contributes approximately two-thirds of Great Bay's nitrogen pollution. This pollution comes mostly from atmospheric deposition, which is difficult to control because it comes from out-of-state plants. The remainder comes from septic systems, fertilizer application, and animal waste (Evans-Brown 2013). Many opponents to the wastewater treatment plant measure argue that it would be more effective to control nitrogen by reducing all these sources. Stakeholders on all sides argue that the science is inadequate, that several decades of data are not convincing, and that more research needs to be done. Scientists and advocates, meanwhile, are warning that Great Bay's problems are worsening and that action must be taken soon (New Hampshire Public Radio 2012).

In May, 2013, U.S. Representative Carol Shea-Porter held a forum in the Town of Greenland to discuss funding issues. At this event, she made clear that there is no guarantee of federal funding for any type of Great Bay cleanup projects, and cities and towns will likely have to shoulder the entire burden. An Exeter Selectman who attended the meeting noted that for his town, construction of a new wastewater treatment plant was estimated to cost \$40 million to \$50 million (Sanborn 2013b). Because New Hampshire does not have income tax or sales tax, there does not seem to be much hope that the state could contribute in any way. Cities and towns are left with an enormous burden, and this highlights the need for innovative and alternative funding mechanisms in the Great Bay watershed.

Anchor Institutions

In the Great Bay watershed municipalities, the University of New Hampshire is the major anchor institution. Besides administering PREP, UNH is host to a number of laboratories and research groups that are studying various aspects of Great Bay's nitrogen issues. It is important to note that UNH is not monolithic, and its contributions to Great Bay come from many parts of the University. However, UNH's mission states, in part, that "UNH is distinguished by... a location in a beautiful and culturally rich part of the seacoast of New England and a strong sense of responsibility for this special place, a commitment to serving the public good, and our emergence over the past decade as a significant research institution" (UNH Office of the President 2013). This part of the mission statement provides a strong argument for UNH's position as an environmental anchor institution.

It seems likely that much of the attention to Great Bay comes from the UNH community because researchers, many of whom live in the watershed and have personal connections to the Bay, choose the area for some of their research because of this personal connection and a sense of community duty. The university, which has focused heavily on research in recent years, also has an opportunity to show the practical relevance of its work by conducting research locally and advocating that it be used in local policy matters. The voices of these researchers are magnified locally because of the respect and prestige of being connected to a major research university like UNH. This inquiry will investigate some of the major motivators for UNH to take such an active role in Great Bay

stewardship, and to better understand the roles UNH plays.

While UNH seems to be the most prominent anchor institution in the region, it is not the only one. This research will identify other anchor institutions and discern what role, if any, each plays in Great Bay protection initiatives. Besides UNH, there is one other higher education institution, Great Bay Community College, located in Portsmouth; there are several prominent private high schools, including Phillips Exeter Academy and Berwick Academy. There is also an active U.S. Naval shipyard (the Portsmouth Naval Shipyard) and a decommissioned air force base (Pease) that is now an active airport as well as a major business park. The impact of this military presence is not entirely clear yet, but both institutions have previously participated in environmental action. The Shipyard has received accolades from the Navy for creating a wetland to mitigate the impacts of its Superfund site on the Piscataqua River, while part of Pease has been set aside as the Great Bay Natural Wildlife Refuge. There are also several prominent institutions in Portsmouth, including the Portsmouth Music Hall and the Strawberry Banke Museum, which benefit from visitors who want to experience Portsmouth's idyllic seaside location. While UNH has the clearest impact on nitrogen policy in the Great Bay watershed, these other institutions may also be motivated to participate. Table 2 provides some anchor institutions that were identified in early stages of research; the list is not inclusive. The table also lists area nonprofit organizations that have been involved in aspects of Great Bay advocacy.

Anchor Institutions	Nonprofit organizations
University of New Hampshire	Conservation Law Foundation
Great Bay Community College	Lamprey River Watershed Association
Port of New Hampshire	Lamprey River Advisory Committee
Portsmouth Naval Shipyard	Exeter River Local Advisory Committee
Pease Tradeport	Piscataqua River Cooperative
<i>Portsmouth Music Hall</i>	Seacoast Science Center
<i>Great Bay Community College</i>	Trout Unlimited
<i>Phillips Exeter Academy</i>	Trust for Public Lands
<i>Berwick Academy</i>	The Nature Conservancy
<i>Eliot Hospital</i>	Society for the Protection of NH Forests
<i>Portsmouth Hospital</i>	Cochecho River Watershed Coalition
<i>Exeter Hospital</i>	Save Our Groundwater
<i>Wentworth Douglas Hospital</i>	Winnicut River Watershed Coalition
	Salmon Falls Watershed Collaborative

Table 2: Anchor Institutions in the Great Bay Watershed and Nonprofits Concerned with Great Bay Management. (Anchors listed in italics are hypothesized to be less active in Great Bay's health.)

Two nearby estuaries will serve as comparisons to Great Bay: Casco Bay, in Maine, and Plum Island Sound, in Massachusetts. While the estuaries' problems are not identical, and the proposed solutions will be different, there will be many similarities—mainly that in controlling their watersheds' pollution, all three areas will have to consider the behavior of their residents and municipal governments. The nitrogen sources in these three watersheds will be the same: septic runoff, discharge from point sources such as wastewater treatment plants, agricultural runoff, pet waste, and lawn fertilizer runoff. As Great Bay has PREP, Casco Bay has the Casco Bay Estuary Partnership and Plum Island Sound is served by the Massachusetts Bay Estuary Partnership, which also serves other estuaries in Massachusetts, including Cape Cod. These two programs are also part of the EPA's National Estuary Program.

The landscapes of anchor institutions in Casco Bay and Plum Island Sound

are very different from each other as well as from that of Great Bay. Several colleges and universities, a law school and a medical school are located in the Casco Bay watershed. There is also a large medical center as well as major corporations, including L.L. Bean, several ski resorts, and Bath Iron Works. Plum Island Sound's watershed, on the other hand, has a sparse population of anchor institutions. The watershed consists mostly of small bedroom communities, without many institutions beyond prominent private schools. The headwaters cross the heavily congested Interstate 93 corridor, but the watershed's development is primarily low-density and highly residential. Table 3 shows the primary anchor institutions that were identified in each watershed, as well as nonprofit organizations that may be concerned with estuarine health. As with Table 2, these were simply high-profile institutions that were initially identified. The lists are not exclusive and do not imply that each institution listed actually acts as an anchor.

Casco Bay Estuary Partnership:

Anchor Institutions	Nonprofit Organizations
University of Southern Maine	Casco Bay Island Development Association
Maine Law School	Friends of Casco Bay
Bates College	Friends of the Presumpscot River
Bowdoin College	Lakes Environmental Organization
Bath Iron Works	Maine Nonpoint Ed. for Municipal Officials
L.L. Bean	Maine Audubon
Brunswick Naval Air Station	New Meadows River Watershed Project
Portland Port Authority	Presumpscot River Watch
<i>Maine Medical Center</i>	Maine Coast Heritage Trust
<i>Shawnee Peak ski resort</i>	Trout Unlimited
<i>Mount Abram ski resort</i>	land trusts
<i>Hancock Lumber</i>	
<i>Portland International Airport</i>	

Massachusetts Bays Estuary Partnership, Upper North Shore (Plum Island Sound):

Anchor Institutions	Nonprofit Organizations
<i>Governor's Academy</i>	Parker River National Wildlife Refuge Ipswich River Watershed Association Parker River Clean Watershed Association Eight Towns and the Great Marsh The Trustees of Reservations Massachusetts Audubon Society

Table 3: Anchor Institutions in the Casco Bay, Maine and Upper North Shore, Massachusetts, Watersheds and Nonprofits Concerned with Estuarine Management. (Anchors listed in italics are hypothesized to have little engagement in estuarine management.)

The body of literature regarding anchor institutions is still in its infancy, and much of it focuses on the role of anchor institutions in community economic and cultural development. There still seems to be a lack of literature that truly looks critically at the impacts of anchor institutions, which are often politically powerful, among the strongest voices in their communities. The concept of “community” is different as well—not much has been written about the impacts of anchor institutions in rural areas. It may be assumed that an anchor institution will have a larger geographic impact in a rural area than in a more urban one. This thesis will also question that assumption. These three case studies should provide a basis for expanding the study of anchor institutions to include a new area: the way their strong public influences help impact watershed policy issues.

Literature Review

Anchor Institutions

The concept of an anchor institution is relatively new; the term was not coined until 2002, when it was first introduced by Harvard University professor Michael Porter (CEOs for Cities and Living Cities 2010). Perhaps because of its relative newness, scholars define the term in slightly different ways. A 2008 University of Pennsylvania report mentions institutions of higher education and hospitals, or “eds and meds,” as the classic examples. An anchor institution is a place-based driver of economic activity, with large real estate holdings that keep it so rooted in the area that it would be very difficult to move. Additionally, it has a large stake and important presence in the community, is a large purchaser of goods and services, attracts businesses and individuals, has “enormous human resources,” (Netter Center for Community Partnerships 2008, 5) and provides employment on many different skill levels. The same report then goes on to list some potential anchor institutions: universities, libraries, museums, religious institutions, utility companies, military bases, sports franchises, large corporations, and medical centers/hospitals (Netter Center for Community Partnerships 2008). The inclusion of all these entities, which may not fit all of the criteria listed, shows the need to evaluate on a case-by-case basis. For example, many libraries do not have large land holdings and are generally not major purchasers of goods. But, due to community programs or other benefits, libraries may act as anchor institutions.

While corporations can be anchor institutions, certain considerations must

be taken into account. As many traditional corporate community anchors, such as banks, are absorbed into larger, multinational corporations, corporate headquarters tend to relocate frequently. These large corporations have fewer community ties and are less likely to feel bound to their neighborhoods. The distinction is made clear in definitions of anchor institution that highlight motivation. “Anchor institutions are those nonprofit or corporate entities that, by reason of mission, invested capital, or relationships to customers or employees, are geographically tied to a certain location” (Webber and Karlstrom 2009). This definition is much narrower than the previous one laid out by the Netter Center—it excludes public institutions entirely, and sets a bar that would be difficult for corporations, which are generally not entirely rooted in place, to truly reach. While corporations may act as anchors, it is important to note that simply being a large employer does not make a corporation an anchor institution.

“Eds and meds” are the universally-cited examples of anchor institutions. Many reports focus on the successes of institutes of higher education and medical facilities. Libraries, religious institutions, military installments, and cultural institutions seem to be mentioned in few analyses and tend to be overlooked in general reports on anchor activities. One reason for this may be that when looking at the overall effects of anchor institutions, it is difficult to compare the activities of hospitals and universities, which often have large pools of resources in the form of endowments, to the comparatively smaller impacts of less well-funded institutions.

High-profile cases of anchor institution involvement

The University of Pennsylvania (UPenn)'s community revitalization project is possibly the most high-profile example of successful community engagement by an anchor institution. UPenn is located in West Philadelphia, which was neglected and crime-ridden. In 1994, the university's new president, Judith Rodin, kicked off an ambitious project to try to improve the surrounding neighborhood. The initiatives included moving the campus police to a new neighborhood office, securing mortgages for employees who chose to buy houses in the neighborhood, rehabilitating vacant houses, providing loans for home improvement, investing in the local rental market, building new retail establishments, and adding neighborhood cosmetic upgrades such as green spaces and increased streetlights. UPenn also increased local hiring and purchasing, and perhaps most significantly, began a public elementary school in the adjacent neighborhood. As a result of these initiatives, crime has been reduced, home prices have risen significantly, and members of UPenn and surrounding universities are no longer so cut off from the community (Kromer and Kerman 2004).

Yale University is another well-known anchor that took a similarly comprehensive approach to UPenn, launching community health initiatives, forming partnerships with local schools, and participating in the physical rebuilding of homes and businesses in the community. Yale focused heavily on improving community economic success, setting target employment rates for hiring local minorities and women, and starting a business incubator which helps

to start businesses and raises hundreds of millions of dollars in venture capital (Axelroth and Dubb 2010). Syracuse University, meanwhile, is using a model of arts engagement to rejuvenate the city's lagging economy. The university partnered with other community institutions to rebuild the city's Connective Corridor, a road linking 25 arts institutions with the university as well as several low-income neighborhoods. Syracuse's initiative seeks to increase access to the arts for all citizens, with the idea that by creating an “arts, technology, and design quarter,” one of the poorest neighborhoods in the United States can become rejuvenated (CEOs for Cities and Living Cities 2010).

The New York Public Library and the Los Angeles Music Center are two examples of non-“eds and meds” anchor institutions that made significant community contributions. The New York Public Library began a series of lectures aimed at attracting young people, and these have hugely increased membership and attention to the library. These have also had the added benefit of bringing together a community and enriching its culture. The Los Angeles Music Center, which is a performing arts center in Hollywood, has launched a major public arts education initiative; the center employs about 500 artists and works with nearly half a million children per year (Maurasse 2007).

Urban and Rural Anchor Institutions

Historically, some anchor institutions have helped shape community character, while others have put up walls, literally or figuratively, to shield themselves from undesirable surroundings. This “wall building” generally occurred in cities. When inner cities declined in the mid-twentieth century, left

behind were residents too poor to leave—and (mostly) non-commercial anchor institutions, such as hospitals and universities, some of which had been located in place for a century or more and were in no position to move. The numbers are striking: in 66 of the U.S.'s largest 100 inner cities, the largest employer is an anchor institution. One in eight colleges and universities and one in 15 of the largest hospitals in the U.S. are based in inner cities (Initiative for a Competitive Inner City 2011). This creates a clear physical dichotomy: large, wealthy, prosperous institutions, which attract highly-paid, highly-educated professionals, are often located in some of the U.S.'s poorest, most neglected neighborhoods.

Likely because of this dichotomy, much of the literature on anchor institutions has focused on urban engagement. The previously mentioned examples are representative of most case studies that currently exist: large institutions in deindustrialized cities that now face a significant revitalization needs. While it is likely that rural anchor institutions play very different, but still important, roles in community building, this rural anchor engagement has not received much attention as of now.

Studies of the economic impacts of colleges and universities can help to illustrate the importance of non-urban universities. A 2006 study that quantified the economic impacts of knowledge, degree attainment, and other services contributed by colleges and universities found that institutions in small and medium economies actually have a proportionally stronger economic impact than those in urban areas. The authors conclude that the contribution of knowledge capital these higher education institutions contribute may actually make up for

some of the economic activity that is lost without a large private economy (Goldstein and Drucker 2006).

Land-grant universities have not received much attention as anchor institutions, but they represent some of the earliest examples of civic engagement. The first-land grant universities were established in 1861 by the Morrill Act. Every state now has at least one land-grant university, and because one of their primary purposes was to advance agricultural studies, many are located in rural areas (Association of Public and Land-Grant Universities 2012). The land-grant system transformed higher education, previously only accessible to those in the highest socioeconomic classes, into something that was attainable by most people at a relatively low cost. Rejecting the classic model of education, land-grant universities sought to create knowledge that would have full relevance to locally-important industries. The Smith-Lever Act, passed in 1914, mandated that every land-grant college and university establish a cooperative extension, in which federal, state, and county governments were to partner with the university in order to extend university knowledge to relevant local parties (McDowell 2003). These cooperative extensions, still active today, may serve as an important vehicle for universities to engage in their regions.

Motivations for Engagement

While land-grant universities are mandated by law to engage at some level in their communities, the motivation for other anchor institutions is not as clear. Colleges and universities have always been places of social activism, from the Settlement House movement that began in Chicago in the late 1800s to the rise of

“experiential learning” in the same era. Beginning in the 1960s, social engagement on campuses was mainly global—for example, many of the nation's largest Vietnam War protests were staged at colleges and universities (Axelroth and Dubb 2010).

Since then, colleges and universities have variously dealt with neighborhood involvement in different ways. Many have begun to abandon the idea of a college or university as a gated enclave separate from the outside world, for various reasons. Some of the motivation for this was economic; for example, the University of Pennsylvania began to blame declining enrollment on student concerns over neighborhood safety (CEOs for Cities and Living Cities 2010). Once university-community engagement began to gain credibility as a means for social change, outreach organizations began to form. In 1994, the United States Department of Housing and Urban Development formed its Office of University Partnerships to help foster the roles of colleges and universities in neighborhood development (U.S. Department of Housing and Urban Development 1998).

Anchor institutions besides colleges and universities may have very different motivations. For some publicly-funded anchor institutions, and for nonprofits as well, community engagement may be a way to stay viable. The previously-mentioned New York Public Library case illustrates how the library benefited from its engagement; the community gained a valuable educational resource, and in return, the library gained 7,000 new patrons and saw attendance at programs increase by 350 percent (Maurasse 2007). In a time when public libraries face the risk of being seen as obsolete, becoming a community anchor

can be a way for the library to prove its staying power.

Michael Porter argued that corporations who engage in their communities can create for themselves a competitive advantage. In “The Competitive Advantage of Corporate Philanthropy,” Porter and Kramer write that strategic community engagement has too often meant corporations investing money into public causes in an effort to gain more recognition, essentially making philanthropy a type of marketing. They argue that, instead, companies should direct their efforts toward improving the environment in which they operate. This often means creating social improvements that directly relate to a company's business (2002). Porter and others have made the case that engaged businesses should be motivated both by community needs and self-interest—and that those two factors may be intrinsically connected.

Types of Anchor-Community Partnerships

Community Development and Purchasing Roles of anchor institutions

In *The Road Half Traveled: University Engagement at a Crossroads*, David Axelroth and Steve Dubb classify university's community development activities into three roles: facilitator, leader, and convener. The “university as facilitator” has less of a specific geographic focus. In this role the university shares resources to build community capacity, emphasizing education and health partnerships, access to education, and responsiveness to a community's agenda. In contrast, the “university as leader” has a much more comprehensive focus, which is usually to transform the surrounding neighborhood. These projects are ambitious and expensive, and the university, not the community, tends to set the

agenda. The “university as convener” tends to focus on a non-adjacent neighborhood, as a strategic choice, whether because of the neighborhood's need or the desire to be more physically removed from the project. These efforts, which require moderate amounts of resources, tend to focus on building capacity and developing businesses, with the university and the community setting the agenda together (2010).

Universities can play several other roles in their communities, most notably in local capacity building, educational and health partnerships, scholarly engagement, and the formation of multi-anchor partnerships (Axelroth and Dubb 2010). This framework could be applied to other, non-university anchor institutions. These roles clearly show the potential strategies, as well as the varying amount of resources, different anchors apply to different projects.

Another important role of a large anchor institution is that of purchaser. Many anchor institutions are electing to spur economic growth by promoting local spending and local hiring. Large anchor institutions are huge purchasers of goods and services, and this can create significant local demand. While it could be assumed that local purchasing would simply shift resources from one area to another, researchers have found that strengthening an area's economy actually helps to spur more innovation—a small boost in the economy can lead to disproportionately larger economic growth (Howard and Dubb 2012). This practice requires less resources than large projects would, and it allows the anchor institution control while still empowering the community.

The University Hospitals' Vision 2010 initiative in Cleveland emphasizes

the power of local purchasing and hiring. In this initiative, University Hospitals embarked on a massive expansion plan, building five major new facilities and expanding existing ones. The project set goals for local procurement of goods and services, hiring of local residents, and contracting female- and minority-owned businesses. The project was a major success, and in most cases the goals were either met or exceeded. 5,000 jobs were created, totaling over \$500 million in salaries. Much of this went to local residents. After the construction had ended, local purchasing benchmarks were put in place for the medical facilities themselves, helping to ensure continuing local success. The multiplier effect mentioned above has taken place here, and the initiative has helped to spur investment and revitalization in Cleveland, potentially even changing the standards to which large projects will be held in the future (Serang, Thompson, and Howard 2013).

Consortiums and the role of anchor coordinators

Anchor institutions can increase their capacity by joining with other anchors to set and work toward common goals. To help forward this goal, “anchor coordinators” can bring these entities together, set benchmarks, and make sure that anchor activities are having the desired effects. These anchor coordinators may be anchor institutions themselves, and they may also be other entities such as development agencies and local government whose sole mission is the progress of an area (The Work Foundation 2010).

There are many examples of cities in which anchor institutions have joined together to accomplish specific projects or to pursue strategic routes toward a

common goal. Cincinnati's Uptown area has historically been in decline. It was facing significant poverty problems, and to better deal with them, the neighborhood's largest employers banded together. The Uptown Consortium consists of five employers, including a hospital, two health care providers, a university, and a zoo/botanical garden. Together, these institutions had begun to realize the downsides of blocking themselves off from the decaying community, and banded together to pool resources to develop projects for neighborhood revitalization (Maurasse 2007).

Payments and fees

Increased scrutiny and distrust of nonprofits and severe municipal budget shortfalls have led to increased interest in payments in lieu of taxes (PILOTs). Particularly in the cases of higher education institutions, hospitals, and arts centers such as museums and performing arts halls, nonprofit entities can hold large parcels of land, decreasing tax revenues to municipalities. In Boston, Massachusetts, universities and medical institutions possess 14 percent of the city's total assessed property value. Boston has become a leader in PILOT systems; the city collected \$15.7 million from nonprofits in 2009. Before PILOTs were put in place, those institutions would not have contributed any money to the city in this form. This lack of contribution created a major burden for Boston in that police, firefighting, and other services would have been shouldered by the City and its taxpayers. Other cities have begun to implement such systems as well, and Rhode Island and Connecticut have passed laws mandating such payments to the state (Kenyon and Langley 2010).

Another method that allows cities and towns to gain more monetary benefit from potential anchor institutions is the community benefit agreement (CBA). These agreements are generally made in situations where for-profit enterprises plan large commercial development projects. These can help to ensure the community will fully benefit from such development; the stipulations can range from the hiring of local minority contractors to contributions to building a mitigation project (such as a playground) in another area. Municipalities may also use CBAs to attract anchors to their communities; sometimes these anchors are granted tax exemptions for a certain amount of time in exchange for a CBA (Wolf-Powers 2010). This type of agreement differs from a PILOT in that it is not mandatory, and it benefits both the landholder and the city. However, CBAs can act as a way for cities to encourage needed growth and employment.

Drawbacks to Anchor Activism

There is an inherent problem in evaluating anchor institutions, and that is that most of the evaluation is done by anchor institutions themselves. Much of what has been published on anchor-community partnerships has been written by universities who are presumably loath to “bite the hand that feeds” them. Most of the highly-publicized work that has been done by anchor institutions so far has had the goal—and the result—of increasing real estate values in the surrounding area. This presents a serious problem of causing gentrification and displacing residents. Many of the programs were designed to benefit the university and not the community, and these consequences have seemingly come as a surprise. For example, since Yale began its neighborhood efforts, poverty in the community has

actually risen slightly. In response, Yale began an enhanced local hiring and purchasing program in an attempt to reverse this trend (Axelroth and Dubb 2010).

While much instructional literature trumpets the importance of including community voices, the lack of honest evaluation of many such projects is of great concern. Before promoting these types of projects as something all anchors should attempt to take on, there should be an honest inventory that real good is being done, and that benefits will flow to both the anchor and the community. In his book Pushing Back the Gates, UPenn alumnus Harley Etienne examines the university's revitalization movement from a community perspective. His findings do not reflect well on the university's efforts. Many of the much-touted effects seem to have benefited the university at the expense of the community; local residents have been forced to leave, and local businesses have been competed out of business by those retail establishments funded by UPenn. Minorities have left West Philadelphia at an extremely high rate, and UPenn's elementary school, which only serves one neighborhood, has become so prestigious that only the wealthiest can afford to live in that neighborhood (2012). Examinations of projects like this are badly needed but exceedingly rare. Community perspectives, for the most part, are largely absent from the analysis of anchor institution's activities.

Etienne highlights the risk of anchor involvement that puts the institution's needs before that of the neighborhood. When this happens, gentrification is almost inevitable. In these cases, neighborhood residents may be worse off than before: residents that once faced poverty and social problems may now also be

pushed out of their homes. When anchor institutions focus on place rather than people and on improving a neighborhood rather than the lives of residents, the results can be devastating for those residents.

Little has been written about anchor activities in rural areas, or anchor institution involvement in environmental initiatives. However, the idea of focusing on people rather than place can still apply. In divisive and controversial cases such as the one in Great Bay, anchor institutions will not want to engage in policy debates. Instead, engaging stakeholders to work toward a commonly-held goal—in this case, a clean bay—is a way to make a difference without alienating community members or appearing to “choose a side” in a controversial issue. In all cases of true anchor engagement, the anchor must work to ensure that its own needs do not eclipse or contradict the needs of local citizens.

Methodology

The literature review examined the scholarly writing on the field of anchor institutions in an attempt to understand some of the ways anchor institutions have participated in community change, and to examine the theory behind anchor institution involvement. This analysis attempted to include much of the seminal literature in this relatively burgeoning field. Because the study of anchor institutions is still in the early stages, a major part of this analysis was to identify the knowledge gaps that still exist.

Great Bay was chosen as a case study for several reasons, the primary one being the fairly dramatic circumstances surrounding its management. As discussed in the literature review, the Bay's management, particularly regarding nitrogen runoff, has created contentious political battles. Another reason Great Bay was chosen is that, while many aspects of Great Bay's biogeochemistry have been heavily studied, there is still a seeming consensus that not much is being done to actually protect the Bay. From an anchor institution perspective, UNH is a large and highly publicized anchor institution. On a personal level, Great Bay is a place of great beauty and cultural importance to many people, including this author. Casco Bay and Plum Island Sound were studied in an attempt to understand the ways Great Bay differs from nearby watersheds with fairly similar cultural and physical climates. Besides the relative similarities that are discussed in more detail in the Introduction, the sites were also chosen because they, like Great Bay, are National Estuary Program sites. The fact that each of these watersheds is served by an Estuary Partnership meant that the activities of these

partnerships would provide another means of comparison.

The next major step was familiarization with the political, demographic, and regulatory landscape of watershed management in the Great Bay watershed and the comparison watersheds. This analysis involved a different kind of literature review, where the “literature” consisted of many informal cultural artifacts. Newspaper articles, program websites, bills and laws, nonprofit organizations' mission statements, and government documents were all analyzed in this stage, in an attempt to understand some of the forces influencing environmental management in these areas. During this time, through this analysis as well as through informal conversations and personal knowledge of the area, a list of anchor institutions in these study areas was created; institutions were chosen because they seemed to possess the characteristics of an anchor institution (listed in the introduction), regardless of whether they seemed to be involved in water-related initiatives.

Initial interview subjects were identified as members of relevant anchor institutions and estuary partnerships. Interviews were conducted with representatives of Great Bay's Piscataqua Region Estuary Partnership, the Casco Bay Estuary Partnership, and the Plum Island Sound's Massachusetts Bay Estuary Partnership. Other initial interviews were conducted with researchers from UNH. Interview subjects were selected through personal connections and through recommendations of others who were familiar with the area. Several interview subjects recommended others who could provide relevant information. Appendix 4 contains a list of those parties who were recommended, or those whom were

identified as being able to give valuable input but were not interviewed due to time constraints. Table 4 lists all interview subjects and their titles.

Name	Job Title/Expertise	Organization
Dr. Mimi Becker	Associate Professor/ Expert in Environmental Policy	UNH Department of Natural Resources
Dr. Curtis Bohlen	Director	Casco Bay Estuary Partnership
Dr. David Burdick	Research Associate Professor/ Marine Wetland Scientist	UNH Department of Natural Resources/ Jackson Estuarine Laboratory
Michelle Daley	Associate Director/ Research Scientist	UNH Department of Natural Resources/ NH Water Resources Research Center
Jill Farrell	Community Impact Program Manager	Piscataqua Region Estuary Partnership
Dr. Paul Kirshen	Research Professor	UNH Department of Civil Engineering/ Institute for the Study of Earth, Oceans, and Space
Peter Phippen	Director	Massachusetts Bays Program – Upper North Shore Region
Peter Wellenberger	Great Bay-Piscataqua Waterkeeper	Conservation Law Foundation

Table 4: Interview Subjects, with Titles and Affiliations.

Each interview lasted approximately one hour, and, with the exception of two telephone interviews (with Dr. Becker and Dr. Kirshen), were conducted in person at the subjects' offices or other sites of their choosing. All interviews were conducted in a semi-structured manner. This format allowed all subjects, experts in their fields, to share insights and knowledge I may not have been able to anticipate beforehand, and for me to go “off-script” to learn more about what the subject wanted to share. Because of the politically sensitive nature of the situation in Great Bay, and to foster an open and honest conversation, interviews

were not audiorecorded but transcribed by hand and later typed. Because all interview subjects were experts in their fields, the Tufts Institutional Review Board did not mandate that interview data be kept anonymous.

Interviews with representatives of estuary partnerships were all conducted with the aim of learning the capabilities of each organization, and the ways these organizations worked to fulfill their stated missions and goals. Particular attention was paid to learning which nonprofits and other groups, including anchor institutions, acted as partners with these estuary partnerships.

Interviews with researchers went in different directions—some researchers interviewed were policy experts, while others were scientists. With scientists, the focus was on learning about the major research needs in the area and on what needs were being fulfilled. Particular focus was given to the ways that funding shortages were affecting research and whether politics were seen as an influence in selection of research topics. Many of these interview subjects are very active in community environmental nonprofits, and those experts were questioned about how they separated their role as community activist from that of scientific expert. Of course, there was some overlap between experts in different fields—for example, some policy-oriented researchers and estuary partnership staff members were intimately familiar with the estuaries' research needs. Because so many of the experts interviewed were involved in local nonprofit advocacy groups, and because most of these nonprofits are volunteer-driven, only one interview was conducted with someone primarily representing an independent nonprofit organization: an individual from an umbrella organization called Rescue Great

Bay, which has affiliations with the influential, New England-based Conservation Law Foundation.

The interviews were conducted to understand experts' opinions on issues in the Great Bay, but primarily to analyze the ways anchor institutions operate within the framework of Great Bay's management. However, it was difficult to speak directly about this with interview subjects for two reasons. First, most of the interview subjects had never heard the term “anchor institution,” and many had difficulty understanding the concept. The second reason was the relative lack of anchor involvement by institutions besides UNH. Rather than risk misleading subjects and conducting discussions on a theoretical basis, discussions strictly focused on the current situation in the watersheds instead of leading subjects to speculate about how or why the situation could be different.

Keeping this consideration in mind, the interviews were analyzed as an inventory of the current state of the estuary. A trend was identified if a given theme arose in more than three interviews. Because the interview content varied enough that a side-by-side comparison would be difficult, and the subjects were experts in relatively different fields, the interviews were used as a way to guide research and supplement the lessons learned from the literature review. The trends that could be identified from such a disparate set of interviews were limited, but together, the interviews led to a more thorough understanding of situations identified in the literature review.

Recommendations were made using guidance from two sources: successful case studies of anchor-community partnerships, and successful case

studies of large-scale, community-driven watershed management initiatives.

When taking into account some of the major limiting factors identified in the interview analysis, these anchor-driven watershed success stories can provide insight into some of the ways anchor institutions and watershed advocates may enjoy a more mutually beneficial relationship.

Analysis

Differences Among NEP Partnerships

Estuary partnerships have different management structures, and Great Bay, Casco Bay, and Plum Island Sound illustrate this. Each of these partnerships is unique in its management and administration. The Great Bay watershed presents a particular management jurisdiction challenge because it lies within two states. According to Jill Farrell, Community Impact Program Manager of PREP, the flexibility of the NEP setup, and PREP's "home" in a university rather than a state government, means that PREP is not limited to New Hampshire. Its program has jurisdiction throughout the watershed, in both the New Hampshire and Maine portions. (Personal interview: January 10, 2013).

Like PREP, CBEP is also housed in a university, the University of Southern Maine (USM). However, Curtis Bohlen, CBEP's Director, points out that the university's nature makes a major difference. UNH's status as a major research institution, with appropriate facilities and federal funding, helps Great Bay receive needed research, and provides PREP with important scientific information and monitoring tools. USM is a teaching institution; faculty have heavier course loads with less opportunity for outside research, and the university system does not have any laboratories in the facility. For the CBEP, this represents a major gap that other anchor institutions in the watershed could not easily fill. One of CBEP's goals is for the University of Maine, an anchor institution outside of the watershed with many more research resources, to center more of its research around Casco Bay—but, still, the lack of laboratory facilities

presents an obstacle (Personal Interview: February 1, 2013).

The Plum Island Estuary, represented by the Upper North Shore Region of the MBP, faces very different circumstances. The MBP is actually a branch of the government of the Commonwealth of Massachusetts, and the Upper North Shore region is run by 8 Towns and the Great Marsh, an arm of a regional planning authority, the Merrimack Valley Planning Authority. While Casco Bay and Great Bay each have three full-time staff members and several others contributing, 8 Towns and the Great Marsh has just one employee, Peter Phippen, who works only three-quarters time. However, the Upper North Shore/Plum Island Sound region has an abundance of monitoring and research activities. Massachusetts Audubon, Parker River Wildlife Refuge, Plum Island Estuary Long-Term Ecological Site, and Rachel Carson Preserve all contribute to the research and management of the area. In contrast to the CBEP, an overarching goal of MBP/Upper North Shore is not to attract more research but to encourage education and awareness of the ecosystem (Peter Phippen, Personal Interview: 1/14/13).

Besides the relative lack of need for scientific information, this type of approach would also be difficult because Eight Towns and the Great Marsh has a relatively small geographic scope, limited mostly to the nine coastal towns abutting the Great Marsh, with a few exceptions for large projects further inland. The watershed of the Upper North Shore region (including Plum Island Estuary and coastal drainage) is huge, because it contains the Merrimack River, which has its headwaters as the Pemigewasset River in northern New Hampshire. Combined

sewer overflow runoff into the Merrimack makes up the bulk of the pollutant load to the estuary. Since it has no way of controlling this, the NEP program focuses on more immediate coastal threats, in contrast with the larger, watershed-scale focus of CBEP and PREP (Peter Phippen, Personal Interview: January 14, 2013).

For PREP, UNH's involvement provides a major advantage in the form of the organization's mandatory Comprehensive Management Plan. PREP releases a new report, the *State of Our Estuary*, every three years, the most recent released in December 2012 and published in early 2013 (Piscataqua Region Estuary Partnership 2013). In contrast, CBEP released its last report in 2010, with its previous one in 2005 (Casco Bay Estuary Partnership 2010), and the Massachusetts Bays Program last updated its report in 2010, its first update since 2004 (Massachusetts Bays Program 2010). PREP's report lists its Technical, Social Science, and Public Policy Advisory Committees—the group of experts who volunteer to curate the material and provide assistance in the completion of the report (Piscataqua Region Estuary Partnership 2013). The list, made up largely of UNH researchers, provides a likely reason that PREP is able to release its report so much more often. In contrast, the CBEP report seems to be written totally by staff members, and the MBP report lists experts, mostly from various state agencies and research institutions, as authors of its report sections. By virtue of the fact that there are so many researchers whose everyday work involves social and natural ecosystems in the Great Bay watershed, it is unsurprising that so many of these professionals contributed to the *State of Our Estuary*.

New Hampshire Funding Issues

Funding shortages set the backdrop for all environmental initiatives in New Hampshire, and this contributes to some of the political controversy around Great Bay: there are major monitoring gaps, and this leads to unanswered questions about the severity of the problems in Great Bay and how they should be addressed. New Hampshire is last in the nation in per-capita university system funding from the state, and held this position even before the 2011 fiscal year, when state appropriations were cut by 49 percent (University of New Hampshire 2013).

These circumstances place obvious constraints on UNH's activities, and the amount that it can fulfill the gaps in Great Bay's monitoring. Currently, much is not known about the Great Bay ecosystem. Many of the freshwater tributaries have been frequently monitored and heavily studied, but the Cocheco River, which has some of the most severe pollution problems of all the Great Bay tributaries, is not monitored (Peter Wellenburger: Personal Interview 2/7/13). There is little monitoring of the water quality in tidal areas throughout the Bay, and macroalgae, which has important ecological effects, is still not adequately understood or monitored (Michelle Daley: Personal Interview 1/17/13, David Burdick: Personal Interview 1/17/13). Seagrass monitoring is scarce, the role of chlorophyll not fully understood, and there are major research needs regarding the presence of phytoplankton. Besides these individual factors, there has been no holistic study of the way the Bay functions or how all these factors interact (Burdick 1/17/13).

The budget constraints also make it more difficult to overcome the limitations of academia in trying to bring about ecosystem-based management. The traditional setup of academic departments creates compartments: there is a wetlands expert, a soils expert, a policy expert, and so on. With researchers forced to find alternative funding sources, create a steady output of new data, and stay relevant, this compartmentalization seems to worsen. While many experts volunteer on local boards and advocate outside of work, budget constraints seem to limit the amount they can collaborate and study the system on a more holistic level. When asked whether he believed this compartmentalization was due to shortcomings of the academic system, Burdick placed the blame not on the researchers or the system itself but on the constant lack of funding, saying that researchers would be happy not to be limited (1/17/13).

Recent efforts have been made to reconcile science and policy, with the National Science Foundation now asking for interdisciplinary teams that include social scientists on environmental research projects. Other federal funding sources now stipulate that researchers work with stakeholders throughout the research process (Mimi Becker: Personal Interview 2/28/13).

Who Participates—and Who Doesn't

One of the underlying hypotheses of this thesis is that NEP partnerships—PREP, CBEP, and MBEP—act as anchor coordinators, bringing together various institutions and smaller nonprofits. The research process made it clear that this is not always the case. Administrators of each NEP program are given relative freedom to run their programs in ways that fit the local political climate and take

advantage of the resources available. NEP partnerships are structured for collaboration, designed for all stakeholders to get involved. These stakeholders include local experts, local citizens, the business community, and all others interested in and affected by watershed management decisions (Imperial and Hennesy 1995). By this definition, anchor institutions should certainly be considered stakeholders. However, this research made it clear that there are many anchor institutions, even those that are heavily involved in other social, economic, and cultural initiatives, that have not stepped up or been recruited as “partners” in these watershed partnerships. In Great Bay, some of the obvious non-partners include the Portsmouth Naval Shipyard, Pease Tradeport, various hospitals and private schools, and large businesses such as Lanza and Liberty Mutual, which are both major area employers.

It should be noted that a lack of collaboration with PREP does not necessarily mean that these institutions are not involved in Great Bay protection activities on other levels. For example, the Portsmouth Naval Shipyard, which is directly adjacent to the Piscataqua River, has launched a major remediation effort to counteract the extreme toxic pollution that has resulted from years of submarine and ship repair; for this it won a U.S. Navy award for its stewardship (Naval Facilities Engineering Command 2011). Public Service of New Hampshire, a utility company, partnered with the Town of Durham to create an educational exhibit on compact fluorescent light bulbs (Public Service of New Hampshire 2011) and to install energy-efficient upgrades to its wastewater treatment plant (Public Service of New Hampshire 2011b). However, as a whole,

anchor institution collaboration in watershed protection seems limited to just a few very visible groups.

The Many Roles of UNH

UNH does not have a marine school, but its Marine Program acts as an umbrella uniting its Seagrass program, which receives national funds for oceanic research, with PREP and the Great Bay National Estuarine Research Reserve. The Cooperative Extension is also active in watershed protection matters. These programs tend to avoid politicization by focusing on wise use and management rather than advocating for specific policies (Burdick 1/17/13). Appendix 2 provides a full list of UNH programs directly relevant to Great Bay.

Despite all these programs, UNH has not approached management of Great Bay in a coordinated, and there are still major research gaps. As previously discussed, this piecemeal approach is caused in many ways by funding shortages. As an undergraduate and an employee at UNH, a common mantra was that Great Bay is the most studied estuarine system in the world (although no literature was found to back this up). While there are in fact many such programs that have some hand in Great Bay's monitoring or research, it is striking that most of it is not coordinated. As discussed previously, researchers have little systemic understanding of the Bay. While UNH, as the only local research institution and with its many initiatives, is almost certainly the most important player in researching Great Bay, the severe budget limitations limit Great Bay to something of a laboratory. The lack of protective measures implemented in the Bay, and the hostile political climate surrounding the question of how to protect its resources,

reflect the fact that there are still many questions to be answered, and it is unclear whether it is possible for UNH researchers to answer those questions given their current constraints. While UNH's role is important, it may just be too limited—financially and politically—to provide comprehensive long-term solutions to the Bay's ecological problems.

Local Business Involvement

One of PREP's recent, highly publicized partnerships was the “Clean Water - Tasty Beer” campaign with Smuttynose Brewery. Besides a cash donation, Smuttynose also contributed to a summer concert series promoting PREP's efforts, distributed to local restaurants pint glasses with the campaign's logo, and sponsored various events. Jill Farrell of PREP noted that this was a beneficial arrangement for both partners, since Smuttynose depends on local water supplies for its beer.

It could be questioned whether a business like Smuttynose, which has 39 employees (Smuttynose Brewery 2013), is actually an anchor institution. However, by engaging in activities like this and embedding itself more deeply in the community, a relatively small business like Smuttynose, which is actually named for an island off New Hampshire's coast and uses as its logo an illustration of a harbor seal, can position itself as an anchor institution. Small business development has been shown to be a strategy for community revitalization in cities such as Camden, New Jersey, which recognize their economic and community building power (Christiansen 2013). In interviews and conversations, many people mentioned a love for living in New Hampshire, for its beautiful

scenery, outdoor recreation, and low taxes. The large amount of independent restaurants and breweries in the area certainly contributes to this culture.

Smuttynose's effort is an example of a way that a business can leverage its philanthropy in order to gain a strategic advantage by helping to create a more beneficial business environment: “(W)here corporate philanthropy has an important influence on a company's competitive context... philanthropy is truly strategic” (Porter and Kramer 2002, 7). Speaking to the Green Alliance, a Portsmouth-based coalition of sustainable businesses, the owner of Smuttynose also mentioned that many of his customers and staff members feel a great love for kayaking and other recreation on Great Bay (The Green Alliance 2012). In contributing to the conservation of the Bay and helping to preserve essential parts of the Southern New Hampshire lifestyle, Smuttynose is creating a happy and productive staff, while at the same time working to ensure that the area is livable and attractive to customers.

Another business effort is a collaboration between the Coastal Conservation Association of New Hampshire, the Nature Conservancy, UNH's Jackson Estuarine Laboratory, and several local businesses. Through an oyster restoration program, restaurants keep oyster shells after customers have eaten them, and the shells are placed in Great Bay to create a substrate for more oysters to grow. The initiative also hosts an annual “Piscataqua Oyster-Palooza” at the Seacoast Science Center in Rye, an educational and culinary event—complete with Smuttynose beer (Coastal Conservation Association of New Hampshire nd). The competitive advantage for participating restaurants is clear; they make money

by selling oysters. The oysters, which act as important filters for the water, will help clean Great Bay, and by using local oysters instead of having to import from other states, restaurant owners can cut down on costs. By participating in philanthropy that is relevant to their mission, the restaurants are gaining a strategic advantage beyond just good publicity.

By themselves, these projects are fairly small—it would be difficult, if not impossible, to create significant environmental change with such small-scale initiatives. But besides the potential cumulative impact of many such small projects, business participation creates a major opportunity to build public awareness. New Hampshire residents, as a whole, are notoriously opposed to taxes and government intrusion (Michelle Daley: Personal Interview 1/17/13, Peter Wellenberger: Personal Interview 2/7/13). Because of this lack of faith in the government, businesses and anchor institutions have a unique opportunity to shape public opinion in ways that might be more effective than information provided by the government. In the Great Bay watershed, if the estuary is to be protected, public awareness is key. If citizens feel the imperative to protect Great Bay, that will lead to pressure on elected officials to make laws that will benefit the Bay.

In March 2013, Newmarket residents voted on a ballot measure to set aside \$14.1 million to upgrade the town's wastewater treatment plant to meet the EPA's standards. The measure passed overwhelmingly, with the support of over 80 percent of voters. This came as a surprise to lawmakers in the town, which is facing major financial problems (McMenemy 2013). In cases like this, citizen

opinion directly and heavily impacts the decisions regarding Great Bay's management, and this extra legitimacy added by businesses may sway voters' decisions.

Efforts to Collaborate

Throughout the interview process, it became clear that many activists see collaboration among groups as a way to help. PREP, the Southeast Watershed Alliance, the Great Bay Municipal Coalition, and the Rescue Great Bay Coalition all exist as a result of attempts to bring together different groups to pool resources. This thesis began with the hypothesis that PREP acts as an anchor coordinator, bringing together anchor institutions, residents, and nonprofit organizations to achieve a common goal. These other groups also seemed to have been created with that same goal.

To some extent, PREP does fulfill the role of anchor coordinator. PREP uses its resources to foster collaboration among stakeholders large and small, and does bring about some collaborative projects. However, according to Jill Farrell, PREP's overarching goal is to bring together many scientific findings and communicate the overall findings to the community. This goal, and its location at UNH, enable PREP to work closely with UNH but do not make such an obvious case for working with other anchor institutions. However, PREP has branched out in efforts such as the Clean Water – Tasty Beer collaboration. Farrell also expressed interest in working with other groups, and as more connections are made, it seems that further anchor institution involvement could be possible in the future.

CBEP and MBEP—Upper North Shore seem to have less collaborations in general. As discussed previously, these two partnerships have different challenges. In the Casco Bay watershed, while there are many anchor institutions, particularly cultural institutions, the lack of current and potential monitoring and research is a major limitation. In the Upper North Shore region, there are few anchor institutions, and the bureaucracy of a state agency running the partnership seems to limit the scope and types of projects that are allowed. Perhaps this is why both agencies seem to be more constrained, with more focus on allocation of funds and general support of existing projects than on the creation of major new partnerships.

In Great Bay, however, PREP is not the only group that seeks to create partnerships. With regard to nonprofits, this sort of collaboration seems logical, especially given the many nonprofit groups in the watershed—each of the major tributaries to Great Bay, for example, has at least one citizen-run watershed association. According to Peter Wellenberger, Great Bay-Piscataqua Waterkeeper, this volume of nonprofits was the impetus for Rescue Great Bay, a collaboration originally formed in opposition to the Great Bay Municipal Coalition.

The Great Bay Municipal Coalition was formed by municipalities in the watershed in opposition to the EPA's mandate that they update their wastewater treatment plants, but since its formation most of the member municipalities have reached agreements with the EPA, with long-term plans being put in place for funding and either replacing or upgrading existing plants. The status of the Coalition seems unclear, with only Portsmouth, Dover, and Rochester left without

approved permits. With Newmarket voters choosing to set aside funds for a new plant, and after repeatedly being rebuffed in court, the Great Bay Municipal Coalition does not seem to have a promising future.

There is risk in founding a coalition around a single purpose, but Rescue Great Bay seems to be continuing, with nonprofits, small local businesses, and one town, Newington, working to promote good stormwater practices to local residents. Although the organization does not yet legally exist, its membership meets monthly and its initiatives are continuing (Personal Interview: Wellenberger 2/7/13). There are several possibilities why the Municipal Coalition has largely collapsed while Rescue Great Bay seems to be continuing. The first is that Rescue Great Bay was founded to bring together many organizations with similar missions, while the Municipal Coalition sought to bring together very different municipalities around one issue which would likely have very different effects in different towns. Secondly, while the Municipal Coalition's mission was largely reactive and fairly antagonistic, Rescue Great Bay is likely to see more support by educating homeowners on proactive ways to protect Great Bay.

The Southeast Watershed Alliance (SWA) was founded to unite the municipalities of the Great Bay watershed, fostering a more regional approach to watershed protection (Southeast Watershed Alliance 2013). The group does have legislative power, although so far most of its activities seem to have been smaller initiatives and the creation of model water protection legislation for cities and towns. Several interview subjects privately expressed skepticism over the organization's effectiveness, because of its lack of action so far, and because it has

been linked to the Great Bay Municipal Coalition through several of its members and many of its activities.

Although these collaborative groups were all created to bring about major change, so far there hasn't been much evidence that Great Bay will benefit from these large collaborative groups. Although this may change in the future, it also seems that many major stakeholders are getting left out. Most of these groups do not count any local anchor institutions as members, and anchor institutions seem unlikely to publicly align with groups that have overt political agendas. Unless these groups work to make their messages less political and to attract more large supporters, this lack of major support may continue to limit these collaborations.

Case-by-Case Approach

Many of the initiatives that anchor institutions have been involved in have been on the basis of an individual project, such as UNH's research projects, or Great Bay Community College doing community outreach for rain garden construction (Hodgson Brook Restoration Project 2013). These types of alliances allow for effective projects that are not in name only, and also allow anchor institutions to make a contribution to an environmental cause. Even small projects can also be leveraged for bigger projects in the future; a successful collaboration with an advocacy group could make an anchor institution more likely to pursue more ambitious projects in the future.

This case-by-case approach could also be beneficial to small towns. Anchor institutions are likely to intervene in their own city or town as is the case with initiatives involving Phillips Exeter Academy in Exeter and UNH in

Durham. While these towns are fairly small and may not have had the resources to undergo major projects on their own, the contribution of anchor institutions can help to make it easier. Once these initial projects have been completed, they can act as models for other towns and present potential improvements for future projects.

Recommendations

In New Hampshire, a lack of state government funding for environmental projects is a major limiting factor. Due to the prevailing anti-tax attitude among the state's residents, this is unlikely to change anytime soon. UNH, as a state-funded university and perhaps the largest player in Great Bay's monitoring and management, plays an important role, but this role is limited by these funding shortcomings.

However, this anti-government, pro-business attitude also provides distinct opportunities for anchor institutions to intervene in environmental efforts. While many residents in this area are pro-small-government, this does not mean they are anti-environmentalists. To residents and businesses, a clean Great Bay is an essential part of the local lifestyle. Anchor institutions likely have more credibility than the government in many, if not most, cases in New Hampshire. When anchor institutions “endorse” a problem by acknowledging it as something important that must be addressed, this could have a clear impact on public opinion. In cases of local government, if even small-government proponents could support diverting some funds to Great Bay projects, such as a new wastewater treatment plant, this could be very beneficial.

While PREP and other groups should continue in striving to unite different groups, anchor institutions should be included in the conversation whenever possible. However, some anchor institutions are reluctant to align themselves with groups overtly advocating for anything that could be considered political. In cases like this, individual and community-level projects may be

beneficial on many levels. An agreement with an anchor institution for a one-time project should not be seen as negative. This type of arrangement helps to build future relationships, and it can also provide models for similar future projects. One consideration is that many anchor institutions are more motivated to work in the municipalities in which they are located, potentially putting other watershed communities, particularly small ones, at a disadvantage. A case-by-case approach is not always negative, and a hyper-local project can be a good beginning. Once a project is completed and a relationship is formed between the anchor and the advocates, the advocates may be able to help the anchor see beyond political boundaries in future projects. Shifting the scale from municipality to watershed can create partnerships to help smaller, often-underserved towns complete projects that would otherwise require outside resources.

This investigation found that PREP and other NEP partnerships do not necessarily act as “anchor coordinators,” organizing and bringing together multiple community anchors with nonprofit organizations and other stakeholders. There are many reasons they do not do this, including funding limitations, political expectations, and a lack of capacity. In some watersheds—such as the Plum Island Sound/Upper North Shore region, which has few anchor institutions—acting as an anchor coordinator simply would not make sense. In Great Bay, however, PREP has already begun acting as an anchor coordinator in some ways. If nonprofits take a case-by-case approach to initiate small projects with anchor institutions, PREP would be an ideal vehicle for coordinating larger

projects.

In trying to engage anchor institutions, advocates and anchor coordinators should embrace the idea of strategic philanthropy, or, as PREP's Jill Farrell put it, "natural alignments" with other groups' missions (Personal interview, 1/10/13). This provides incentive for anchor institutions to participate and to be invested in the success of a project, rather than just donating funds. For several of the more obvious anchor institutions that have not participated in partnerships, there are many natural alignments.

The Portsmouth Naval Shipyard is located directly on the Piscataqua River, where it docks its submarines. This dependence likely gives the Shipyard an interest in clean water. Although it can be very difficult to work with the military due to security concerns and differing priorities, among other considerations, the Shipyard, with its not-stellar history of environmental stewardship, has recently embarked on high-profile environmental efforts, as discussed previously. Collaborations with local groups can be a strong way for the Shipyard to enhance its environmental efforts. These types of community partnerships may help to make the Shipyard even more of a community anchor institution. Such community connections may prove to be important with the periodic threat of base closures.

The Shipyard, with 4,700 civilian employees (U.S. Navy n.d.), has incentive to keep the area livable and attractive for its employees. The same can be said for the Pease Redevelopment Authority, which has played a major economic development role in the region since the site was decommissioned as an

Air Force base. Clean water can be seen as a key part of economic development in southern New Hampshire, and it is a big part of the reason many people seem to choose to live in the area. Boating, fishing, and even eating at waterfront restaurants are all part of the culture that attracts residents and employees. An entity truly invested in the area's continuing growth should acknowledge the importance of its natural resources.

For Pease, the motivation goes beyond the environment/economy connection. Pease is located on Great Bay, and contains the Great Bay National Wildlife Refuge. Some of its businesses are also connected to Portsmouth's public water and sewer systems, but Pease also has its own wastewater treatment plant that will likely face some restrictions in the future. Positioning themselves as strong supporters of a clean and healthy environment will position the Redevelopment Authority not just as land managers and economic drivers but as advocates for the area as a great place to live and do business.

Many small cultural institutions have these "natural alignments" and should not be overlooked. For example, the Portsmouth Music Hall's new Loft, located across the street from the original historic Music Hall, is a smaller venue. The Loft hosts speakers, writers, and musicians from many different areas, including a set of programs known as "Explore + Learn," which encompasses many subject areas and is aimed at many different ages (Portsmouth Music Hall n.d.). Nonprofits and other advocates should seek out opportunities like this; the Music Hall's popularity and ability to draw an audience would make it an ideal place to host an educational speaker about the issues facing Great Bay.

Educating children and youth about the importance of Great Bay is crucial as well. The Seacoast Science Center and the Great Bay National Estuarine Research Reserve host programs for children, but Great Bay advocacy aligns with anyone with an educational mission. Private schools such as Phillips Exeter Academy and Berwick Academy have many resources and could incorporate such environmental projects with their educational activities. Museums such as Portsmouth's Strawberry Banke and the Dover Children's Museum may find internal motivations to embark on such activities as well. All four of these anchor institutions are located less than a half mile from a major water resource (Exeter, Great Works, Piscataqua, and Cocheco Rivers). This proximity makes it convenient for these anchor institutions to incorporate some sorts of hands-on activity—and it also makes it clear how connected members of the watershed are to Great Bay, and how much motivation can be found to get involved.

Conclusions and Consideration for Future Research

The political situation in Great Bay is complex, and this thesis was limited by time and scope. It was impossible to contact all stakeholders in this investigation, and as discussed in the Methodology section, individuals were identified as a sort of representative cross-section. A deeper investigation should develop a set of standardized questions, and ask the same questions of all. This investigation was intended to set the stage for efforts to involve anchor institutions more heavily in watershed advocacy.

In further research, more representatives of anchor institutions, nonprofits, and community groups could be useful. Interviews were tailored to the subject and conducted on an open-ended basis; this was an intentional effort to obtain the most complete picture of the situation in Great Bay within the constraints of the project. However, this meant an overall inability to compare the ways that different stakeholders answered the same questions—future researchers could help bring this to light by conducting more structured interviews and by using the same script to interview all subjects. Appendix 4 contains a list of individuals who were not interviewed due to time constraints, despite being recommended by others.

An unquestioned assumption of many stakeholders seemed to be that an umbrella group with the ability to bring together different people would present an ideal solution. While several of these groups currently exist, none has been

unequivocally successful in its goals. There are many possible explanations for this, including simply the lack of funding. However, a crucial aspect of finding success in Great Bay will be to figure out how to make these groups succeed—or determining whether they are simply not the best way to bring about positive environmental results in Great Bay. The possibility that these umbrella groups may act as “anchor coordinators” should also be examined. Because these umbrella groups are so often seen as the answer, an honest examination of them is crucial.

Finally, a common theme of this thesis was the lack of research and monitoring in many aspects of the Great Bay ecosystem. This lack of data also extends to the watershed's social ecosystem. If advocates for Great Bay are hoping to influence popular opinion and to create management solutions that are feasible in the area, the social aspects will be crucial. Washburn created a useful analysis of the decision-making ecosystem in the Lamprey River watershed; if a similar analysis could be applied to the entire watershed, the results may help advocates create more locally-beneficial policies and education measures (2009).

In the much-maligned Great Bay watershed, anchor institutions have often been overlooked as a key player in management. Anchor institutions do participate in many ways—UNH on a large and often haphazard scale, and smaller institutions and particularly businesses on the basis of smaller, individual projects. However, advocates often fail to consider the ways that these institutions can contribute valuable resources in a time of severe government scarcity and can influence public opinion in potentially crucial ways. Anchor

institutions, in deciding to take part in environmental initiatives, may find a major strategic advantage, and environmental advocates should think strategically and find ways to leverage mutual missions to maximize the impacts of these partnerships.

Bibliography

- Association of Public and Land-Grant Universities. 2012. *The Land-Grant Tradition*. Washington, D.C.
- Axelroth, R. and S. Dubb. 2010. *The Road Half Traveled: University Engagement as a Crossroads*. College Park: University of Maryland.
- Blodgett, J. E. 2004. *Environmental Protection: New Approaches* Nova Publishers.
- Bresler, Samantha E. 2012. "Policy Recommendations for Reducing Reactive Nitrogen from Wastewater Treatment in the Great Bay Estuary, NH." *Environmental Science & Policy* 19–20 (0): 69-77.
- Casco Bay Estuary Partnership. "Partners.", <http://www.cascobay.usm.maine.edu/partners.html>.
- . . 2010. *State of the Bay 2010*.
- CEOs for Cities and Living Cities. 2010. *How to Behave Like an Anchor Institution*.
- Christiansen, Gayle. 2013. "Strengthening Small Businesses: Strategies for Makin' a Way Where there is no Way in Camden, New Jersey." Chap. 1, In *Transforming Cities and Minds through the Scholarship of Engagement: Economy, Equity, and Environment*, edited by Lorlene Hoyt, 29-57. Nashville, TN: Vanderbilt University Press.
- Clark, Joshua. 2010. "Communities Question Science in Determining Nitrogen in Great Bay." *Portsmouth Herald*, June 20, 2010.
- Coastal Conservation Association of New Hampshire. "CCA NH Oyster Restoration Program.", <http://www.ccanh.org/oyster-restoration.html>.
- Deegan, L. A., D. S. Johnson, R. S. Warren, B. J. Peterson, J. W. Fleeger, S. Fagherazzi, and W. M. Wollheim. 2012. "Coastal Eutrophication as a Driver of Salt Marsh Loss." *Nature* 490 (7420): 388-392.
- Evans-Brown, Sam. "New Study: Lawn Fertilizer, Septic Tanks Big Contributors to Great Bay Pollution." New Hampshire Public Radio, last modified May 16, 2013, accessed June 13, 2013, 2013, <http://www.nhpr.org/post/new-study-lawn-fertilizer-septic-tanks-big-contributors-great-bay-pollution>.
- Goldstein, Harvey and Joshua Drucker. 2006. "Economic Development Impacts of Universities on Regions: Do Size and Distance Matter?" *Economic Development Quarterly* 20 (1): 22-43.
- Haddadin, Jim. 2012. "Dover, Rochester, Exeter File New Lawsuit Against the EPA." *Foster's Daily Democrat*, December 17, 2012.

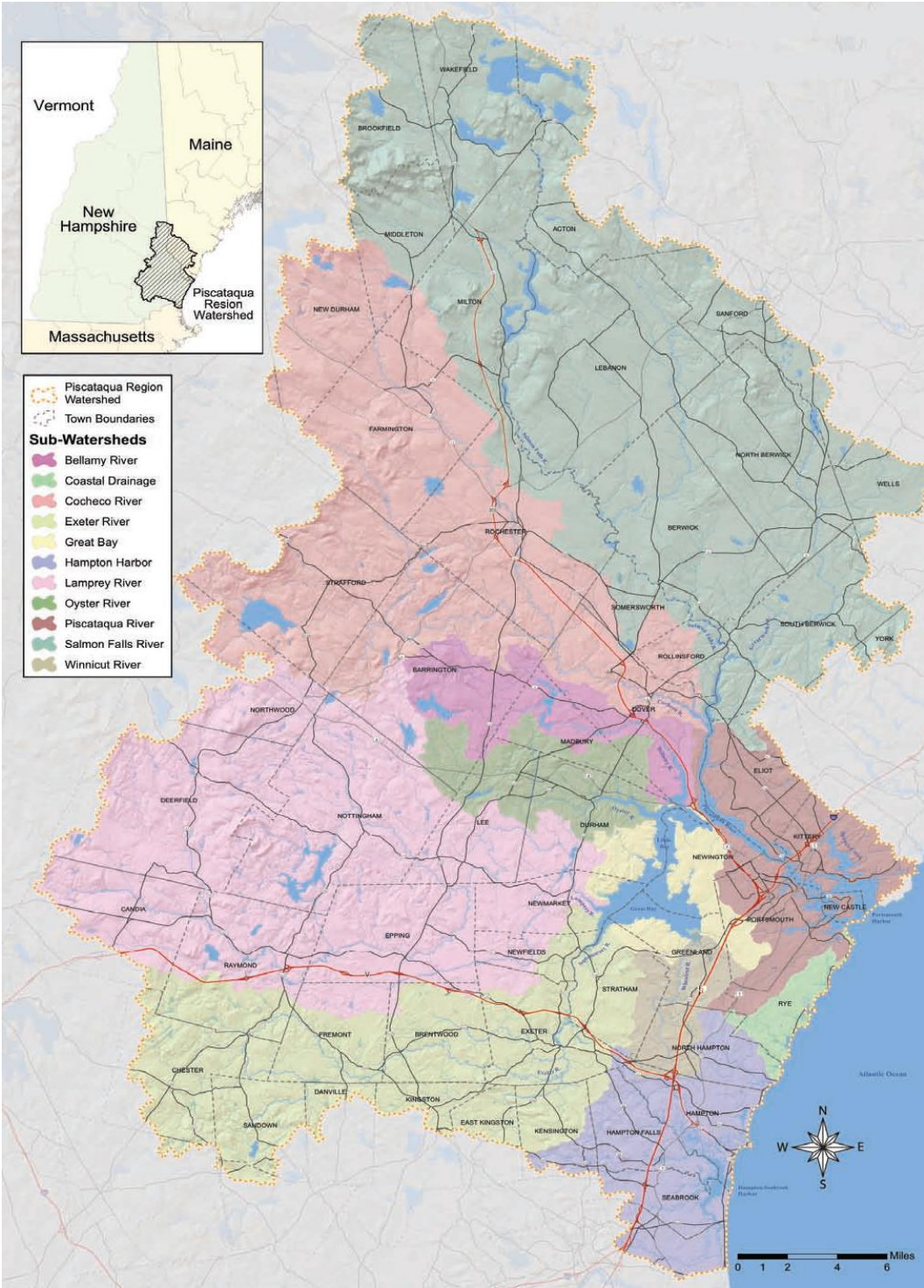
- Hodgson Brook Restoration Project. "An Introduction to Rain Garden Design and Installation.", <http://extension.unh.edu/events/files/8E4C2690-EC92-DCF5-17AD911BDF601569.pdf>.
- Howard, T. and S. Dubb. 2012. *Leveraging Anchor Institutions for Local Job Creation and Wealth Building*. Berkeley, CA.
- Imperial, Mark T. and Timothy M. Hennessey. 1996. "An ecosystem - based Approach to Managing Estuaries: An Assessment of the National Estuary Program." *Coastal Management* 24 (2): 115-139.
- Kingston, Michelle. 2013. "Cities Sign Pact with State for Great Bay Peer Review." *Foster's Daily Democrat*, May 1, 2013.
- . 2012. "EPA Dismisses Misconduct Concerns by Great Bay Coalition." *Foster's Daily Democrat*, October 16, 2012.
- Kromer, J. and L. Kerman. 2004. *West Philadelphia Initiatives: A Case Study in Urban Redevelopment*. Philadelphia: University of Pennsylvania.
- Long Term Ecological Research. *Plum Island Ecosystems*.
- Maine Department of Labor. "Top 50 Private Employers in Maine by Average Monthly Employment (Third Quarter 2012)." accessed May 9, 2013, <http://www.maine.gov/labor/cwri/publications/pdf/MaineTop50Employers.pdf>.
- Massachusetts Bays Estuary Program. 2010. *State of the Bays*.
- Maurasse, D. 2007. *Leveraging Anchor Institutions for Urban Success: CEOs for Cities*.
- McDowell, George. 2003. "Engaged Universities: Lessons from the Land-Grant Universities and Extension." *Annals of the American Academy of Political and Social Science* 585: 31-50.
- McMenemy, Jeff. 2013. "Newmarket OKs EPA Mandate for Wastewater Treatment Plant." *Portsmouth Herald*, March 12, 2013.
- Moore, Elizabeth A. and Tomas M. Koontz. 2003. "Research Note A Typology of Collaborative Watershed Groups: Citizen-Based, Agency-Based, and Mixed Partnerships." *Society & Natural Resources* 16 (5): 451-460.
- National Estuary Program. 2005. *Community-Based Watershed Management: Lessons from the National Estuary Program*: U.S. Environmental Protection Agency.
- National Ocean and Atmospheric Administration. "Ocean Facts." National Ocean Service., last modified March 26, 2013, accessed June 11, 2013, 2013, <http://oceanservice.noaa.gov/facts/population.html>.

- . "Quick Report Tool: Spatial Trends in Socioeconomics.", last modified 2/13/2013, accessed 3/22, 2013, <http://coastalsocioeconomics.noaa.gov/qrt/welcome.html>.
- National Science Board. 2012. *Diminishing Funding and Rising Expectations: Trends and Challenges for Public Research Universities*. Washington, D.C.: National Science Foundation.
- Naval Facilities Engineering Command. 2011. *Environmental Restoration - Installation: Portsmouth Naval Shipyard, Maine*: U.S. Department of the Navy.
- Netter Center for Community Partnerships. 2008. *Anchor Institutions Toolkit: A Guide for Neighborhood Revitalization*. Philadelphia: University of Pennsylvania.
- New Hampshire Department of Environmental Services. 2010. *New Hampshire's Watershed Report Cards*. Concord, NH.
- New Hampshire Public Radio. 2012. "The Exchange: The Future of Great Bay." www.nhpr.org/post/future-great-bay.
- Piscataqua Region Estuary Partnership. 2010. *Piscataqua Region 2010 Comprehensive Conservation and Management Plan*.
- . 2013. *State of our Estuary 2013*.
- Porter, Michael E. and Mark R. Kramer. 2002. "The Competitive Advantage of Corporate Philanthropy." *Harvard Business Review* 80 (12): 56-68.
- Portsmouth Herald Editorial Board. 2011. "EPA must Prove Need to Spend Millions." *Portsmouth Herald*, April 1, 2011.
- Portsmouth Music Hall. "Explore + Learn.", accessed 6/27, 2013, http://www.themusichall.org/explore_and_learn.
- Portsmouth Naval Shipyard. "Shipyard Facts.", accessed May 9, 2013, <http://www.navsea.navy.mil/shipyards/portsmouth/Pages/Facts.aspx>.
- Public Service of New Hampshire. "Study Up on Energy Efficient Lighting at the Durham Library.", last modified 9/28/2011, accessed 3/27, 2013, <http://www.psnh.com/MediaCenter/Press-Releases/2011-Press-Releases/Study-Up-on-Energy-Efficient-Lighting-at-Durham-Library.aspx>.
- . "Wastewater Treatment Facility Gets Efficient.", last modified 3/22/2011, accessed 3/27, 2013, <http://www.psnh.com/MediaCenter/Press-Releases/2011-Press-Releases/Wastewater-Treatment-Facility-Gets-Efficient.aspx>.
- Ramsdell, Laurene. 2012. "Durham Separates itself from Coalition Against Strict

- Environmental Permits." *Foster's Daily Democrat*, July 2, 2012.
- Rutheiser, Charles. 2011. "The Promise and Prospects of Anchor Institutions: Some Thoughts on an Emerging Field." *PD&R Edge HUD User*: 1-12.
- Sanborn, Aaron. 2013a. "Exeter Selectmen Accept EPA Permit for Wastewater Treatment Plant." *Portsmouth Herald*, January 9, 2013.
- . 2012a. "New Lawsuit Looms in Great Bay's Nitrogen Fight." *Portsmouth Herald*, September 18, 2012.
- . 2013b. "Towns Will Need Federal Funds to Clean Up Great Bay." *Portsmouth Herald*.
- . 2012b. "Wastewater Mud Slinging on Seacoast." *Portsmouth Herald*, December 19, 2012.
- Serang, Farzana, J. Phillip Thompson, and Ted Howard. 2013. *The Anchor Mission: Leveraging the Power of Anchor Institutions to Build Community Wealth*. College Park, MD: The Democracy Collaborative.
- Short, F. 2011. *Eelgrass Distribution in the Great Bay Estuary for 2010*: Piscataqua Region Estuaries Partnership.
- Smuttynose Brewery. "FAQ's: Questions we Get Asked a Lot.", accessed 3/26, 2013, http://www.smuttynose.com/faqs_questions_we_get_asked.html.
- The Green Alliance. "Blog: Smuttynose Brewing Company and Piscataqua Region Estuaries Partnership Unite for the Greater Good.", last modified 10/11/2012, accessed 3/26, 2013, <http://www.greenalliance.biz/blog/archives/201210/smuttynose-brewing-co-and-piscataqua-region-estuaries-partnership-unite-greener>.
- The Work Foundation. 2010. *Anchoring Growth: The Role of 'Anchor Institutions' in the Regeneration of UK Cities*.
- Townsend, Alan R. and Robert W. Howarth. 2010. "Fixing the Global Nitrogen Problem." *Scientific American*: 64-71.
- Trowbridge, Philip. 2008. *Methodology and Assessment Results Related to Eelgrass and Nitrogen in the Great Bay Estuary for Compliance with Water Quality Standards for the New Hampshire 2008 Section 303(d) List* New Hampshire Department of Environmental Services.
- U.S. Department of Housing and Urban Development Office of University Partnerships. 1998. *Colleges & Communities: Partners in Urban Revitalization*. Washington, D.C.: U.S. Department of Housing and Urban Development.
- U.S. House of Representatives Committee on Oversight and Government Reform.

2012. *EPA Overreach and the Impact on New Hampshire Communities*. 2nd sess., June 4, 2012.
- UNH Office of the President. "Mission and Institutional Identity." University of New Hampshire., accessed June 13, 2013, ,
<http://www.unh.edu/president/mission>.
- United States Census Bureau. "American Fact Finder.",
<http://factfinder2.census.gov/faces/tableservices/>.
- United States Environmental Protection Agency. "National Estuary Program (NEP) Overview.", last modified May 2, 2013, accessed May 8, 2013,
<http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2>.
- . "NPDES Permit Program Basics Frequently Asked Questions.", last modified 1/24/2013, accessed 2/12, 2013,
http://cfpub.epa.gov/npdes/faqs.cfm?program_id=45#107.
- . "State Program Status.", last modified 4/14/2003, accessed 2/12, 2013,
<http://cfpub.epa.gov/npdes/statestats.cfm>.
- United States Navy. "Shipyard Facts.", accessed 6/17, 2013,
<http://www.navsea.navy.mil/shipyards/portsmouth/Pages/Facts.aspx>.
- University of New Hampshire. "Budget Facts and Highlights.", accessed 4/9, 2013, <http://www.unh.edu/president/budget-facts-and-highlights>.
- Vitousek, P. M., J. D. Aber, R. W. Howarth, G. E. Likens, P. A. Matson, D. W. Schindler, W. H. Schlesinger, and D. G. Tilman. 1997. "Human Alteration of the Global Nitrogen Cycle: Sources and Consequences." *Ecological Applications* 7 (3): 737-750.
- Washburn, Erika Lea. 2009. "To Pave Or Not to Pave: A Social Landscape Analysis of Land use Decision-Making in the Lamprey River Watershed." Ph.D., University of New Hampshire.
- Webber, H. and M. Karlstrom. 2009. *Why Community Investment is Good for Nonprofit Anchor Institutions*: University of Chicago Chapin Hall.
- Williams, S. L. and E. D. Grosholz. 2008. "The Invasive Species Challenge in Estuarine and Coastal Environments: Marrying Management and Science." *Estuaries and Coasts* 31 (1): 3-20.

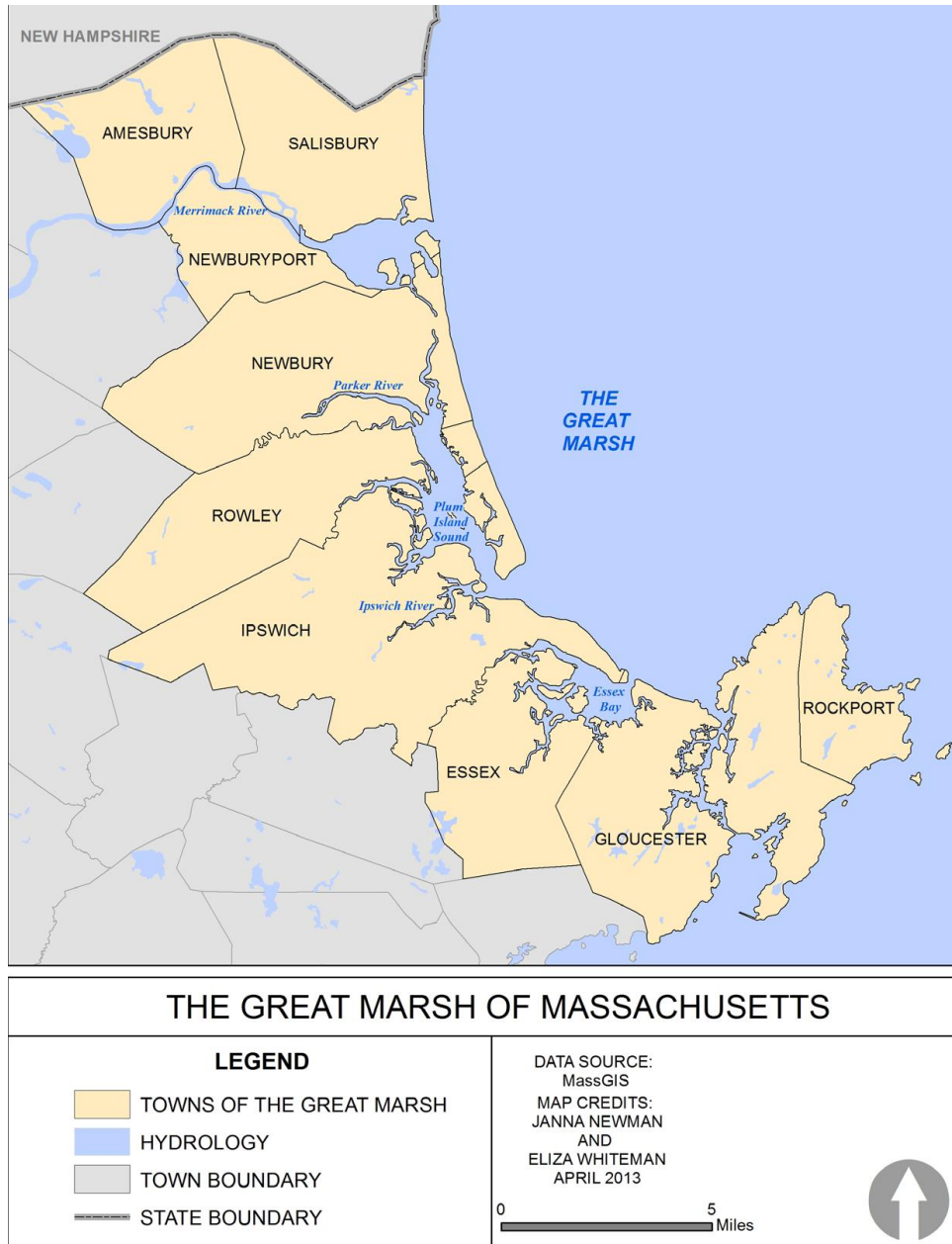
Appendix 1: Watershed Maps



Great Bay Watershed (Source: Piscataqua Region Estuary Partnership, 2013)



Casco Bay Watershed (Source: Casco Bay Estuary Partnership, 2010)



Upper North Shore Region, Massachusetts Bays Estuary Program (Source: Holden et al. 2012)

Appendix 2: UNH Programs Involved in Great Bay

Center for Coastal and Ocean Mapping
Coastal Carbon Group
Coastal Ocean Observing Center
Cooperative Institute for Coastal and Estuarine Environmental Technology
Department of Natural Resources
Department of Environmental Engineering
Department of Earth Sciences
Department of Ocean Engineering
Jackson Estuarine Laboratory
Marine Program
New Hampshire EPSCoR
New Hampshire Water Resources Research Center
SEAGRANT
Shoals Marine Laboratory
Stormwater Center

Appendix 3: Relevant New Hampshire Coastal Programs

Acton Wakefield Watersheds Alliance
Bear-Paw Regional Greenways
Bellamy & Oyster River Watershed Protection Partnership
Blue Ocean Society for Marine Conservation
Cochecho River Watershed Coalition
Conservation Law Foundation
Ducks Unlimited
Exeter River Local Advisory Committee
Exeter River Watershed Association
Great Bay Municipal Coalition
Great Bay National Estuarine Research Reserve
Great Bay National Wildlife Refuge
Great Bay Resource Protection Partnership
Great Bay Stewards
Lamprey River Watershed Association
Lamprey River Advisory Committee
Milton 3 Ponds Protective Association
Oyster River Watershed Association
Piscataqua River Cooperative
Rescue Great Bay
Save Our Groundwater
Salmon Falls Watershed Collaborative
Seacoast Science Center
Society for the Protection of NH Forests
Southeast Watershed Alliance
Strafford Rivers Conservancy
Spruce Creek Association
The Nature Conservancy
Three Rivers Land Trust
Trout Unlimited
Trust for Public Lands
Winnicut River Watershed Coalition
York Rivers Association

Appendix 4: Additional Interviews

Following is a list of people who were suggested as potential sources of information, but were not interviewed because of time constraints. This list is intended as a resource for future researchers interested in further investigation of this subject.

Candace Dolan, Great Bay Community College and Southeast Watershed Alliance

Pease Redevelopment Authority staff

Jonathan Pennock, Director of UNH Marine Program, Seagrass Program, and

Jackson Estuarine Laboratory

Julia Peterson: Extension Professor/Specialist, UNH Cooperative Extension

Portsmouth Naval Shipyard Public Affairs Office

Representatives of area anchor institutions, listed in Table 2

Representatives of relevant nonprofits, listed in Appendix 3

Peter Rice, City of Portsmouth Engineer