Building Green Infrastructure through Urban Land Conservation: The Social and Ecological Value of Dispersed Open Space in the Boston Urban Wilds

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Through an analysis of the thirty-year history of the Boston Urban Wilds, this thesis investigates the ability of distributed urban open spaces to provide social and ecological value to the surrounding community. The capacity of the Urban Wilds to act as system to provide simultaneously ecosystem services, public space and wildlife habitat is examined. The evolving understanding of green infrastructure is used as a lens through which to understand the elements of the Urban Wilds model applicable to other communities. Through this lens, the ability of the Urban Wilds to provide social and ecological value greater than the sum of its individual parts is considered. Reflecting on the tools that have been used to enact Urban Wilds conservation, the tools best suited to preserving the Urban Wilds' social and ecological value are assessed. Drawing from the evolution of the Boston Urban Wilds over the past three decades, this thesis concludes with designation, preservation and stewardship recommendations for other cities and towns considering a similar system of distributed open spaces.

Thesis Supervisor: Anne Whiston Spirn
Professor of Landscape Architecture and Regional Planning

Abstract

Acknowledgements

I would like to thank Anne Spirn and Sam Bass Warner, my thesis advisor and reader, for their wisdom and patience over the course of the past two semesters. Anne never failed to clarify my thinking and Sam's enthusiastic support propelled me through each round of revisions. I would also like to express my thanks to Mark Schuster for leading me through the process of finding and honing my topic. What I have learned from each of these individuals extends much further than the pages of this thesis.

My two years at DUSP have been a gift made possible by my parents, Robert and Lee Ann Kinzer and Jonathan Cherry. I am deeply grateful to Jonathan for his unwavering interest in my research and for accompanying me on my explorations of the Boston Urban Wilds. Without my parents unquestioning support I would not have had the opportunity to write this thesis and as a small token of my appreciation, I dedicate this work to them.

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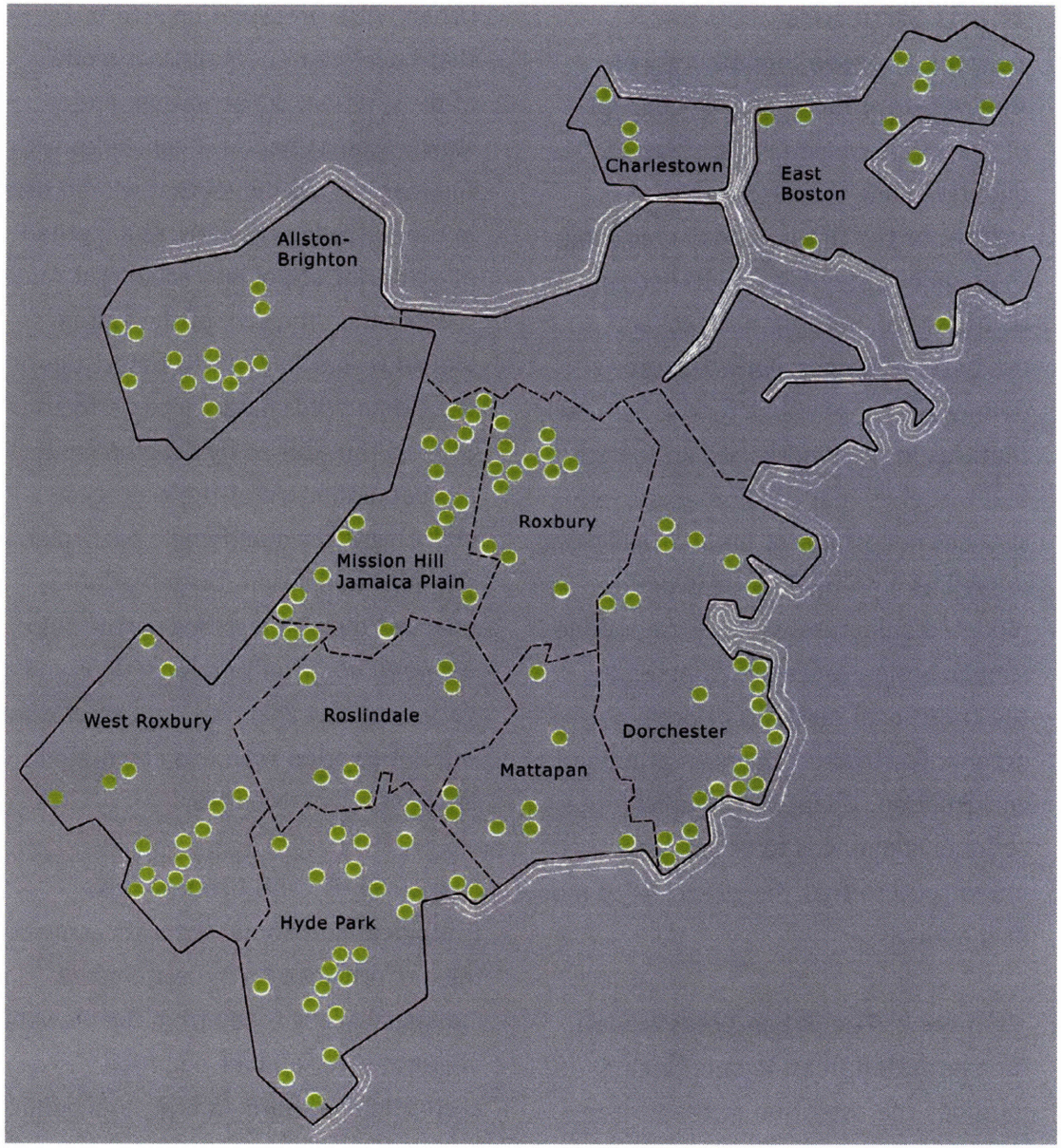
Introduction

Designated in 1976, the Boston Urban Wilds were a series of 143 open spaces ranging in size from ½ an acre to over 100 acres, including woodlands, wetlands, and a handful of cultivated landscapes, all threatened by development through their ownership. Over the following three decades, this designation in the Boston Redevelopment Authority study *Boston Urban Wilds: A Natural Areas Conservation Plan* led to the permanent preservation of 735 of the original 2,000 acres in 45 open spaces. Intended to address many more values than a traditional city park, the Urban Wilds were conceived as not only providing space for recreation but also protecting ecological values including wildlife habitat and ecosystem services, such as absorbing and filtering stormwater, mitigating the urban heat island, and capturing air pollution. What is remarkable about this system is both its use of land conservation to address urban environmental issues and its success over a thirty-year period with no single city agency spearheading a coherent conservation program. In the past three decades, a distinctive model of designation, preservation and management of the Urban Wilds has emerged. This model is relevant to any community looking for ways to maximize the values provided by a public open space network or seeking an alternative to traditional infrastructure as a method of solving an urban environmental problem.

Today, the Urban Wilds can be viewed as an early example of urban green infrastructure, a term that emerged in the mid 1990s. The evolving understanding of green infrastructure provides a lens through which to understand the elements of the Urban Wilds model applicable to other communities. In this thesis, I use the broader framework of green infrastructure to evaluate the successes and failures of the Urban Wilds, assess the relevancy of this model to other



cities and towns, and to provide a set of recommendations for the designation, preservation, and stewardship of a similar system in another location. Through this research, I seek to answer two primary questions:

1. Can a series of disconnected urban open spaces act as a system to provide social and ecological value greater than the sum of their individual values?

2. What can be learned from the Boston Urban Wilds model that is applicable to urban planners working to sustain these values in other locations?

Figure 1.1 **Boston Urban Wilds, 1976**

Research Methodology

To answer these questions, I examined both qualitative and quantitative data at the scale of the city as a whole and the individual site. I used three primary methods to capture the broad range of information needed to fully address the research questions: GIS modeling, interviews, and direct observation. I assessed the Urban Wilds' ability to ameliorate the environmental impacts of development and their function as wildlife habitat through GIS and direct observation at individual Urban Wilds. To address social value, preservation and stewardship methods, I conducted interviews with staff of the organizations engaged in Urban Wilds preservation and management and with Boston residents. To facilitate my analysis of the Urban Wilds at the site scale, I choose one Boston neighborhood for more detailed research: Mission Hill. At the Mission Hill Urban Wilds, I used similar methodologies but incorporated a finer grain of detail into my research.

Thesis Structure

Chapter 1, Green Infrastructure: An Overview addresses the concept of green infrastructure as a way of understanding the successes and failures of the Urban Wilds in meeting the goal of providing simultaneously public space, wildlife habitat, and ecosystem services. This chapter defines green infrastructure as natural features in the landscape like forests and wetlands that provide ecosystem services necessary for human well-being, as well as man-made infrastructure modeled on natural systems to provide similar ecological benefits. Assessing the traditional methods of providing green infrastructure, conservation and construction, Chapter 1 highlights the residual challenges to urban green infrastructure that the Urban Wilds model may address.

Chapter 2, The Urban Wilds Model: Conservation in an Urban Setting outlines the evolution of the Boston Urban Wilds preservation efforts that have created its distinct model of designation, conservation, and stewardship. Chapter 2 concludes with a summary of the model that will be tested in the following chapters as a method of achieving social and ecological value greater than the sum of the system's individual parts. The characteristics of the Urban Wilds model include focus on land threatened by development, a broad definition of the ecological characteristics qualifying a particular site for designation, preservation enacted through a strong partnership between non-profit organizations and a variety of city agencies, and an emphasis on preservation with less attention to long-term maintenance.

Chapter 3, Boston Urban Wilds: Ecological and Social Benefits assesses the performance of the system and individual Wilds today from the viewpoint of stormwater and air pollution absorption, wildlife habitat, and public

space. A major finding of this chapter is that the Urban Wilds can only ameliorate urban environmental problems but cannot provide a solution. A second major finding is that while the Urban Wilds do offer a source of habitat significantly better than the surrounding environment and can be functional public space, the existence of a Friends Group is crucial to maximizing either value. Chapter 3 discusses the applicability of the Urban Wilds model to other communities, which includes the assessment that unlike constructed green infrastructure, urban land conservation cannot solve urban environmental problems but does offer greater benefits in terms of habitat and public space than constructed green infrastructure alone. Chapter 3 concludes that the most important value of the Urban Wilds system is perhaps its ability to conceptually link disparate spaces of special value and mark them as worthy of the dedication of time and energy necessary for preservation.

Following the conclusion that the Boston Urban Wilds does provide a model relevant to urban planners in other communities, **Chapter 4, Preserving Urban Wilds: Lessons from Boston** evaluates the preservation tools used in Boston over the past thirty-years both at the citywide scale and in a single neighborhood, Mission Hill. These tools include fee-simple purchase, land use regulation, negotiation, and the Urban Wilds list itself. The chapter concludes that early fee-simple purchase can be a key building block for later preservation efforts and that the lack of tools to incentivize conservation of private property is a major barrier to truly successful conservation through negotiation. With a discussion of the challenges created by a shifting definition over time, Chapter 3 also elaborates on the strongest tool created in 1976: the list of Wilds itself.

Chapter 5, Urban Wilds in Other Places: Recommendations for Other Cities and Towns concludes the thesis with a reflection on the lessons learned from the Boston Urban Wilds that can be applied to cities and towns in other locations. The recommendations in this chapter address designation, preservation, and stewardship. The key recommendations focus on the need for an explicit definition of the spaces making up the network, the ability to expand the initially designated system over time, the importance of early physical examples of conservation, and the need for a bold idea to inspire the individuals who will continue the work of preserving and stewarding these spaces over decades.

Within Boston's boundaries are over 2,000 acres of natural land than lie outside the city's park system. These 'Urban Wilds' are a valuable, even irreplaceable resource for the city and its residents; they afford great beauty, provide environmental and recreational amenities, and often are critical to the ecological balance of their surroundings... Unless we begin to act now, many of these scenic natural areas may indeed be our 'last landscape.' And we and future generations of Bostonians will be much the poorer without them.

Robert T. Kennedy, Director, Boston Redevelopment Authority
The Boston Urban Wilds: A Natural Area Conservation Program, 1976

Green infrastructure is a term that is appearing more and more frequently in land conservation and land development discussions across the United States and the world. The term however means different things depending on the context in which it is used; for some it refers to trees that provide ecological benefits in urban areas; for others it refers to engineered structures that are designed to be environmentally friendly...We define it as an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife. Used in this context, green infrastructure is the ecological framework for environmental, social, and economic health - in short, our natural life support system.

Mark Benedict and Edward McMahon
Green Infrastructure: Linking Landscapes and Communities, 2006

Chapter 1
Green Infrastructure: An Overview

Still unusual today, the idea of preserving a wild landscape as urban public space were even more exceptional in 1976. Though the Boston park system featured open spaces ranging from small playgrounds to the renowned Emerald Necklace, the concept that uncultivated open space can also be utilized for recreation was not reflected in the Boston park system in the 1970s, nor was it reflected in the aesthetic traditions of American park design upon which most Boston's parks were based. As explained by Rutherford Platt in his discussion of the emergence of uncultivated urban parks:

> The naturalness of urban open spaces was antithetical to earlier landscape paradigms. Downing and Olmsted assumed that nature in the city had to be designed, not simply allowed to happen. The City Beautiful planners reduced nature to rows of ornamental trees and shrubs, and plots of grass framed by hedges and pavement. Even the Garden City proponents envisioned open space as fully utilized for civilized purposes, not free to run wild.[1]

The Urban Wilds challenge this aesthetic tradition with the proposal that remnants of the native landscape found within the city are not only valuable in creating a sense of place within Boston neighborhoods, but also provide an opportunity for nature-based passive recreation that traditional parks do not offer. The thirty-year evolution of the Urban Wilds and the challenges faced by this unconventional conception of urban public space provide insights that are relevant to any attempt to create access to nature within an urban area.

Also unusual in 1976, and not yet mainstream today, was the idea that public space can provide ecological benefits such as air pollution absorption, stormwater filtering, or wildlife habitat in the center of a city. The Boston Urban Wilds sought to protect these ecological values through the conservation of isolated naturally vegetated parcels. Similar to traditional infrastructure, the Urban Wilds are fixed points, which absorb and support the flows of air, water, heat, wildlife, and people across Boston. The concept of an infrastructure network or system grows from a physical net, in which individual strands are held together at points of intersection. In a physical net, the loss of one intersection of strands does not destroy the ability of the net to carry its contents, but weakens the net's ability to do so. Similarly, the Urban Wilds were conceived as collectively improving Boston's environment by providing benefits that accumulate from individual site's abilities to provide ecosystem services and wildlife habitat. The question remains today of whether these scattered sites function as a system provide to their value or if their impact is no more than the sum of their parts.

The idea that naturally vegetated open space can act as infrastructure evolved from landscape architecture and engineering projects dating back to the mid-nineteenth century. From

its beginnings in the work of Frederick Law Olmsted, green infrastructure has typically been created by one of two methods: constructing landscapes to utilize natural processes or preserving land to protect ecosystem services. These forms of green infrastructure usually correlate to a physical location, with construction-based infrastructure found in urban or dense suburban areas and conservation-based infrastructure found in rural and less populated suburban areas. The Urban Wilds model is unusual in that it pursues ecological and social value through conservation in an urban setting. Also unusual is the comprehensive nature of the benefits the Urban Wilds model strives to provide to surrounding residents. Until recently, most green infrastructure efforts focused primarily on a single issue, such as drinking water quality or stormwater runoff, yet in 1976, *The Boston Urban Wilds: A Natural Area Conservation Program* tackled the full range of urban environmental issues. Due to the breadth of issues addressed by the Urban Wilds model and its unique use of conservation to meet these goals, this early green infrastructure example remains relevant today. The challenges faced by the modern green infrastructure projects form a framework for considering what elements of the Urban Wilds model are most valuable to other communities.

Constructed green infrastructure

Like so many elements of the relationship between design and the American landscape, the origins of green infrastructure in the United States are found in the work of Frederick Law Olmsted. Olmsted introduced Americans to the use of the landscape to address environmental problems posed by urban development. A landmark example is his design of Boston's Emerald Necklace, which aimed to control the Muddy River's flooding and the pollution of stagnant tidal flats through the creation of the Back Bay Fens and the Riverway. The Fens was a thirty-acre bowl scooped out of the tidal flats, while the Riverway transported the Muddy River's waters through the Jamaica Plain neighborhood within river banks rather than over city streets. Olmsted did not consider the Fens to be appropriate for recreation beyond a stroll or drive at the marsh's edge, a sharp contrast to many cities today, where real estate value and development pressure creates an environment in which urban open space with only a minor role as recreation is inconceivable.[2] The Fens lost much of its hydrological function in between 1910 and the 1950s with the damming of the Charles River, followed by partial filling with material from a variety of municipal projects, yet today the Fens and Riverway remain prized elements of the Emerald Necklace.[3] While the value of these spaces in the minds of Bostonians is no doubt due in part to their connection to the Olmsted legacy, this occupation of space not designed to be enjoyed as a park highlights an issue that remains

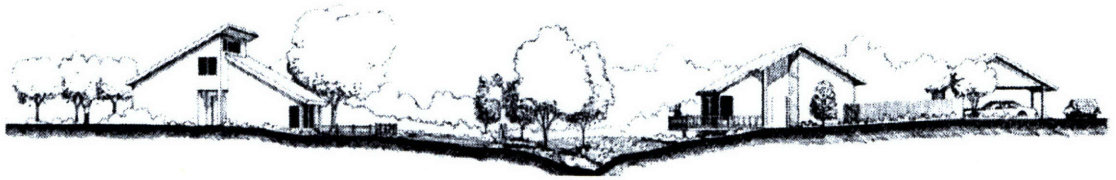
central to green infrastructure today: the intensity of demand for every square inch of land in economically thriving cities. While the opportunity may remain to create conservation-based green infrastructure without a dual role as public space in 'shrinking cities' such as Detroit, a purely ecological use of urban land is virtually impossible in the modern day in cities like Boston.

Riverway, Boston

Figure 1.2, top
View during construction, from Longwood Avenue Bridge looking southwest 1892.

Figure 1.3, bottom
View upstream from Longwood Bridge, 1920, 28 years after construction.

Contemporary to the Urban Wilds, Village Homes in Davis, California provides an early example of a wholly new residential development designed around green infrastructure. Construction at Village Homes began in 1975, with a focus on limiting impact on the immediate environment by using community open spaces to infiltrate stormwater. By re-grading the entire site prior to construction, the neighborhood was built to drain stormwater through the house lots into swales in the rear yards, and finally into several large open spaces which infiltrate stormwater. This stormwater infrastructure also doubles as pathways through the community, a playground, and grass-covered public spaces during dry weather. Linked to a constructed wetland adjacent to Village Homes, this network not only holds and cleans stormwater from this and other adjacent neighborhoods but also provides wildlife habitat that the open spaces and swales within the neighborhood alone cannot.[4]



Village Homes, Davis, California

Figure 1.4 (top). Section showing site grading to create a drainage swale.

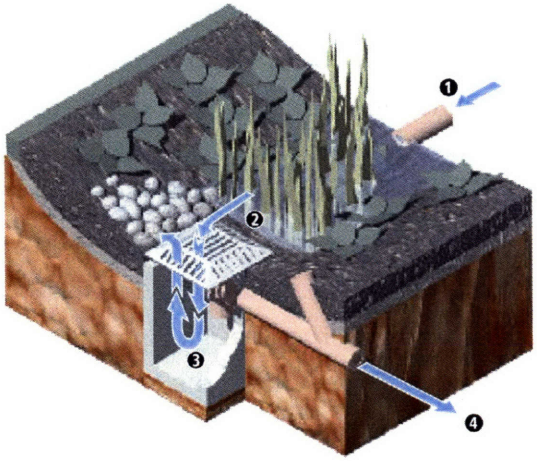
Figure 1.5 (center). Back yard draining into a swale.

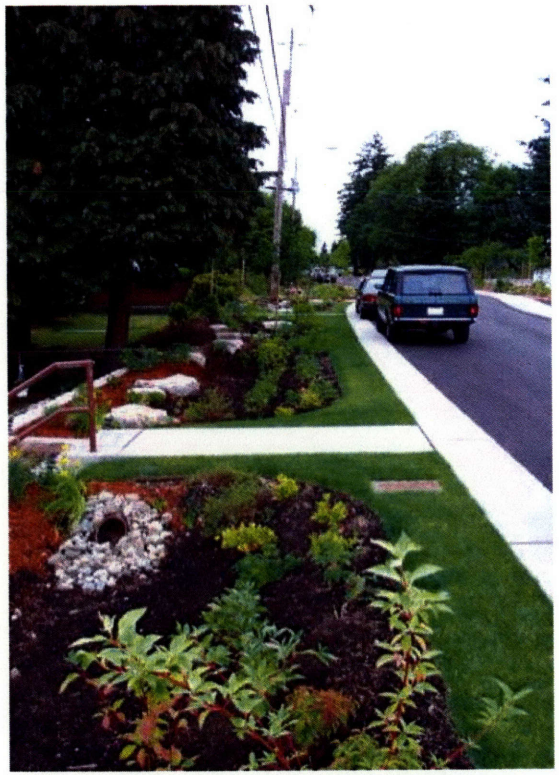
Figure 1.6 (bottom). Front yard adjacent to an open space designed to infiltrate stormwater.

Seattle Street Edge Alternatives Project, Seattle, Washington

Figure 1.7 (below). Bioswale structure.
1. Flow direction
2. Absorption
3. Ponding
4. Overflow port

Figure 1.8 (right) Bioswales adjacent to a public street.





While Village Homes demonstrates the potential for integrating green infrastructure into a new residential neighborhood, it is not wholly applicable to urban areas that are already developed and cannot simply be re-graded at will. Engineers and landscape architects began to retrofit pre-existing urban development with green infrastructure in the 1970s and 80s but design solutions as graceful as the Village Homes swales were slow to appear. By the mid-1990s exemplary urban retrofits emerged that addressed both flooding and water quality through vegetated swales, often referred to as bioswales. One of the most widely cited is the Seattle Street Edge Alternatives Project. This project focuses on a neighborhood where impervious surfaces have increased the stormwater runoff volume, leading to excessive erosion at nearby Piper's Creek. As an experimental solution to the problem of stormwater runoff, one block's existing stormwater ditches were replaced with undulating swales containing over 1,000 shrubs and trees. Data captured at a recording station monitoring this retrofit indicate the bioswales have reduced the amount of stormwater runoff by 98 percent in the wet season and 100 percent in the dry season.[5] The high cost of the Street Edge Alternatives

project, over three quarters of a million dollars for a one-block project, points to what may be the greatest challenge of infrastructure retrofits: the capital-intensive construction process.[6] The relative success of the Urban Wilds to absorb and filter stormwater may provide a lower-cost alternative to landscapes constructed to employ natural processes.

Employing constructed landscapes to mitigate the impacts of urban stormwater is the most broadly accepted use of built green infrastructure today and agencies ranging from the EPA to the Prince Georges County, Maryland Planning Division advocate for the employment of natural systems in stormwater engineering. The cutting edge has begun to push beyond simply addressing runoff to the integration of a comprehensive range of ecological functions into urban redevelopment. The Lloyd Crossing Sustainable Urban Design Plan and Catalyst Project leads the cutting edge with its proposal to redevelop a 35

block area of central Portland, Oregon while taking the impact of development back to what existed there over a century ago: a coniferous forest with 90 percent tree cover. Though a number of the recommendations focus on green building techniques, a large portion of the plan calls for the use of green infrastructure, envisioning "a study area that integrates an abstraction of a mixed conifer forest into the urban streetscape, through the use of a hierarchical system of green streets, pedestrian streets, bioswales, and public open space."[7] This infrastructure is proposed at three scales: first, bioswales at each intersection to filter stormwater and provide some habitat; second, public spaces in the form of 'mixed conifer patches' totaling two acres; and third, habitat corridors also totaling two acres, connecting to Sullivan's Gulch, a nearby wetland.[8]

The attention received by the Lloyd Crossing Sustainable Urban Design Plan and Catalyst Project from across the

Lloyd Crossing Sustainable Urban Design Plan, Portland, Oregon

Figure 1.9 (previous page) Conceptual drawing of existing wildlife habitat in the study area.

Figure 1.10 (below) Conceptual drawing of wildlife habitat in the study area in 2050.

Figure 1.11 (following page) Rendering showing the urban design of public space and wildlife habitat.

design disciplines indicates there is now broad acceptance of green infrastructure as a laudable and forward-thinking goal for the redevelopment of an urban area. In 2005, the study won the Environmental Design Research Association Award, the American Society of Landscape Architects Planning and Analysis Award of Honor, and an American Institute of Architects Top Ten award. However, while the text paints a convincing picture of the inclusion of green infrastructure in urban development, it does not propose the revolution in urban design at the site scale that will be necessary to accomplish the outlined urban habitat goals. The review in the ASLA Awards glows:

> Imagine an under utilized inner-city neighborhood transformed into a vibrant, attractive, and highly desirable place to live and work where the entire 35-block ecosystem mimics the behavior of a pristine forest, even as the area's population and built space increase fivefold...The Lloyd Crossing Sustainable Urban Design Plan not only proved that it could be built, but created a new model for urban planners worldwide.[9]

Yet the study does not offer new suggestions that go from the level of the neighborhood to specific proposals for the integration of a functional wildlife corridor or habitat patch. The understanding of how birds and animals may pass through an urban area in habitat patches and along corridors has increased over the past twenty years. However, the Lloyd Crossing Sustainable Urban Design Plan clearly illustrates that the physical image of public space that doubles as wildlife habitat within

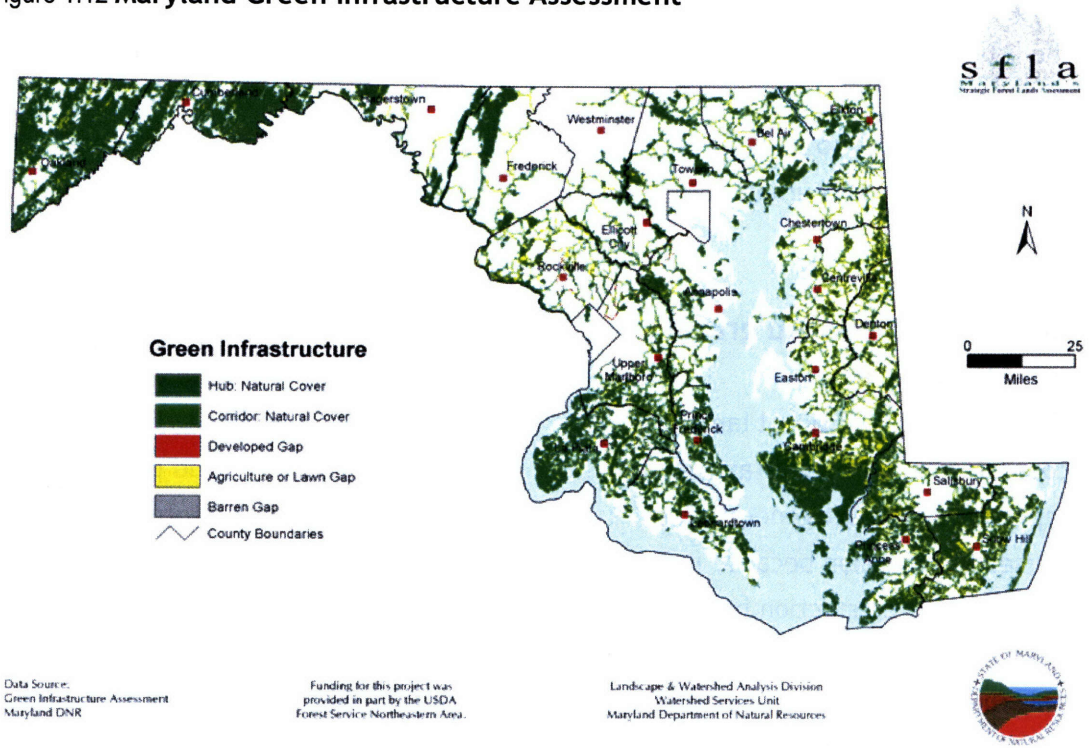
an urban area has not yet entered the collective vocabulary of urban designers, even those at the forefront of such work. The Boston Urban Wilds have existed at the intersection of wildlife habitat and the urban environment for the past three decades and Boston's experience may shed light on how to better integrate wildlife habitat into urban design in other locations.

Conservation-based green infrastructure

Growing from traditional land conservation, "green infrastructure represents the next generation of conservation action because it forges an important connection between land conservation and land use planning."[10] This form of green infrastructure often begins with a water quality problem and the realization that preserving an existing natural resource offers a vastly more cost effective solution than traditional engineering. An example pre-dating the Boston Urban Wilds is the 1965 flood control study for the Charles River Basin conducted by the Army Corps of Engineers. The Corps found that the two alternatives for preventing flooding of the Charles River were to invest $100 million in traditional engineered flood control measures up-stream of the basin or to spend $10 million to purchase and preserve seventeen wetlands totaling 8,500 acres. The purchase of the wetlands was approved by Congress in 1974 and funding was appropriated as the research and writing of the 1976 Urban Wilds report took place.[11] Land preservation has also been used to protect drinking water quality, with the largest example found in the Adirondack watershed, which supplies New York City's drinking water. The decision by New York City in the 1990s to forgo construction of a $4 to 6 billion waste water treatment plant in favor of employing conservation easements to protect the watershed from development is perhaps the largest example in the United States of green infrastructure supporting water quality.[12] Unlike constructed infrastructure, land conservation also easily provides secondary benefits such as wildlife habitat and forests acting as carbon sinks. Where land preserved to protect environmental quality also becomes publicly accessible, public recreation can be added to the list of secondary benefits.

Similar to the cutting edge of constructed green infrastructure, the leading edge in land conservation has recently begun to address a much more comprehensive set of goals than the preservation of a single watershed. Work such as the Maryland Green Infrastructure Assessment has emerged as a result of greatly increased understanding of landscape ecology, combined with the development of geographic information systems, or GIS, as a powerful method of analyzing vast amounts of spatial data. Perhaps the most extensive analysis of this type undertaken to date, the Maryland Green

Figure 1.12 **Maryland Green Infrastructure Assessment**

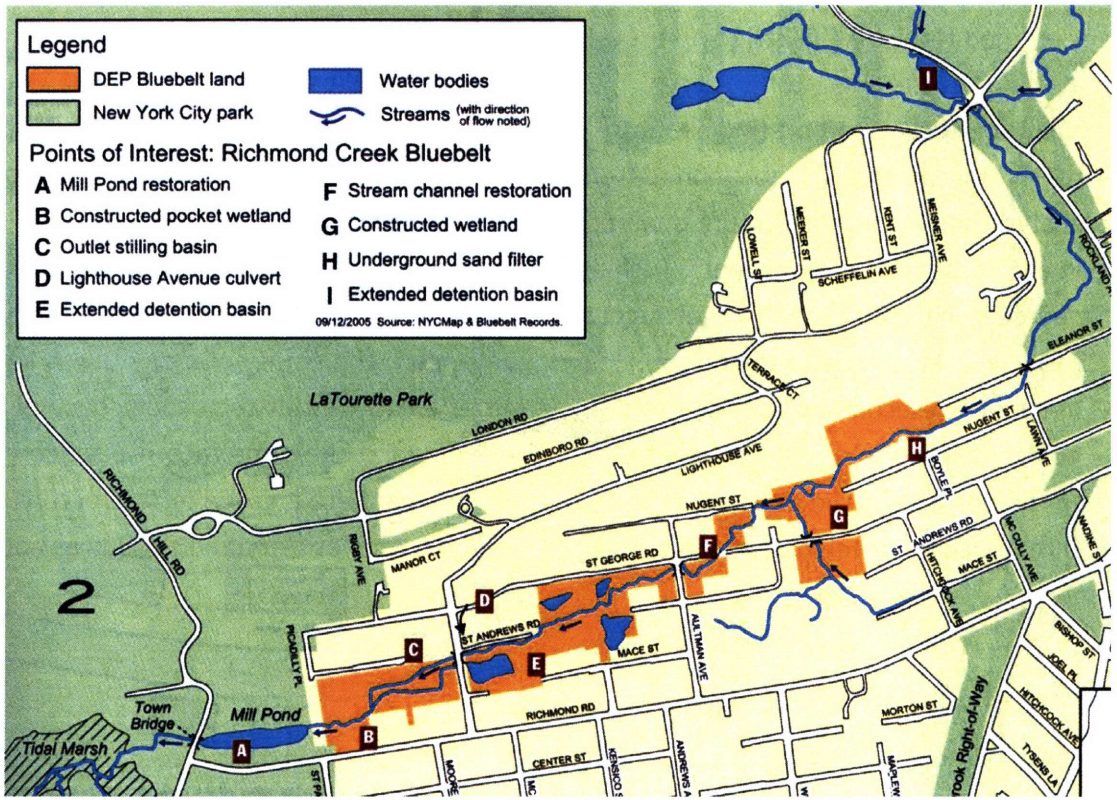


Infrastructure Assessment includes 33% of the state in either a hub of 250 acres or more of continuous forest or 1,000 foot wide undeveloped corridors connecting the hubs. The network was identified through analysis completed at scales as small as ¼ of an acre, simultaneously incorporating habitat patch content analysis, corridor content analysis and network structure analysis. In each case multiple elements, such as degree of naturalness and edge-to-core ratio were evaluated to define the ideal network.[13] A second level of analysis was completed to direct preservation to the portions of the network most threatened by development. This study of habitat preservation was rolled into the GreenPrint program to purchase recreational land compatible with intact ecosystems, efforts to shape land use to preserve the health of the Chesapeake Bay, and land use planning in the counties adjacent to Washington D.C.[14]

While the technical ability to assess the contributions of individual elements of a green infrastructure network to the overall goals of the network is now very advanced, the ability of many towns and cities to utilize this technology has not expanded at the same rate. To utilize GIS to complete a green infrastructure analysis such as Maryland's requires not only highly skilled GIS technicians, but a team of ecologists to establish the parameters of the analysis, and highly detailed baseline data on the area to be assessed. Although states at the forefront of regional planning have the resources to accomplish such an undertaking, many, if not most, planning agencies at the state or local level do not. The Urban Wilds model of designating a green infrastructure network based on the best information available (but without a highly technical analysis) remains relevant today in part because in many areas of the United States, this non-technical analysis is all that can be reasonably expected with the resources available.

Combining constructed and conservation green infrastructure

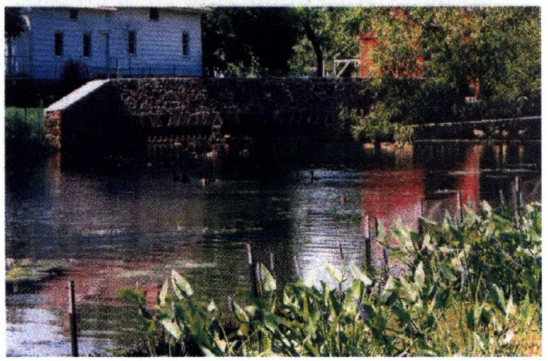
The problem faced by creating green infrastructure through land conservation is that it requires undeveloped land that simply no longer exists in many urbanized regions of the United States. This conundrum has given rise to a combination of land preservation and constructed green infrastructure in urban and suburban areas in order to give existing natural systems the boost needed to solve an environmental problem. The Staten Island Bluebelt is an example of this combination of land preservation and construction. Here, an existing stream, pond, and wetland system was augmented over the past decade with constructed wetlands, sand filters, and siltation ponds to address water quality and flooding. Located in the only borough in New York City built without a formal sewer system, the Bluebelt saved the city $80 million as of 2004 by allowing the new sewer system to carry and clean only wastewater. The parallel traditional infrastructure solution would have been to create a sewer system large enough to absorb both Staten Island's wastewater and stormwater runoff.[15] Because it is based in land conservation, the Bluebelt also has the added benefit of protecting and improving wildlife habitat, as well as benefiting the public realm and the local microclimate. This solution to overwhelmed septic systems suggests that even in the case of acute environmental problems the integration of land conservation and construction may offer an alternative to traditional infrastructure.



Long Island Bluebelt, New York

Figure 1.14 (left) Map of one of eight project sites along Richmond Creek.

Figure 1.15 (below) Mill Pond on Richmond Creek before and after construction of a side weir.



Addressing the challenges of Urban Green Infrastructure through the Boston Urban Wilds

While green infrastructure has become more sophisticated since 1976, the Boston Urban Wilds remain unique. The thirty-year history of the Urban Wilds has carved out a distinctive model for the designation, preservation, and management of conservation-based urban green infrastructure, placing equal emphasis on a broad range of social and ecological values. The success of these sites in addressing both ecological and social goals at singular sites is germane to any city with limited land inside its borders. As other cities consider multiple forms of infrastructure, the relevance of the Boston Urban Wilds model lies in part in its ability to address the challenges faced by modern green infrastructure. I will address the following questions posed by green infrastructure's evolution since 1976 as I assess the validity of the Urban Wilds model today:

- Can urban land conservation approximate the ecological benefits possible through constructed green infrastructure?

- What conflicts exist between functional wildlife habitat and urban public space and what can be done to ease these conflicts?

- Can a qualitative and non-technical designation process accurately define the spaces most appropriate for an urban green infrastructure system?

- Can natural areas and urban development be integrated to the extent necessary to form a network rather than a series of isolated islands of green?

Chapter 2
The Urban Wilds Model: Conservation in an Urban Setting

The Boston Urban Wilds' history cannot be precisely replicated elsewhere but it provides a framework for the investigation of a series of scattered green spaces as potential infrastructure. The following brief history of the Urban Wilds highlights the seven elements that characterize the Boston Urban Wilds model. In subsequent chapters, these elements will form the framework for evaluation.

The origins of the Boston Urban Wilds are found in the work of Elliot Rhodeside, a young landscape architect who served as the Chief Landscape Architect at the Boston Redevelopment Authority in the early 1970s. In the course of his work reviewing development proposals to the BRA, Rhodeside came across several sites that he would later deem Urban Wilds and began to search for a way to publicize and preserve these remnants of the natural landscape. Working independently to develop the concept of the Urban Wilds, Rhodeside applied to the National Endowment for the Arts City Options program in 1974 for a to grant cover the cost of cataloging and publicizing these spaces. As Rhodeside explained in 2006, "The BRA considered this to be a good thing because it caused money to come into the city, but largely ignored what I was doing on a day to day basis. This left me free to do my work without interference."[1] The legacy of this work within a government agency, but without the full support of the agency, is one of the defining factors in the Boston Urban Wilds' evolution.

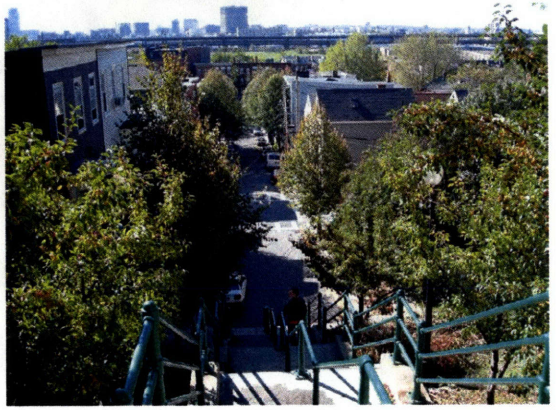
Also emerging from Rhodeside's work is the second major element of the Urban Wilds model: the broad definition of the characteristics qualifying an open space as an Urban Wild. The 143 spaces listed in *Boston Urban Wilds: A Natural Area Conservation Program* met the common definition of "areas of land or water that have retained or re-established considerable natural character even though they may not be completely

Boston Urban Wilds, 2006

Figure 2.1 (left) Crittendon Hospital Urban Wild, Brighton.

Figure 2.2 (top right) Kennedy Rock Urban Wild, Allston.

Figure 2.3 (bottom right) Charlestown Overlook, Charlestown.



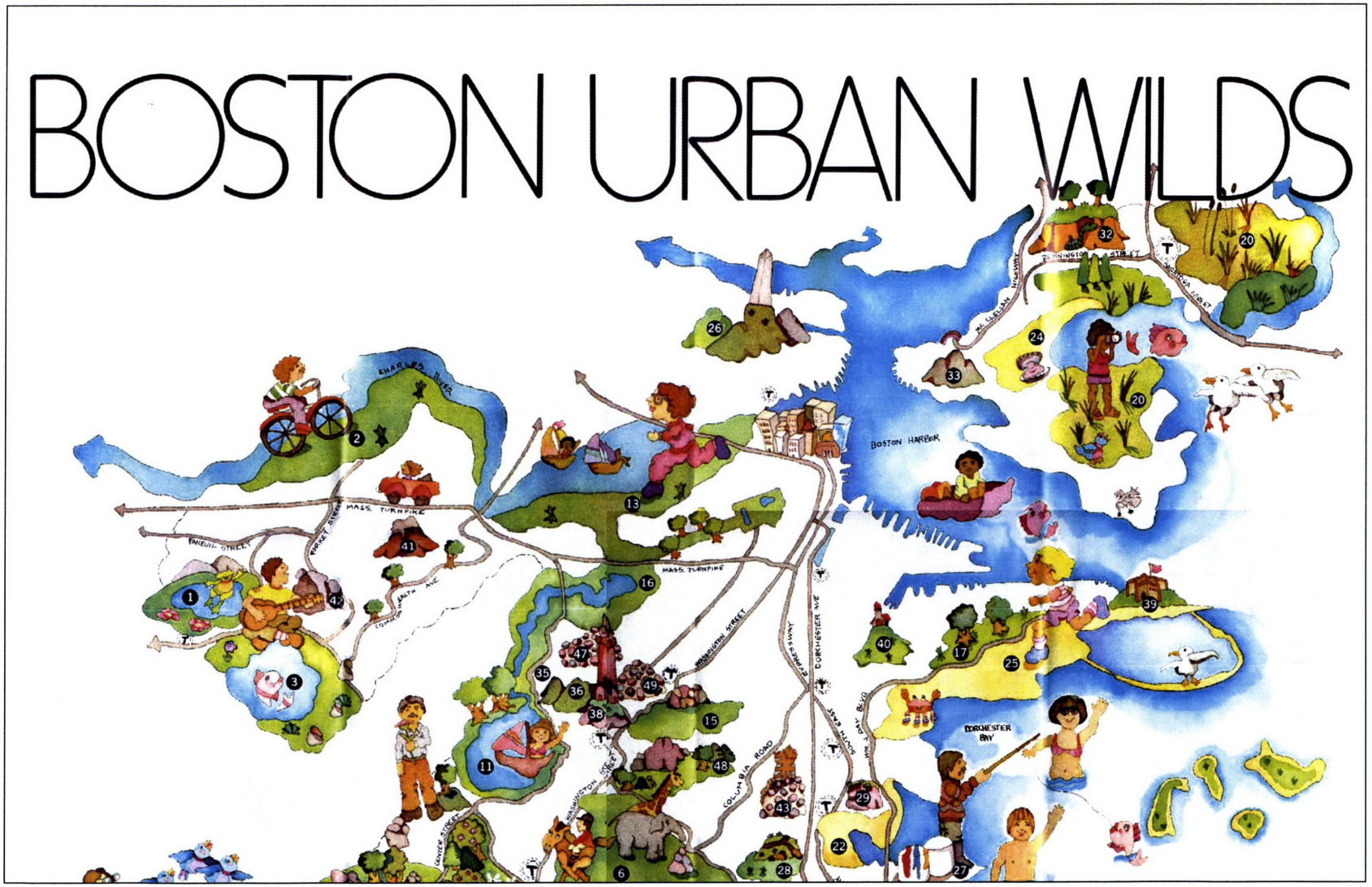


Figure 2.4 Section of an Urban Wilds poster distributed by the Boston Redevelopment Authority in 1976

undisturbed."[2] Based in the traditional use of the word 'wild,' many of the Urban Wilds were woodlands, wetlands, and geological features. Expanding from the usual understanding of the term, vegetated spaces with a great view and cultivated open spaces featuring heritage trees were also included on the list.[3] Similarly, the value of these sites was also defined broadly through statements such as:

> "These Urban Wilds frequently perform important functions in the environment: for instance, the wetlands store stormwater to help prevent flooding in low areas and also provide feeding and breeding grounds for fish and wildlife. Yet many sites are valuable quite simply because they are scenic and can help create pleasant surroundings for residents and visitors, and also because they have potential for recreational uses such as hiking, picnicking or bird watching."[4]

The final element common to all spaces designated as Urban Wilds was relative threat by development. All were either privately owned or owned by a government agency without land conservation or public space in its mission. The initial designation based on this set of criteria remains central to their evolution, as the list of open spaces designated as Urban Wilds has never been expanded.

Shortly after the 1976 report was published, Rhodeside left the BRA to pursue a career as a private practitioner.[5] In the absence of an implementation plan, and Rhodeside himself, the document intended as a starting point for planning became the plan itself. Inspired by bold ideas of the 1976 report, a group of individuals took the reins from the BRA and put in place an implementation strategy derived from the designations in the 1976 report. First, a revolving loan fund from area banks was created, known as the Boston Natural Areas Fund (BNAF). The fund enabled the non-profit organization established to manage fund, also known as BNAF, to purchase Urban Wilds, transfer their ownership to the Boston Conservation Commission, and repay the loan using federal and state grants.[6] Simultaneously, the Metropolitan District Commission, a state agency with the ability to purchase lands of statewide importance, purchased several of the Urban Wilds.[7] These early preservation efforts resulted in the protection of only a small fraction of the Urban Wilds from development, but underscored the validity of the idea that these spaces were worth preserving in perpetuity. This early, visible preservation success is also a major characteristic of the Urban Wilds model.

As funding for open space dried-up in the 1980s, the purchase of Urban Wilds that marked the first wave of preservation drew to a close and a second phase of preservation began, by means of a broad set of conservation tools. Although individually less powerful than the outright purchase of land, these tools are more relevant to most

cities today, as the purchase of open space is not an easily realized goal. The preservation tools employed in the second phase of conservation include land use regulation implemented through the Boston Redevelopment Authority re-zoning process, conservation restrictions, negotiation, and the Urban Wilds list itself.[8] A final preservation tool used throughout the 30 year history of Urban Wilds preservation is the transfer of Urban Wilds owned by a city agency without preservation in its mission, such as the Real Properties Department, to an agency that will provide long-term stewardship for the Wild as an open space. Both the Conservation Commission and the Parks and Recreation Department have played the role of advocating for such transfers.[9]

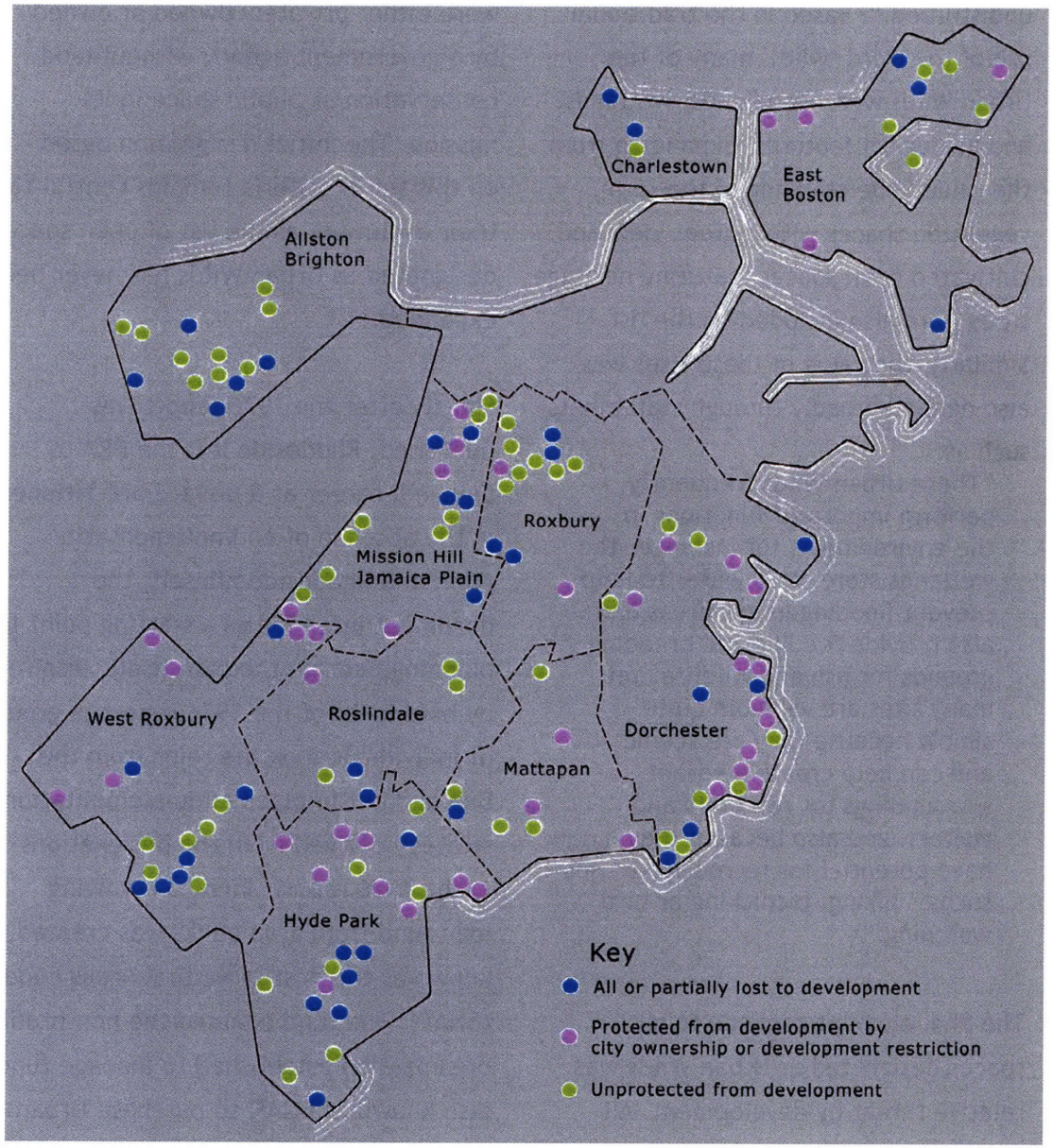


Figure 2.5 **Urban Wilds Status 2006**

523 acres lost to development
734 acres permanently protected
714 acres unprotected from development

The focus on preservation over long-term stewardship forms the final characteristic of the Urban Wilds model. As is often the case in land preservation, the early focus of the efforts to protect the Urban Wilds network focused almost completely on removing the Wilds from the real estate market. No mechanism was created for ongoing management, yet the location of such a site within a city requires a much higher level of attention than similar sites outside an urban area. Stewardship is necessary to maintain the vegetation required for successful ecosystem services and wildlife habitat but also to balance these needs with the elements that can plague urban open spaces: crime, drug use, and trash dumping. While the Conservation Commission excelled at bringing Urban Wilds into preservation, no mechanism was put in place to maintain the Urban Wilds and by the mid-1980s, management issues had reached crisis level. Responding to community outcry, then-Mayor Flynn shifted the management of the Urban Wilds to the Parks and Recreation Department in the late-1980s, where it remains today.[10] This arrangement has vastly improved the management of the Urban Wilds, but the BPRD Urban Wilds Initiative remains continually under-funded, reflecting a conflict between the preservation of natural landscapes and the larger mission of the Department to provide opportunities for active recreation.[11] The ongoing struggle to maintain the Urban Wilds as spaces that function as both recreationally and ecologically is the ongoing legacy of the lack of initial consideration for how the Wilds would be stewarded in perpetuity.

In summary, the Boston Urban Wilds green infrastructure model consists of the following seven elements:

- Broad definition of the Urban Wilds
- Designation of only spaces threatened by development
- An initial list of Urban Wilds that has never been expanded
- Designation of Urban Wilds by a government agency
- Advocacy for preservation by both public and private organizations
- Early, visible conservation success
- A strong emphasis on preservation with less attention to long-term maintenance

Chapter 3
Boston Urban Wilds: Ecological and Social Benefits

The Urban Wilds model seeks to provide both social and ecological benefits to the city of Boston as a whole through contributions accumulated from 143 individual sites. A truly comprehensive study of the Urban Wilds would incorporate research on each site, but the time constraints of this thesis required the selection of a limited set of Urban Wilds for analysis at the site scale. To facilitate an analysis of the Urban Wilds as public space rooted in neighborhood history and tied to other open spaces around them, I chose to focus my site-level research on one neighborhood. After a broad assessment of the Urban Wilds in each Boston neighborhood, I selected Mission Hill due to the variation in its Urban Wilds and traditional open spaces, and the density of the neighborhood. Mission Hill residents are fortunate to have multiple traditional open spaces to meet their recreational needs, including two playgrounds, two community gardens, three basketball courts, a playing field, and two parks for passive recreation. Six Urban Wilds were originally designated in Mission Hill, one of which was lost to development in the 1990s. The remaining Wilds range from well loved by a Friends Group to ignored by residents.

The 'triple deckers' that make up much of Mission Hill's housing stock leave little personal outdoor space, placing pressure on the neighborhood's public space to fulfill residents' recreation needs. This situation is typical of urban neighborhoods and I assumed the relationship between residents and open space in Mission Hill to be representative of most city-center neighborhoods. The lessons learned from the evolution of Mission Hill's Urban Wilds are applicable to other neighborhoods in Boston, as well as other communities.

Mission Hill, Boston

Figure 3.1 (left) Triple decker housing.

Figure 3.2 (center) Limited personal outdoor space between buildings.

Figure 3.3 (top right) Calumet Street, a characteristically steep Mission Hill street.

Figure 3.4 (bottom right) A ball field in the center of the neighborhood.

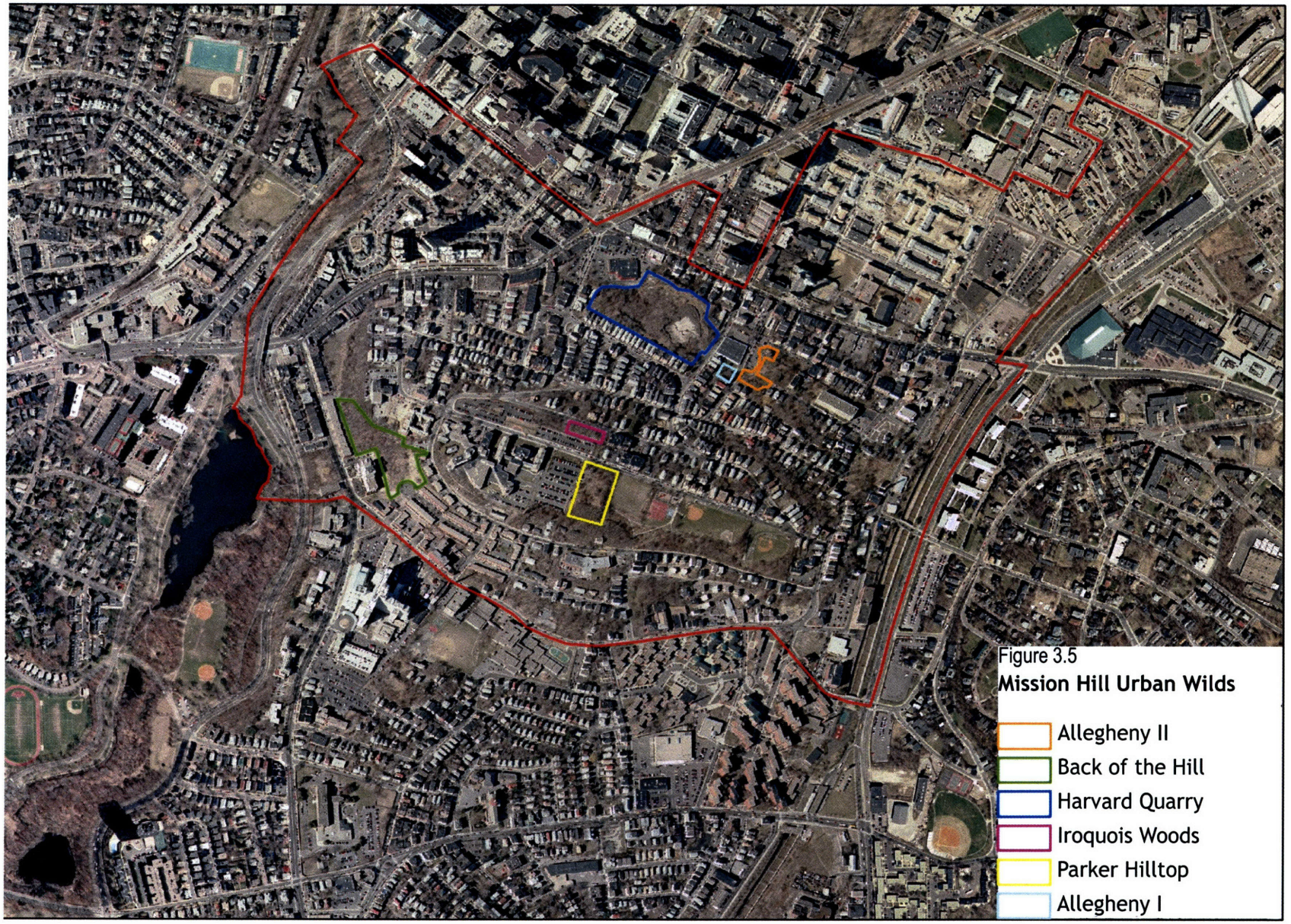


Figure 3.5
Mission Hill Urban Wilds
Allegheny II
Back of the Hill
Harvard Quarry
Iroquois Woods
Parker Hilltop
Allegheny I

Because no single research method can address both social and ecological issues, I employed several methods to investigate the ecological and social benefits of the Boston Urban Wilds. Throughout the literature on sustainable cities and urban open space, a chorus of voices vaguely asserts that green space positively impacts the urban environment but it has recently become possible to quantify these ecological benefits using desktop software. Addressing what is often referred to as 'ecosystem services,' I analyzed the absorption of air pollution and stormwater runoff by the Urban Wilds at the city, neighborhood, and site scale with ArcGIS, software that facilitates the process of creating, integrating, and analyzing geographic data, and the CityGreen, an ArcGIS extension created by American Forests. CityGreen models ecosystem services by integrating land use data with formulas derived from scientific research on urban hydrology and air pollution. To assess the ability of the Urban Wilds to function as wildlife habitat, I applied research from other Massachusetts cities, using GIS at the scale of Boston as a whole and observation at the site scale. It is also likely that the Urban Wilds have a positive impact on Boston's microclimate by mitigating the urban heat island and blocking wind, but this impact cannot yet be modeled with a personal computer today. Rather than hypothesize, this thesis does not address the question of the microclimate relation to the Boston Urban Wilds.

To evaluate social benefits, I interviewed Mission Hill residents and augmented the information gained from these conversations with interviews of City of Boston, Boston Natural Areas Fund, and Earthworks staff. Similar to my use of the CityGreen program to gain a broad understanding of ecosystem services in the Urban Wilds, I completed only the number of interviews required for a broad understanding of the Urban Wilds' social value. The following assessment of the ecological and social value of the Urban Wilds is based on the data and information collected through these varied research methods.

The Urban Wilds and ecosystem services

The 1976 report places each Urban Wild into one of five categories: waterbody, wetland, woodland, hill or geological formation. Within each category, *Boston Urban Wilds: A Natural Area Conservation Program* delineates the ecological values provided. Water bodies are described as affecting the quality of water resources through groundwater recharge, water flow, and reservoir storage. Wetlands are also seen as key to protecting water quality, as aquatic plants transform inorganic nutrients into organic material and absorb sediment that would otherwise cause a build-up of silt and pollution in downstream areas. The ability of wetlands to hold water, thereby preventing flooding and providing a source of water in times of drought, is also highlighted. The third category is woodlands, which are described as moderating the micro-climate and filtering ground water. The remaining two categories of Urban Wilds are described as providing fewer ecosystem services but are nonetheless considered ecologically important. Hillsides are seen as a potential source of significant erosion, and the importance of maintaining vegetation on these sites to hold soil in place is described. Finally, geological formations such as rock outcroppings are considered valuable largely for education, as they provide visible evidence of Boston's geological history.[1] Many of these rock formations do also support some vegetation although it is not detailed in 1976 report. Although *Boston Urban Wilds: A Natural Area Conservation Program* clearly states

Urban Wilds categories in *The Boston Urban Wilds: A Natural Area Conservation Program*

Figure 3.6 Woodland at Allandale Woods Urban Wild

Figure 3.7 Waterbody at Brook Farm Urban Wild

Figure 3.8 Geological formation at Kennedy Rock

these broad values, it provides little insight into the specifics of how an individual Urban Wild might absorb more or less pollution from the air or runoff during a storm.

In 2006, several residents of Mission Hill voiced a similarly vague belief that trees improve air quality when discussing the impact of trees on quality of life within their neighborhood. Unlike in 1976, today extensive scientific research on the urban ecosystem supports these beliefs and makes it possible to quantify the impact of woodlands and wetlands on the urban environment. A wide range of studies over the past two decades indicate that trees play a role in improving local air quality both by absorbing gasses into their leaves and collecting solid particles on leaves and bark.[2] A second set of studies have firmly established the link between land cover, such as grass or pavement, and stormwater runoff patterns.[3] By 1990, sufficient data had been generated by the studies that the USDA Soil Conservation Service could use this data to develop a series of formulas to predict the impact of land use change on urban hydrology.[4] Subsequently, the EPA and Purdue University combined research on land cover and pollution with the Soil Conservation Service model to create a model that predicts the pollution in stormwater runoff generated by land use change. These models are known respectively as TR-55 and L-THIA.[5] The CityGreen program integrates geographically specific land use data with the TR-55 and L-THIA models through ArcGIS. CityGreen also introduced a new model that estimates the impact of forested areas on air pollution by joining air pollution data from individual US cities with the tree canopy extent (defined by the user). To complete my analysis of the Urban Wild's impact on air and water quality, I used ArcGIS to compile baseline data on Boston's land cover and then analyzed the Urban Wilds using CityGreen (see Appendix 1 for details on the data and methodology I employed).

Although CityGreen's ability to model the air and water quality impacts of the urban tree canopy is at the cutting edge of accessible integration of scientific studies on the urban ecology and land use, there are three limitations to the accuracy of the data the program generates. CityGreen was developed by American Forests (originally the American Forestry Association) to analyze impacts on urban hydrology and air quality caused by losses in the tree canopy. The fact that this program was created by a non-profit organization engaged primarily in promoting and preserving trees places a somewhat disproportionate emphasis on trees as the key to urban ecosystem services, but because I was looking for a gross estimate of the ecosystem services provided by the Urban Wilds this did not pose a problem for my research. The accuracy of the baseline land use and tree canopy data limits the ability of CityGreen to analyze a particular area,

and in this thesis the baseline data has a course grain of detail. Without a survey of the Boston tree canopy, I was required to make broad generalizations regarding land cover, limiting the accuracy of the CityGreen data to some degree. CityGreen's third limitation is the fact that the program establishes the ratio of impervious to pervious surfaces in pre-defined land use categories, such as commercial or industrial. Although these categories do not precisely match Boston's development patterns, I assumed that CityGreen's approximation of typical land cover is accurate enough to create a general understanding of ecosystem services provided by the Urban Wilds. Taking these limitations into account, the analysis that follows seeks to determine whether the Urban Wilds' impact on Boston's environment is accurately portrayed in the broad belief that the Urban Wilds provide ecosystem services.

The challenge of urban hydrology

Two of the major water quality issues facing every urban region are increased stormwater runoff and the pollution that the runoff picks up from the urban surfaces it passes over. Runoff occurs in every landscape, both urban and rural, but in undeveloped landscapes enough rain is absorbed as water passes over the land that it only rarely causes major problems. As landscapes begin to urbanize, soil that could once absorb rainwater is sealed by roads, buildings, sidewalks, and other impermeable surfaces. Long before the process of urbanization reaches Boston's density, hydrologic problems begin to be evident. The increased volume of runoff scours the remaining natural landscape, leading to erosion, and alters stream and river hydrology and ecology, in some cases causing flash floods. This process also has an impact between storms, as much of the water that swept away during the rainstorm would have otherwise maintained the level of the watertable and the water level in local streams and rivers. A lowered watertable endangers not only trees and streams, but may eventually lead to ground subsidence and structural damage to buildings, as experienced in parts of Boston today.[6]

A second major water quality issue faced by urban areas is pollution. Rainwater washes lead and petroleum off road surfaces and carries nitrogen and phosphorus away from fertilized lawns, transporting these pollutants and many others to nearby streams, lakes, and rivers. While vegetated areas cannot prevent this pollution, trees and plants do have the capacity to absorb and neutralize some pollutants. As rainwater passes through vegetated areas and is absorbed, some pollution is diverted from nearby waterbodies before it reaches the nearest stream, river or pond. The vast majority of the pollution captured by runoff is carried away in the first half hour of a storm. While most open spaces will eventually become saturated and

no longer able to absorb rainwater, the ability of vegetated areas to absorb a storm's first flush is significant.[7]

The Urban Wilds as stormwater infrastructure

In part because the Urban Wilds topography has not been altered to allow stormwater to enter these sites, the design of the Boston sewer system currently limits the ability of the Urban Wilds to absorb or clean stormwater. The unfortunate reality of Boston's traditional stormwater infrastructure is that the sewer system removes stormwater from the landscape as efficiently as possible, joining stormwater and wastewater in a combined sewer system and transporting both to the city's sewage treatment plant on Deer Island. Currently, the Urban Wilds can only absorb stormwater from adjacent properties if no road divides the Wild and nearby land. Even in cases where a building is adjacent to an Urban Wild, it is likely that roof runoff is piped directly to the sewer system. Due to a sewer system undersized for the city's current level of impermeability, Boston is suffering a common urban problem: sewer overflows during major storms.[8] In light of this situation, I assessed the Urban Wilds in terms of the maximum runoff volume these sites can divert from the sewage treatment plant. This analysis looks at the infrastructure potential of fully forested Urban Wilds, assuming that only precipitation falling directly on the sites can be absorbed. Today, few Wilds are fully forested, but many could be. Assessing the *potential* hydrological function of the Urban Wilds not only indicates what role these sites could play in alleviating Boston's combined sewer overflow issues, but also addresses the question of whether naturalized sites can provide ecosystem services comparable to constructed green infrastructure, such as the bioswales or constructed wetlands discussed in Chapter One.

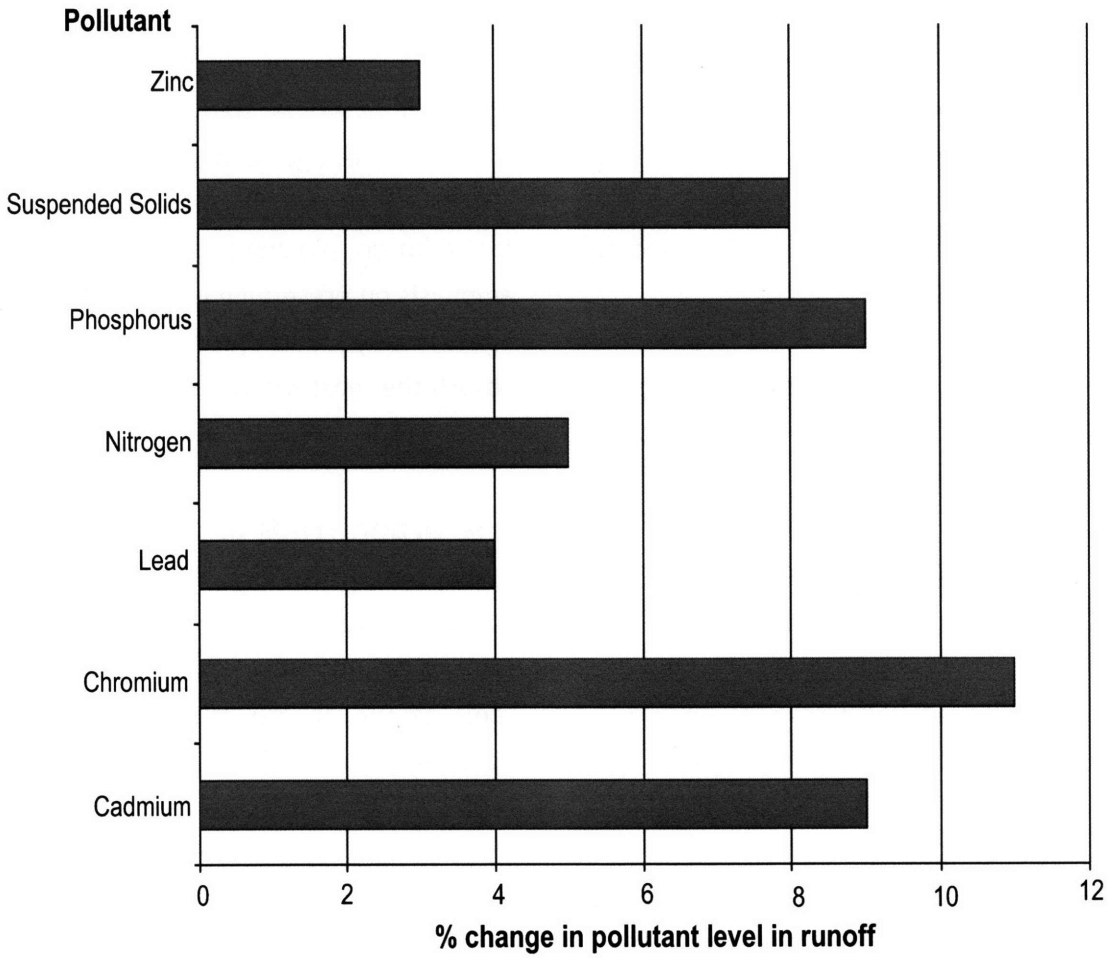
Chart 3.1 **Annual Stormwater Absorption by the Boston Urban Wilds**
Calculated using CityGreen (see Appendix 1)

Soil characteristics	Acres	Cubic feet of rainwater absorbed annually
Highly pervious	190	29,000,000
Somewhat pervious	420	62,500,000
Moderately pervious	500	70,000,000
Total	1,110	161,500,000

As an isolated figure, the 162 million cubic feet, or 1.2 billion gallons, of stormwater captured on an annual basis by the Urban Wilds seems remarkable. Although this is a large volume of water, a comparison to the existing infrastructure is required to assess the pressure fully forested Urban Wilds would remove from the sewer system. The Deer Island Wastewater Treatment Plant was recently upgraded to address the region's combined sewer overflow issue and now has the capacity to accept 1.27 billion gallons of wastewater per day from the 2.5 million person Boston metro area.[9] The 1.2 billion gallons of stormwater absorbed annually by the Urban Wilds does decrease Boston's contribution to Deer Island, but this reduction in Boston's demand on the system is less than one percent annually. From this perspective, the Urban Wilds contribution as stormwater infrastructure becomes much less significant.

Chart 3.2 **Increase in Boston's Total Stormwater Runoff Pollutant Level with Development of the Urban Wilds**

Calculated using CityGreen (see Appendix 1)



The ability of the Urban Wilds to decrease pollution levels Boston's runoff is somewhat more significant than their ability to divert stormwater from the sewer system. If these sites were developed to a typical urban density, the increase in pollution in Boston's stormwater runoff would range from an increase in zinc levels by 3% to an increase in chromium levels by 11%. The overall increase in pollution entering Boston's waterways via runoff would reach 7% if the Urban Wilds were completely lost to development. In contrast, a constructed sand filter (a contained area of sand underneath topsoil and grass) can reduce 85% of suspended solids, 40% of phosphorus, and 50 to 70% of metals in stormwater.[10] With an ability to reduce Boston's pressure on its sewer system by less than 1% and to improve water quality by less than 10%, the Boston Urban Wilds suggest that urban land conservation cannot equal the ability of constructed green infrastructure to solve urban stormwater

problems. While the ability to slightly improve water quality can be considered a benefit of the Urban Wilds, a serious attempt to improve water quality will require a more aggressive strategy than simply preserving open space, possibly incorporating constructed green infrastructure.

The challenge of urban air pollution

Like the pollution accumulated by urban rainwater, urban air also gathers and mixes a wide range of pollutants from sources ranging from automobiles to industry to dust blowing off vacant lots. The main components of air pollution in American cities have been identified by the EPA as carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, carbon dioxide, and particulate matter. The impact of these pollutants is both local and global in scope, ranging from immediate damage to human health to regional acid rain and long-term climate change. The impacts on human health of air pollution vary from simple coughs and eye irritation to lung irritation connected to increased susceptibility to bronchitis and pneumonia. Children and the elderly are the most vulnerable to these effects, as the virtual epidemic of urban children suffering from asthma demonstrates.[11] The impacts of global warming caused by air pollution will effect all ages equally, with predicted consequences that are much graver than eye irritation and a nagging cough.

Urban air pollution presents an even greater management challenge than urban water pollution. While the movement of stormwater is relatively easy to predict, air's movement is invisible to the human eye and is a complex reaction to site-specific conditions such as heat and building height. Higher pollution levels in neighborhoods with more industry or heavy traffic demonstrate that air pollution at any point in a city contains locally produced pollutants, yet this air may also contain pollutants from hundreds of miles upwind.[12] Also unlike stormwater, there is only one option for filtering urban air using natural systems: urban tree management. Urban trees absorb all of the gasses identified by the EPA as the main components of air pollution, as well as particulate matter. Based on size, age, and type, trees also vary in their ability to act as a sink for pollution, placing a management emphasis on preserving existing trees and intentionally planting species selected to absorb the most air pollution.[13]

The Urban Wilds as an air pollution sink

While it is clear that the Urban Wilds remove pollution from Boston's air to some degree, the quantification of this contribution is elusive. The Urban Wilds represent 4% of the total land area in the city (excluding the Harbor Islands and East Boston due to the dominance of Logan Airport), posing a challenge to

Chart 3.3 **Annual Air Pollution Removal by the Boston Urban Wilds**

Calculated using CityGreen (see Appendix 1)

Pollutant	**Source**[14]	**Pounds removed per year**
Carbon monoxide	Automobiles	500,000 pounds
Nitrogen Dioxide	Automobiles, power generation	3,600,000 pounds
Sulfur Dioxide	Power generation	1,900,000 pounds
Ozone	Chemical reaction of nitrogen dioxide volatile organic compounds in UV light	6,400,000 pounds
Particulate matter	Soil erosion, industrial processes, combustion, diesel engines	4,700,000 pounds

Chart 3.4 **Change in Air Quality in Boston through Urban Wilds Pollution Absorption**

Calculated using CityGreen (see Appendix 1)

Annual US per capita emissions	Annual City of Boston emissions	Annual Urban Wilds pollution absorption	% of emissions removed
105 pounds sulfur dioxide[15]	61,000,000 pounds	2,000,000 pounds	3% removed
125 pounds nitrogen dioxide[16]	72,000,000 pounds	3,500,000 pounds	5% removed
695 pounds carbon monoxide[17]	409,000,000 pounds	509,000 pounds	0.1% removed
15 tons carbon dioxide[18]	5,900,000 tons	37,000 tons	1% removed

Ecosystem services at the neighborhood scale

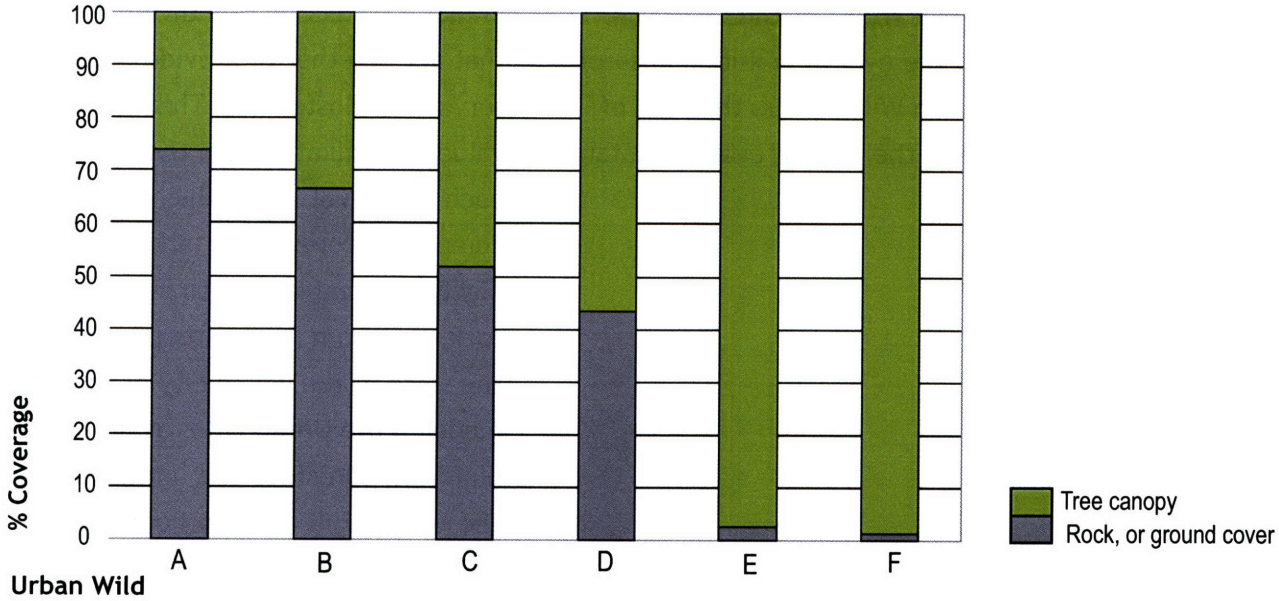
the ability to have a major impact on the remaining 96% of the city.

The trees in the Urban Wilds absorb a total of 17 million of pollution per year, as shown in on Chart 3.4. By itself, the number 17 million pounds of pollution absorbed sounds significant, and it is perhaps such numbers that give urban trees their reputation as significant sinks for air pollution. Unfortunately, when compared to the total volume of air pollution generated by Bostonians, it becomes clear that the quantity of air pollution absorbed by the trees in the Urban Wilds actually makes only a very small dent. It should be noted that this method of comparison is only a rough approximation of the air quality in any given location in Boston, as power production takes place at singular points, car travel is not spread equally on every street in the city, and air pollution can cross states on the wind. The pollution source and sink comparison nonetheless gives an indication of the relative scale of the intervention into air pollution made by the Urban Wilds. As the Chart 3.4 indicates, the overall pollution absorption by the Urban Wilds is less than 5 % of emissions in the case of every pollutant.

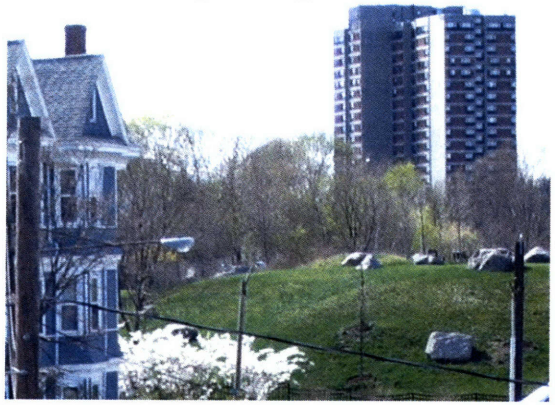
Although modeled at the city-scale as a singular entity, the Urban Wilds are in fact a collection of individual sites that act together to provide ecosystem services to Bostonians. This ecological value accumulates from the conditions of each individual Wild, which varies from completely forested to largely grass, from highly permeable soils to impermeable rock, and from flat to steeply sloped. At the scale of the whole city of Boston, I modeled the Urban Wilds as if each were uniformly forested. The limited size of the Mission Hill neighborhood made it possible to draw the location of trees in GIS using aerial photographs and to then model Mission Hill with CityGreen using this more accurate land cover data. This more accurate data allowed me to assess the impact of vegetation patterns on air pollution and stormwater absorption .

Chart 3.5 **Tree Canopy Coverage in Mission Hill Urban Wilds**

Calculated using CityGreen (see Appendix 1)



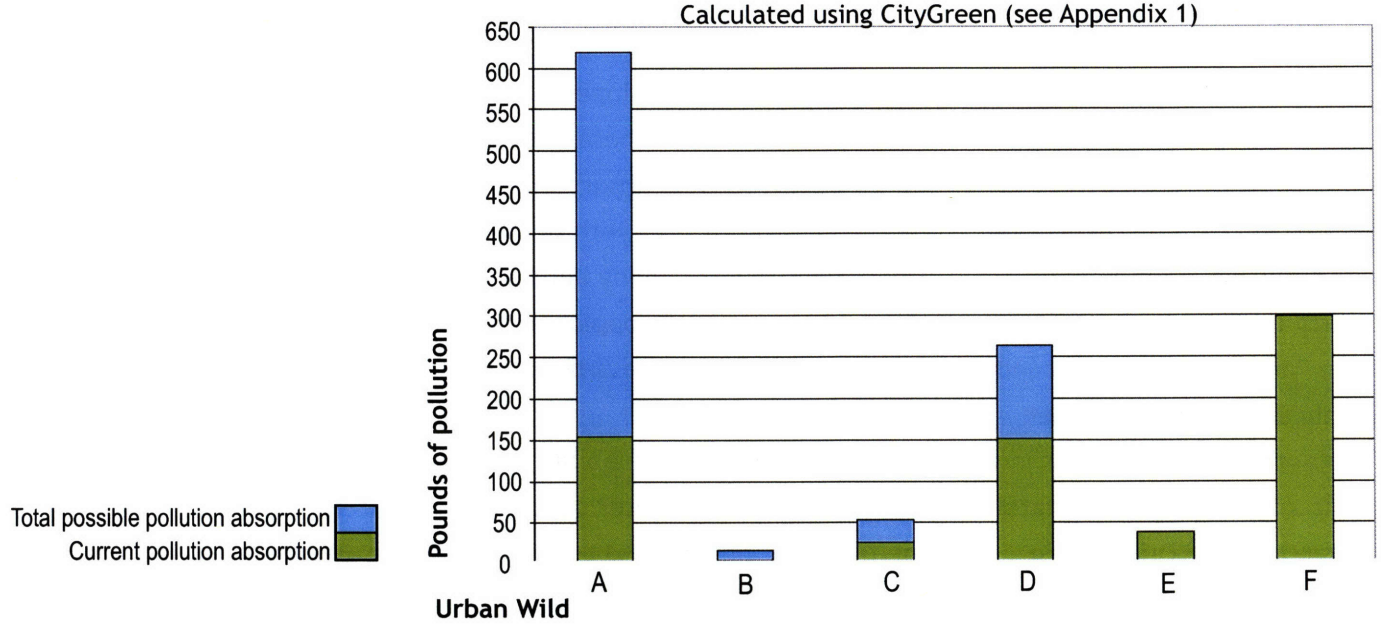
A. Harvard Quarry/Puddingstone Park



B. Allegheny I

C. Allegheny II

Chart 3.6 **Potential and Actual Pollution Absorbed Annually by the Mission Hill Urban Wilds**
Calculated using CityGreen (see Appendix 1)



D. Parker Hilltop

E. Iroquois Woods

F. Back of the Hill

The tree coverage found in an individual Urban Wild ties directly to its ability to remove air pollution. Back of the Hill is completely forested and is therefore removing the maximum amount of air pollution possible for a site of this size unless tree species particularly efficient at absorbing pollution were planted. Harvard Quarry (recently renamed as Puddingstone Park), on the other hand, is wooded only around its perimeter, with newly planted trees and grass in the interior of the site. With approximately 25% tree cover, Harvard Quarry is in theory reaching a quarter of its full potential to remove air pollution, but because young trees absorb up to 70% less pollution than mature trees, this ratio would be even lower if the age of the trees on the site were factored into the calculation (CityGreen can not complete not this type of calculation).[19] The impact of trees on the individual site's ability to absorb stormwater is similar, with larger trees and higher tree density significantly boosting the site's capacity. The ability of individual sites to absorb stormwater is also impacted by slope and soil permeability. Water will move with more force down a steeply sloped site, such as Back of the Hill, and therefore have less of an opportunity to absorb into the soil. In comparison to sites with permeable soils, sites like Allegheny I and II with impervious rock outcroppings also have a decreased ability to absorb stormwater.

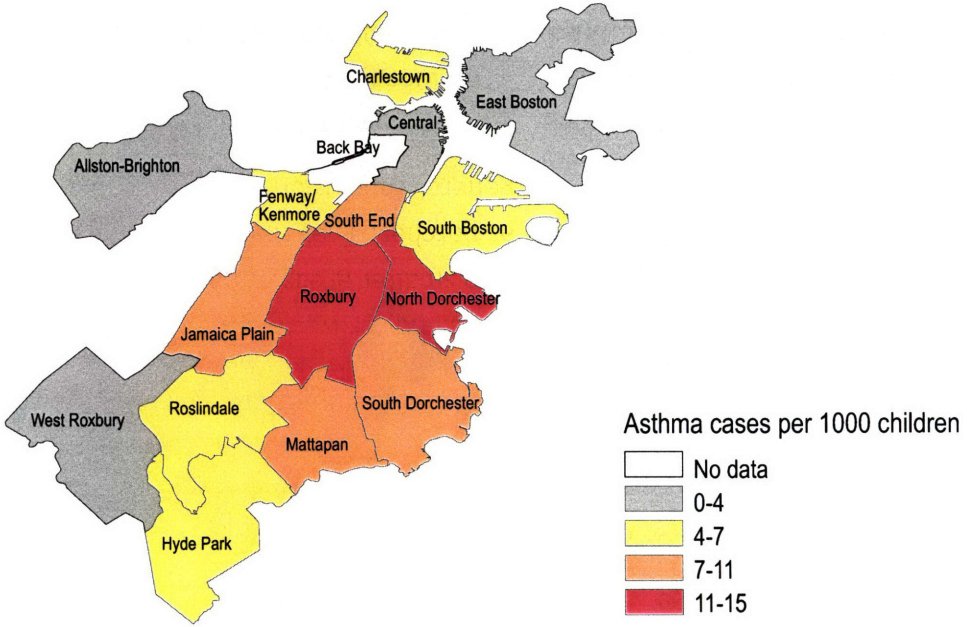
The discrepancy in the ability of trees to improve air and water quality based on tree age, health, and species speaks to the importance of maintenance in ensuring that Urban Wilds are meeting their potential to provide ecosystem services. Today, limited funding prevents the Boston Parks and Recreation Department's Urban Wilds Initiative from aggressively planting or maintaining trees to address air or water quality, but to fully maximize the ability of the Urban Wilds to play this role, careful maintenance is required. The involvement of the Boston Urban Wilds Initiative also plays an important role in ensuring that decisions made about trees in an Urban Wild balance ecological values with other needs and perceptions of the site.[20] In Mission Hill, Allegheny I and II are privately owned and are not managed by the Urban Wilds Initiative. Allegheny II was recently purchased by Westin Properties and at the request of neighbors, Westin Properties cut down a bank of birch trees which the neighbors felt attracted crime.[21] In City-owned Urban Wilds, the role of the Urban Wilds Initiative Coordinator has been to negotiate real and perceived threats to safety and the ecological needs of individual Urban Wilds.[22]

The reduction in air pollution and stormwater runoff and the improvement in overall water quality possible through fully forested Urban Wilds supports the conclusion that *The Boston Urban Wilds: A Natural Area Conservation Program* was not incorrect in drawing attention to these sites as *potential* locations for

ecosystem services. At the same time, the full realization of this potential requires steps further than simply allowing nature to take its course. Water quality requires steps greater than simply protecting the Wilds from development, possibly as dramatic as completely reconstructing some sites to capture and hold stormwater. Fully realizing the goal of maximizing water quality impacts may be difficult, if not impossible, to balance with the fact that mature trees are required to maximize the ability of a site to sequester air pollution. This contradiction suggests a strategy of selecting a singular major ecosystem service desired from an individual Urban Wild and managing the Wild to maximize this potential while sacrificing some of the Wild's ability to perform other ecosystem services simultaneously. The geography of specific public health problems could guide this selection, such as the physical distribution of childhood asthma through the city seen on the map of Boston in Figure 3.9. Because asthma is thought to be linked to particulate matter, a focus on asthma reduction would locate Urban Wilds managed for air quality in neighborhoods with high rates of childhood asthma, seen in red below. In neighborhoods with low rates of childhood asthma, it would be appropriate to focus Urban Wilds management on water quality rather than air quality.

The inherent suitability of individual

Figure 3.9 **Childhood Asthma in Boston**



Wilds to address particular environmental issues could also guide maintenance decisions. The distribution of permeable soils and sloping sites throughout Boston suggests that although some sites may be able to address both water and air quality simultaneously, others may be able to address only air quality due to soils with low permeability, steep slopes, and physical location. Defining the ecological goal of a particular Urban Wild could shape maintenance decisions. On a site where the primary goal is to act as a sink for air pollution, maintenance energy would be focused on nurturing existing trees and planting fast growing trees as holes emerge in the tree canopy. If the goal was to address both air and water quality, an emphasis would still be placed on the tree canopy, but maintenance would also focus on the ground cover, as shrubs and low plants and grasses also play a role in slowing and capturing stormwater runoff. A site designed to address stormwater could go as far as combining forested areas with 'filter strips,' areas of slightly sloped grass that filter out some pollution and trash from runoff before it reaches the main stormwater filtering area of the site, or swales capable of infiltrating a large volumes of stormwater. Going beyond simply restoring the ecological community found on a site, filter strips and bioswales could also be integrate active recreation with an Urban Wild or could be managed to increase wildlife habitat diversity, leading to greater wildlife diversity.

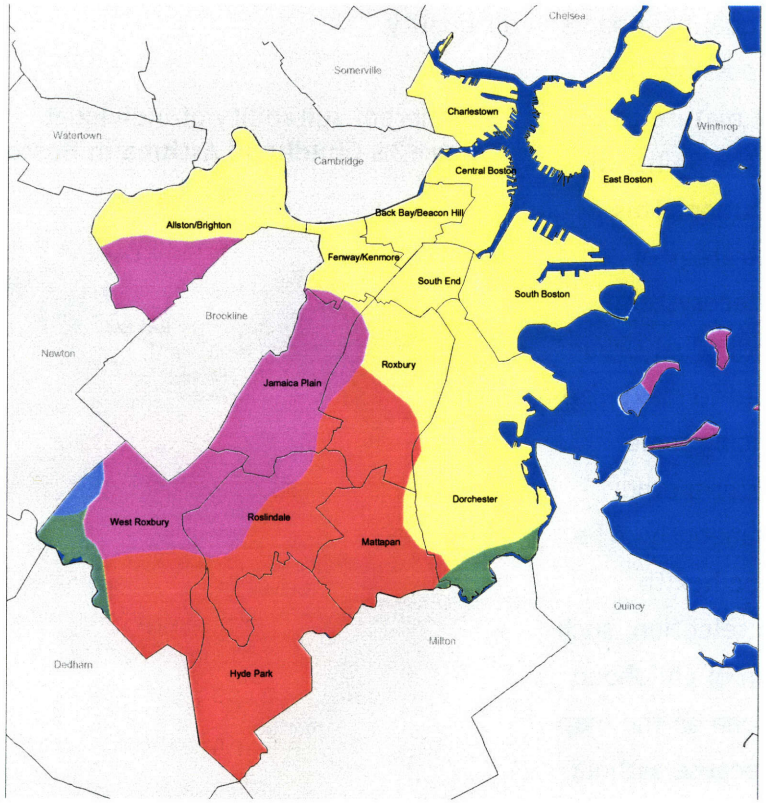


Figure 3.10
Boston Soils Map

Soil permeability
- Highly pervious
- Somewhat pervious
- Moderately pervious

A final issue highlighted by the analysis of Mission Hill is the fact that the tree canopy contained within the Urban Wilds is only a small portion of Boston's total tree canopy. Within Mission Hill, the Urban Wilds total to 7.5 acres, yet another 12.5 acres of woodland exists in patches and strips throughout the neighborhood, owned by private individuals as well as three City agencies. Beyond these areas, Mission Hill's street trees also provide much of the same ecological value as the trees in the Urban Wilds. Extrapolated to the city as a whole, it is clear that while individual Urban Wilds make only small improvements to air and water quality, the Urban Wilds also represent only a fraction of the total tree canopy within Boston. While it has not been calculated for Boston, the average urban tree canopy cover is 28%.[23] Therefore, a policy aimed at improving air and water quality through trees must focus on a larger portion of the canopy than just the trees that grow within the Urban Wilds.

Figure 3.11
Treed areas in Mission Hill

The Urban Wilds as wildlife habitat

The ecological values of the Urban Wilds extend beyond those known as 'ecosystem services,' which primarily benefit humans, to the preservation of wildlife habitat. To the extent that wildlife can thrive within a city, birds and animals clearly profit from urban habitat, but humans benefit from these spaces as well. The experience of escape from the urban environment offered by pockets of nature within the city is a social benefit, an experience heightened by interaction with a wide range of bird and animal species.

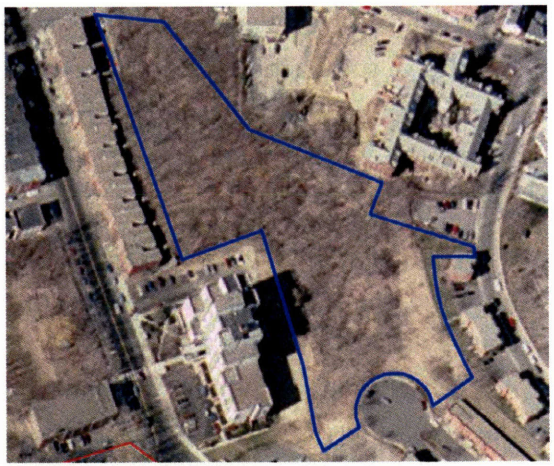
The assumption that areas of trees, shrubs, and other vegetation surrounded by buildings, roads, and people on all sides can provide habitat to birds and animals is by no means exclusive to the 1976 Urban Wilds report. This assumption is commonly made in planning documents and development plans, where any size and shape of green space with any number of trees is thought to provide at least some amount of habitat. Yet, landscape and wildlife ecologists have rigorously addressed the question of what happens to populations of birds and animals when continuous areas of forest, grassland, or wetland become fragmented into smaller areas of habitat, known as patches. They have come to the general conclusion on "the bottom line: large patches, large benefits, and small patches, small benefits." [24] Urban ecology research over the past twenty years has shown that habitat patches surrounded by urban development such as the city of Boston will rarely, if ever, be a microcosm of the ecosystems that existed before the city urbanized several centuries earlier. This research also indicates that urban areas have the potential to support a diverse bird population, along with a somewhat more limited mammal population.[25] Under the right conditions, urban habitats of a wide range of sizes will support a larger bird population than the surrounding landscape, so most Urban Wilds have the potential to offer visitors a window into an ecology that, while not replicating what they might find on a hiking trip outside of Boston, does offer an experience far removed from the ecology of their apartment building's front yard. [26]

From the human point of view, these natural areas within a city represent two things. First, is the opportunity for those rarely able to leave the city to interact with the natural world to a greater extent than is possible in their daily lives. While this experience may not be the unblemished nature valued by ecologists, it remains far removed from watching pigeons vie for crumbs in Copley Square. Secondly, the ability to experience the natural world close to home is a key factor in quality of life for all city residents, not just those who have limited ability to escape the city in search of nature. An extensive body of literature addresses the psychological benefits of easy access

to a natural environment. Rather than summarize this literature here, it will suffice to state simply that greater psychological benefits accrue as the natural environment diverges further from the daily environment.[27] A key element in the experience of leaving the daily environment of buildings, pavement, and grass when entering an Urban Wild is the diversity and number of visible species, tied directly to the Wild's quality as habitat. Here, size is a limiting characteristic, but management also plays a crucial role in increasing the diversity of species supported in an individual Urban Wild.

Challenges facing urban wildlife habitat

Several key factors determine whether a habitat patch of any scale can support the ability of a given species to forage, breed, nest and take cover from predators. Although area is the basic limiting factor, the relative quality of a patch as habitat also depends on the proportion of edge habitat to core habitat. The edge of a patch abutting a different habitat, either vegetated or developed, is a transition zone exposed to both sun and wind, resulting in a somewhat different community of vegetation and insects than the center of the patch. The edge of the patch is also subject to higher rates of predation than the core. For these reasons, many wildlife species simply avoid the edge of a patch altogether and those that can meet their needs for food and nesting sites there are nonetheless subject to a higher risk of predation. Several factors increase the amount of edge habitat in relation to core habitat, including the shape of the patch and the geometry of the patch perimeter.[28]



Back of the Hill's elongated, irregular shape (above) increases its edge habitat. A regularly shaped parcel of the same area would have a greater amount of core habitat and less edge.

Parker Hilltop's regular shape (below) increases its ratio of core to edge habitat, but its small size causes most of the site to have the qualities of edge

Although patch size was once determined by natural shifts from one ecosystem to another, such as wetland to forest, today the area of a habitat patch is determined largely by patterns of development which have created gaps between habitat patches ranging from country roads to entire towns and cities. Fragmentation not only reduces the area of a patch, but also increases the distance between habitat patches. As they become increasingly remote, patches begin to function as islands where local extinctions are possible as no outside source of species can make it to the patch to diversify the gene pool or replenish a population after a harsh winter or summer. The comparatively low diversity of species able to survive in an urbanized environment is the result of the combined impact of decreased habitat size, increased edge effect, and increased isolation of patches.[29] Any Bostonian who has visited the Arnold Arboretum has first hand knowledge of these combined effects. It is impossible to visit the Arboretum and not notice the great increase in bird density, which correlates directly to the high quality habitat found in the Arboretum. As the majority of the Urban Wilds are much smaller than the Arboretum, the question remains to what extent the various negative patch qualities found in most Urban Wilds impact the ability of these patches to provide wildlife habitat.

Wildlife habitat at the citywide scale

While urban ecology is still a relatively young field without the broad understanding that we now have of ecology in undeveloped areas, a few studies have been completed of urban bird habitat in Massachusetts. These studies can be used to evaluate the potential of the Urban Wilds to support a greater variety of birds than visitors would see in the remainder of the city. The most applicable studies were completed in Springfield and Amherst. The first focused on the ability of urban habitat to support breeding pairs of birds, based on characteristics ranging from habitat area to density of surrounding buildings. The second focused on habitat characteristics that correlate to an increased density and diversity of birds within the same size habitat patch. Both studies indicate that approximately sixty to sixty-five bird species is the upper limit that can be reasonably expected to thrive in any naturally vegetated area in a Massachusetts city. From these studies the following conclusions can be drawn, applicable to an assessment of where strong opportunities for bird habitat lie in the Urban Wilds.

- Patch size is the greatest factor in a bird's habitat preference, correlating to 75% of preference. The relationship between species diversity and area is not linear, with the most dramatic gains in diversity seen as small patches increase in size.[30]

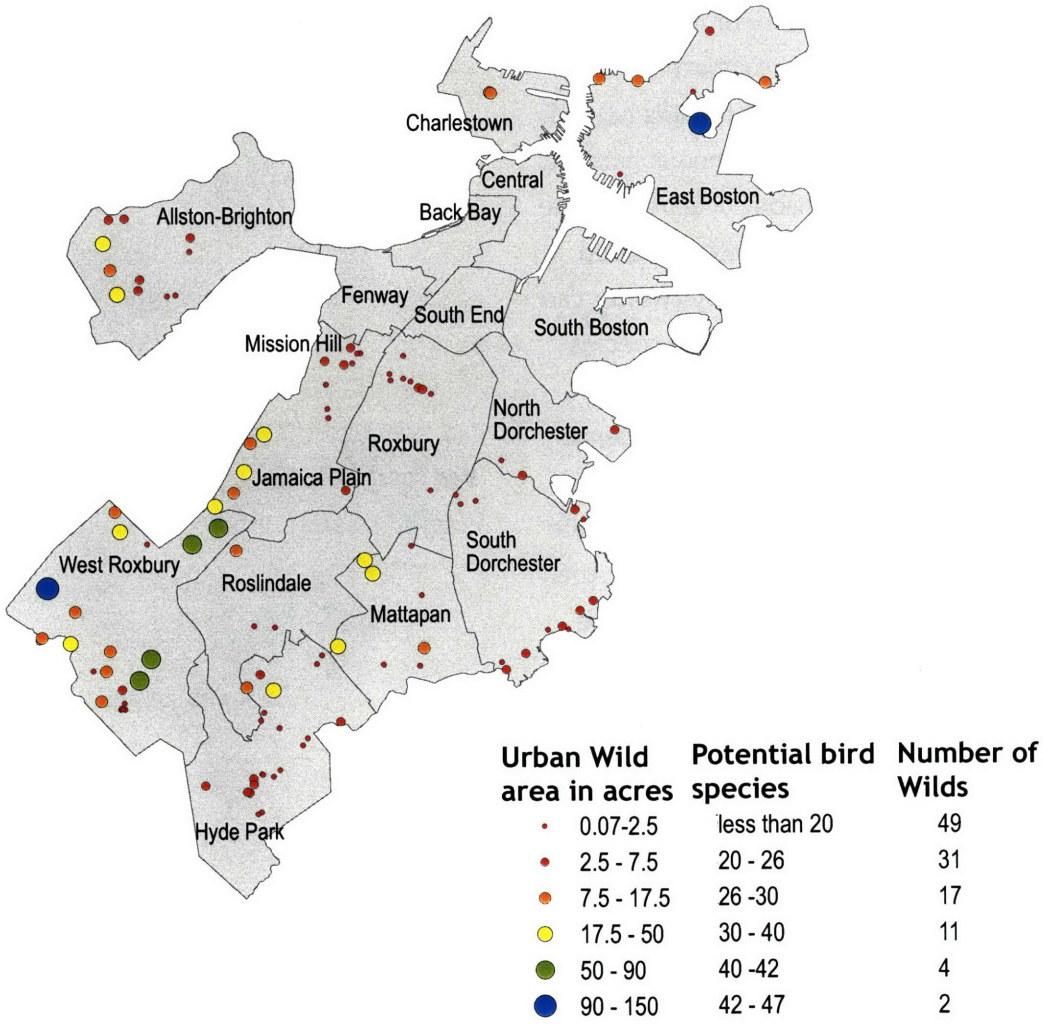
- All other factors, including trails, tree height, and density of surrounding buildings were roughly equivalent in their impact on the number of breeding bird species, impacting preference by only 8%.[31]

- In patches of equal size, the density of vegetation is the most important factor in both diversity of birds and number of birds, accounting for 50% of the variation in bird species.[32]

- 20% of urban bird species can live anywhere in the city (approximately thirteen species) but another 40% can thrive only when patch conditions are optimized. These approximately twenty-five species are considered the most likely to respond to management decisions.[33]

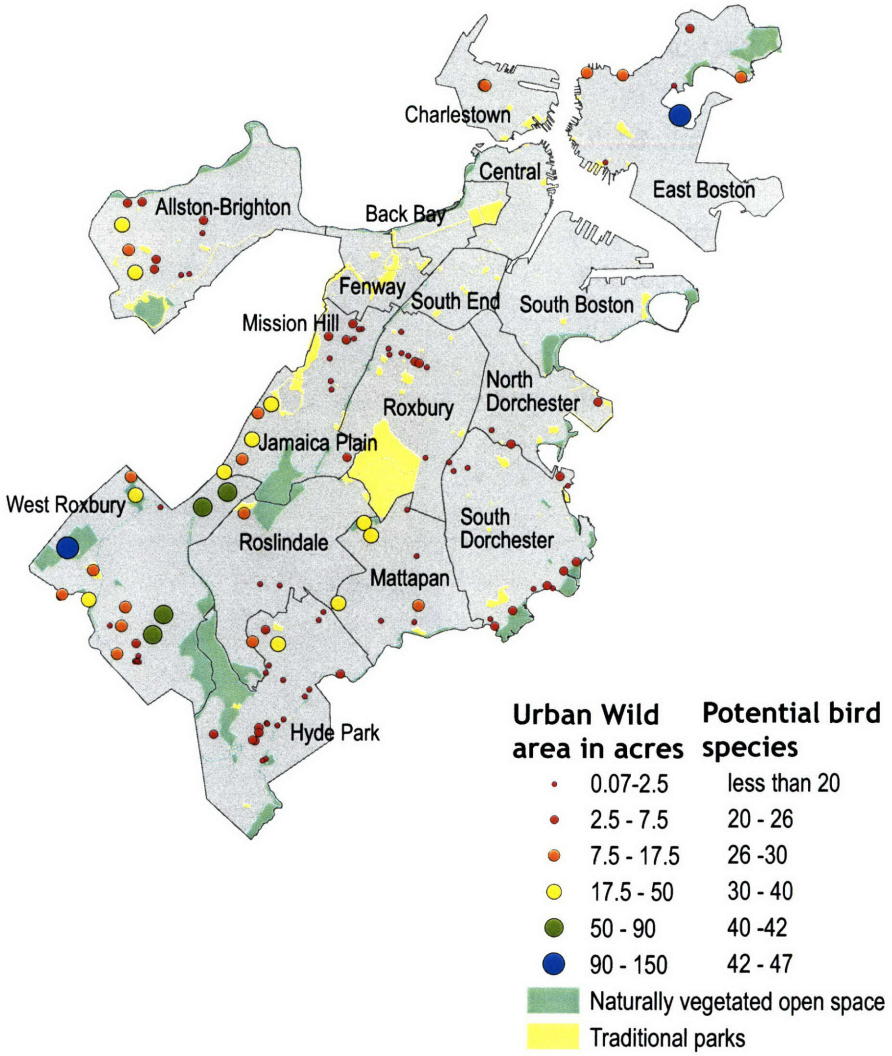
Based on area alone, the Urban Wilds cannot support the full range of sixty to sixty-five bird species able to survive and breed in Amherst and Springfield.

Figure 3.12
Likely Breeding and Resident Bird Species Based on Urban Wild Area



When the adjacent and near by park and reservation land is considered, the number of Urban Wilds likely to support this maximum diversity of breeding urban birds expands to approximately ten sites. In these cases, the Wilds helped to form a relatively continuous habitat, connecting reservations or parks. In the remaining smaller and more isolated Urban Wilds, approximately twenty can support all of the twenty-five species heavily influenced by management decisions such as encouraging a dense shrub layer or leaving dead trees standing to create nesting holes. While the remaining sites do not support this full range, a total of sixty-five of the 114 Wilds mapped will sustain more birds than the approximately thirteen species that thrive anywhere in the urban environment. The remaining forty-nine sites may also be able to support more than these thirteen species through careful management. Site-scale decisions will be the key factor in determining how many species succeed in these Wilds.

Figure 3.13
Urban Wilds in Relation to Boston Parks and Reservations



The map shown in Figure 3.13. Urban Wilds in Relation to Boston Parks and Reservations, suggests that, beyond the qualities of individual sites, a focus on individual Urban Wild's proximity to other green spaces may be the best strategy for maximizing wildlife diversity at the urban scale. Overlaying the Wilds on the parks and reservations, a band of naturally vegetated open spaces across West Roxbury and Hyde Park, and a narrow habitat corridor along the western city boundary in Mission Hill, Jamaica Plain, and West Roxbury become visible. From the narrow viewpoint of maximizing only bird diversity, these Wilds are the most logical sites for preservation and restoration efforts, but when equity is considered this strategy becomes problematic. A disproportionately large amount of green space is already concentrated in the southern portion of the city, highlighting a conflict between planning for wildlife and planning for recreation. To create an equitable distribution of Urban Wilds and to build public support across the city, it will be necessary to sacrifice some of clustering's potential habitat gains by spreading preservation efforts equally.

Wildlife habitat at the neighborhood scale

From the research in Springfield and Amherst, it is clear that vegetation is of central importance to maximizing the number of bird species in a particular Urban Wild, meaning that maintenance plays a key role. Maintenance has been an ongoing struggle in the Urban Wilds. When preservation work began in 1976, the assumption was made that the Boston Conservation Commission, formed only six years earlier, could manage the Urban Wilds. By the mid-1980s, it became abundantly clear that this agency had neither the funding nor the staff capacity for management, and this responsibility was shifted to the Parks and Recreation Department. Internal tension between this department's traditional role in providing opportunities for active recreation and the somewhat unrecognized recreational opportunities offered by the Urban Wilds has led to inadequate funding. [34] The 2002 BPRD *Urban Wilds and Natural Areas Management Plan* aimed to expand the ability of the Urban Wilds Initiative to actively manage the Wilds, but, in the words of the Initiative Coordinator, Paul Sutton, "Unfortunately, there doesn't seem to be much interest here in raising the profile and funding [as outlined in the plan] for this program. Focus here is very much on active parks/playgrounds." [35] The plan was not published and today the focus of the Urban Wilds Initiative is on Friends Groups as the ideal managers of the Urban Wilds.[36]

In Mission Hill, the activities of a core group of neighborhood activists illustrate both the potentials and pitfalls of relying on Friends Groups to achieve management goals. When Iroquois Woods came under management of the Initiative in 1999, the Friends of Iroquois Woods formed. This group intends to restore

the woodland to the point that residents cannot imagine Iroquois Street without it and will eventually fight to make the current forty-year easement permanent. The original goal of this group was to remove invasive Norway Maples that had overrun the site, forming a dense canopy out-competing native trees and plants and discouraging birds from occupying the site by eliminating food sources.[37] Not only did the involvement of the Friends of Iroquois Woods allow this work to take place, but it also provided an ambassador to the neighborhood to explain what exactly was going on in the woods they had recently poured a great deal of energy into preserving. As explained by a neighborhood activist, "many people say 'lets save this space' but are not on the same page about what happens next...it gets complicated when tall trees need to be cut down." Some neighbors of Iroquois Woods were very attached to the Norway Maples on the site, regardless of the problems these trees were causing for wildlife habitat, and it was the involvement of the Friends of Iroquois Woods, also neighborhood residents, that allowed restoration work to move forward.[38]

The Mission Hill Urban Wilds also illustrate the challenge facing a management strategy reliant on the Friends Groups to determine where management does and does not take place. In an urban environment, it is virtually impossible for a small site to sustain itself as a community of native plant species, yet native species lead to a healthy, diverse wildlife population. Because locally evolved insects can not eat non-native plants, exotic plant interrupt the food web by eliminating the insects that birds and small rodents rely on. Intervention from Friends Groups or city staff is necessary to keep exotic plant species at bay, yet not every site can elicit the same level of engagement

Figure 3.14 A volunteer working in Iroquois Woods

from community members. Parker Hilltop came under a conservation easement at the same time as Iroquois Woods, but a much lower level of restoration work is taking place at Parker Hilltop today. This lack of restoration at Parker Hilltop is the result of a decision by neighborhood activists to focus the majority of their energy in the McLaughlin Woodlands (a non-Urban Wild woodland) and Iroquois Woods, allowing Parker Hilltop to evolve with limited intervention. Mission Hill is fortunate to have a number of residents engaged in the neighborhoods wild space, and these individuals are unlikely to allow Parker Hilltop to be overrun by invasive plants, but this focus of restoration efforts by volunteer preferences could be problematic in other neighborhoods.

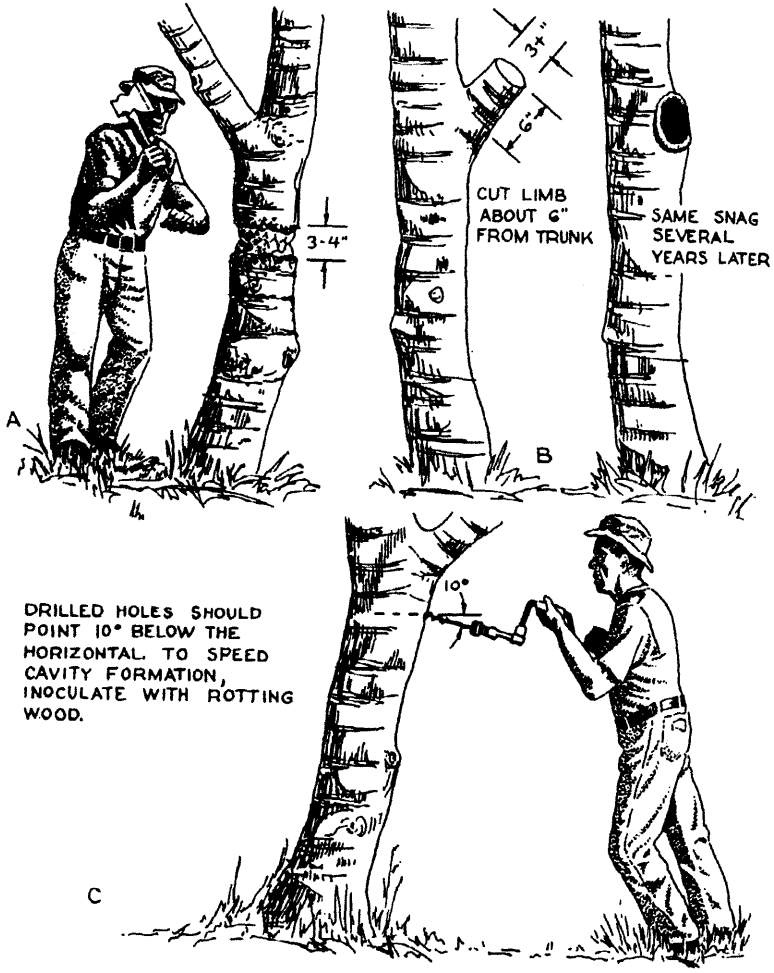
Extrapolated to the city at large, management of only Urban Wilds where there is either a pre-existing engaged group of residents or the potential to easily form such a group is also problematic. A Friends Group supervised and supported by a city staff member clearly is the least expensive form of Urban Wilds maintenance, but it has also resulted in a second set of Urban Wilds which receive little to no attention. Since maintenance is necessary to maintain native species, and native species are required to support wildlife not found in the rest of the city, relying on community interest to drive maintenance is some thing of a 'Catch-22'. Some portion of the Urban Wilds will remain without an engaged community group and therefore unmanaged and less able to meet their maximum potential as wildlife habitat. This ability of an Urban Wild to support visible wildlife ties directly to people's perception of a particular Wild as a special place. An unmanaged Wild will be perceived as less special and will in turn inspire fewer community members to work toward its restoration.

The potential also exists to increase the capacity of the Urban Wilds to support a greater number of birds than naturally occur in a patch of a similar size. While the urban ecology literature indicates that site level management can influence the density of bird species on a given site, maximizing the ability of an urban habitat patch to support an increased number of birds falls outside the realm of urban ecology and into habitat gardening. Habitat gardening seeks to maximize the number of birds and animals in a given area. In the words of Roger Tory Peterson in the introduction to the Audubon Society guide to improving bird habitat through gardening:

> No suburban garden is without birds or butterflies but with imaginative planting you can easily double or triple their numbers. The environmentally oriented gardener can not only enjoy red, orange, yellow, and blue flowers but red, orange, yellow, and blue birds such as cardinals, orioles, goldfinches, and jays.[39]

Building from landscape ecology research, the *Audubon Guide to Attracting Birds* advocates increasing the density of shrubs within a habitat

area and extending the overall habitat area by connecting treed patches with hedgerows. Beyond these basic recommendations, it also recommends a series of steps to attract a greater variety of birds that are beyond what might be found in an ecologically-formed habitat patch. These recommendations include increasing the amount of edge to maximize the number of areas where multiple habitat meet, planting food in long narrow rows, providing nesting boxes, and even providing food in feeders.[40] In some ways similar to engineering green infrastructure for water quality, these steps move beyond what might be found in unmanaged natural areas. Nonetheless, these techniques offer the possibility to increase the urban dweller's ability to interact with the natural world in the Urban Wilds beyond what would be possible if they are restored simply as 'slivers of countryside' surrounded by the city.



Three techniques for creating artificial tree cavities: (A) Girdle the tree by cutting a 3–4-inch wide belt around the tree through the living tissue; (B) cut off a limb at least 3 inches in diameter, creating a stub 6 inches long; and (C) drill holes.

Figure 3.15 An illustration of how to create woodpecker habitat. This type of activity requires a strong Friends Group to explain to neighbors what it taking place.

The Urban Wilds as public space

Boston's wealth of green spaces extends beyond the familiar Common and Public Gardens to encompass many natural parks, woodland reservations, beaches, and hilltops outside the downtown. These 'Urban Wilds' are an asset to the people of Boston, just waiting to be explored. In fact, within the city limits you can find many pleasant places that are open to the public where you can hike and climb rocks, fish, swim, take leisurely walks through the woods, sail, or enjoy a spectacular view... Someday soon, pack a picnic lunch and explore the natural splendors that Boston has to offer - right in its own backyard!

Boston Redevelopment Authority, *Boston Urban Wilds poster*, 1976.

Because of their ambiguous status, the public perception of urban wilds often varies dramatically from one neighborhood to the next. Some wilds are perceived as vacant lots that are off-limits. Devoid of positive use, these areas become pockets where crime flourishes and litter is out-of-sight and out-of-mind. In other communities, people value the suburban quality that Urban Wilds imbue to their neighborhood. They appreciate increased property values and a cleaner, quieter atmosphere. Nevertheless, they prefer to view them through windows and minimize interaction. Meanwhile, some communities have embraced their Wild and have sought to reclaim their natural areas for the purposes of recreation, education, and ecological renewal.

Boston Parks and Recreation Department, *Boston Urban Wilds and Natural Area Management Plan,* unpublished, 2002.

While the ecological values of cleaning the air and stormwater and providing wildlife habitat can be assessed using scientific studies and hard data, the assessment of how wild spaces perform as public space in a city is not clear-cut. No study exists on the use of the Urban Wilds as public space, but the assumption is that passive recreation is their predominant use, largely in the form of walking and enjoyment of nature. While the 1976 BRA poster encouraged residents to, "someday soon, pack a picnic lunch and explore the natural splendors that Boston has to offer - right in its own backyard,"[41] the first wave of preservation of these spaces should not be interpreted to mean that a particularly large number of Bostonians were actually following this advice. The bold idea voiced in *Boston Urban Wilds: A Natural Areas Conservation Program* that natural spaces existed within Boston and were worthy of protecting captivated a small group of politically-savvy individuals. This group

formed the Boston Natural Areas Fund and immediately set to work to preserve the sites with explicitly clear ecological and recreational value, due to sheer size and particularly unique natural features of these sites. The recommendations in the 1976 report shaped their early work, which, although supported by community members after the fact, did not grow out of an identification of sites used recreationally by Boston residents.[42] It was clear that the Urban Wilds *could* be used for recreation, but the preservation work that took place in the late 1970s to early 80s does not indicate that the Urban Wilds in fact *did* provide public space used and valued by the average Bostonian.

Two events of the mid-1980s marked the transition of the Urban Wilds from a novel idea carrying a burst of energy for preservation to a permanent part of Boston's vocabulary.[43] The first of these events was the incorporation of the Urban Wilds into the Boston Zoning Code, as part of a complete overhaul of the Code including the creation of new Open Space zoning designations. While the OS-UW (Open Space-Urban Wild) zoning designation is a very weak tool for preservation (as discussed further in the following chapter) it nonetheless allowed Urban Wilds to enter into the public conversations and debates over rezoning that followed in each Boston neighborhood. The second event was the increased role in planning that the Boston Parks and Recreation Department took on by publishing the first Boston Parks and Open Space Plan in 1987. The plan officially incorporated the Urban Wilds as one of the City's open space resources. The preservation of forty Urban Wilds, followed by the incorporation of the Urban Wilds into official planning by two agencies did not create a situation in which every Boston resident was aware of the Urban Wilds. It can be argued however, that those residents who were engaged in the planning and development of their neighborhoods were aware of the idea that the Urban Wilds are special places that should be preserved as green spaces.

By the 1990s, the concept of Urban Wilds was established in the consciousness of Bostonians actively engaged in their communities and the first wave of preservation with state and federal funding had ended. After funding dried-up, decisions to restore, alter, or ignore an Urban Wild became a much more community-based process. For this reason, the decisions made by Bostonians in the past decade to preserve or alter individual Urban Wilds can be viewed as a critique of the idea that these spaces can meet recreational needs. While far from a scientifically accurate study, Boston's answer to the question of the compatibility of wild and urban spaces emerges from the Urban Wilds with significant community involvement over the past decade. Because study of the recreational use of an individual Urban Wilds is only possible at the site scale,

the following investigation of the ability of the Urban Wilds to provide viable public space focuses primarily on Mission Hill and secondarily on Boston as a whole.

Challenges facing wild public space

Wild space within the city runs counter to the majority of American's aesthetic tastes. For many, the traditional manicured park provides the primary reference point when imagining a new green space in their neighborhood. Yet, as the prior assessment of ecological values demonstrates, the traditional elements of urban parks, such as grass lawns peppered with individual trees and impermeable paving, are incompatible with many ecosystem functions and wildlife habitat. Beyond aesthetic preferences, some urban residents feel personally threatened by wild vegetation because the physical appearance of these wild spaces creates the impression that illegal activities could take place there. The lack of sight lines into these spaces and the lack of a visible record of care or attention to the site combine to create this impression. In some embattled urban neighborhoods, these fears are well-founded and in these places, a completely wild landscape may simply be an incompatible form of open space. In most urban neighborhoods, including virtually every area in Boston, the perception of crime in naturally vegetated open spaces is a much larger problem than actual crime. Here, simple but visible design and maintenance decisions along the edge of a Wild can shift perceptions from a threatening vacant lot to a neutral public space, clearly valued by some portion of the community. These steps can be as simple as maintaining a more manicured landscape along the sidewalk and providing physical markers of attention paid to the Wild, such as signage or trails.

Within the tension between the needs of wildlife habitat and ecosystem services and preferences for traditional public space lie the fate of many small or ecologically degraded Urban Wilds. While everyone understands that sites of ten, twenty or fifty acres have an ecological value, Wilds too small to have an ecological value clear to the general public require a local constituency to withstand development threats. If the 'wild' qualities that create ecosystem services and habitat are not seen as compatible with the type of public space that neighboring residents can enjoy, there will be very little constituency for preserving the natural state of these sites. If ecological value and social value cannot exist independently, the question of compatibility becomes of primary importance in an urban environment and real estate climate like Boston's where no piece of land can remain ignored for long.

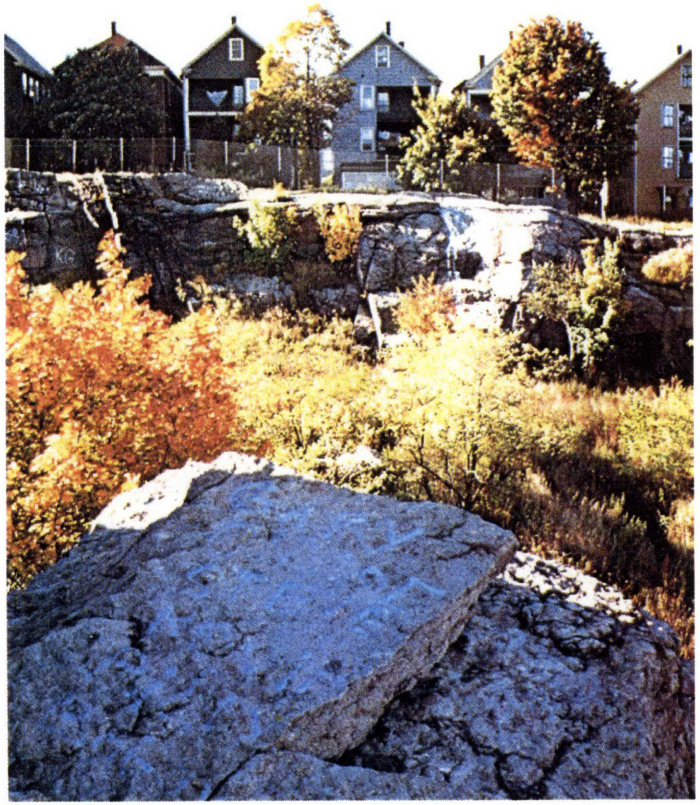
Mission Hill Urban Wilds as public space

From the assumption that the surrounding community will use sites where it is possible to experience nature within the city for passive recreation, it would be expected that sites with the most robust and interesting ecology would be those most valued. While none of the Urban Wilds in Mission Hill remain as they were in 1976, a 1978 letter from Richard Weaver, a horticultural taxonomist with the Arnold Arboretum, to the Boston Natural Areas Fund provides a window into the past ecology of these sites:

> The Harvard Quarry [now Puddingstone Garden] ...is to me one of the finest lots in Boston. The vegetation on the puddingstone ledge on the north side of the site is composed almost entirely of native plant species, an unusual situation in Boston...The unique beauty of the site is apparent in mid-June when the pastel reds of the maturing Broom Grass are set against the brilliant blues of the Viper's Bugloss in flower. This site is also the only place I know in Boston where the False Sunflower has become naturalized.[44]

Parker Hilltop Meadow on the other hand, featured a spectacular view yet was less interesting 'from a botanic point of view, particularly in comparison to the other sites visited.' Vetch and tansy dominated the meadow at the time, both 'widespread and abundant in Boston' and the wooded area was dominated by black locust, 'a common volunteer tree in Boston.' Finally, Weaver visited the Back of the Hill, where he commented on the prior loss of the 'aquatic and marsh plants in a series of small, semi-permanent ponds...unfortunately covered with a thick layer of fill' and found the forested hillside to be the home of 'interesting woody plants' including white poplar, osage orange, crab apples, and sycamore maples.[45] Also notable is the fact that the two remaining Mission Hill Urban Wilds, Allegheny I and II, did not make it into Weaver's letter, foreshadowing the ongoing difficulties to justify the preservation of these rock outcroppings.

Based on the assumption that the community values Urban Wilds for passive recreation and access to ecologically interesting sites, Weaver's description implies that the most valuable site to the community should have been Harvard Quarry, while Parker Hilltop should have elicited a relatively indifferent response. As events unfolded in Mission Hill, the desires of the community were, in fact, the exact opposite of this prediction. Preserving Parker Hilltop in its natural state became a major battle involving most of the neighborhood, while the community found the best use for the Harvard Quarry to be redevelopment as a traditional passive park.



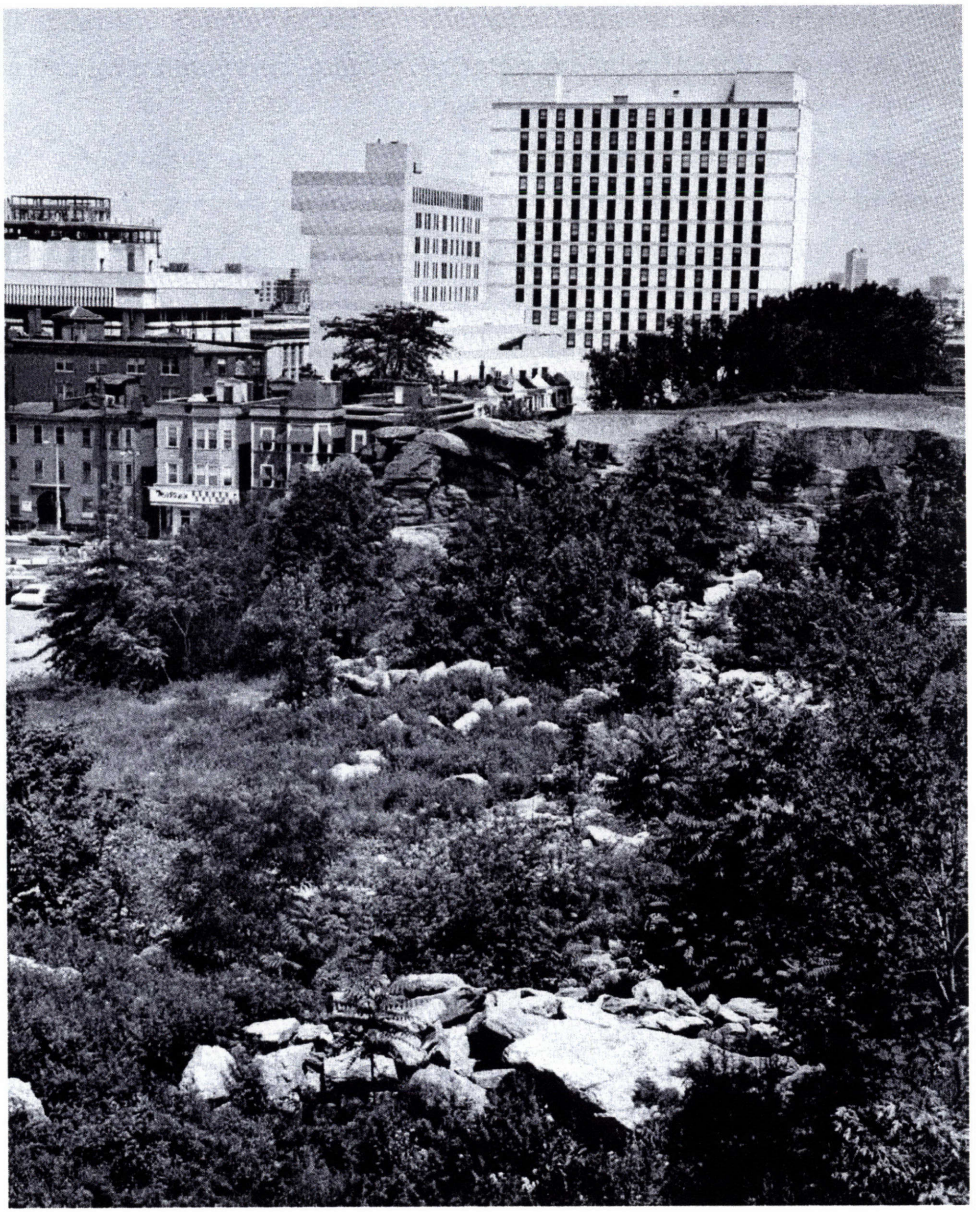


Figure 3.15 (left) Harvard Quarry, 1976

Figure 3.16 (right) Harvard Quarry,1974

Far from being an untouched natural area, Parker Hilltop has a long history of human intervention dating back to the mid-nineteenth century. As one of the highest points in the city, Parker Hill was a logical location for a reservoir and, in 1873, a century of takings through eminent domain began as the City of Boston took possession of the hilltop.[46] In the early 1900s when the reservoir closed, the land was sold to the Robert Breck Brighton Hospital, now the New England Baptist Hospital, Parker Hilltop's neighbor today.[47] One of many institutions located in Mission Hill, the relationship between the New England Baptist Hospital and Mission Hill residents must be viewed within the larger framework of urban renewal. The 1940s through 60s saw the construction of two public housing developments in Mission Hill followed by the worst form of urban renewal, as 180 triple-deckers were taken through eminent domain in order to build a medical clinic that never materialized. Wounds from the prolonged battle to block institutional expansion into Mission Hill have still not healed.[48]

In the mid-1990s, as the New England Baptist Hospital proposed an expansion that would replace the remaining open space at the top of Parker Hill with a 52,000 square foot surgical unit, a 72,000 square foot outpatient facility, and a four story parking garage, Mission Hill residents had had enough.[49] Much of the community became engaged in blocking this proposal, the Mission Hill School created a 'TV spot' in support of preserving Parker Hilltop and community residents physically blocked bulldozers.[50] In part due to this community pressure and, partially due to an appropriate building becoming available at the base of the hill, New England Baptist eventually changed its plans, shifted the location of the new facility, and constructed a parking lot on a portion of the debated four acre Urban Wild. The outcome of this process was a permanent conservation easement on the remaining one and 1/2 acres and a forty-year development restriction placed in 1999 on second one-acre woodland, Iroquois Woods.[51]

Due to the intense engagement of the community in this preservation effort, it would be expected that Parker Hilltop is an actively used open space today, yet interviews with Mission Hill residents indicate that in fact, it is quite rare to visit Parker Hilltop and encounter another visitor.[52] A greater level of activity is found in Iroquois Woods, in large part due to the ongoing efforts of The Friends of Iroquois Woods to bring the woodland back to a state which will support wildlife and be perceived as inviting to residents. These restoration efforts have begun to succeed and a space where there was no light, no birds, and 'nasty' urban activities took place is today frequented by dog walkers and joggers.[53] While the end result of this history is the preservation of two Urban Wilds, it is clear from their ecological

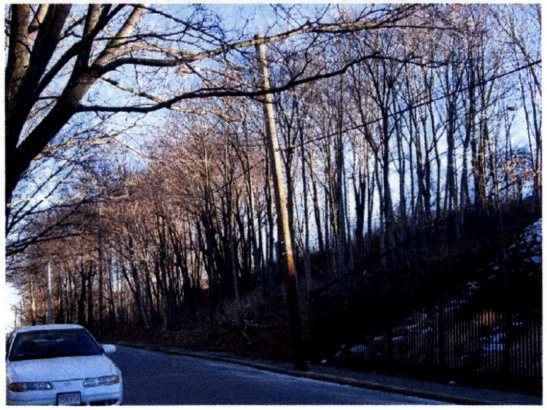
state, patterns of use, and statements made in most interviews in Mission Hill, that the desire to protect these sites from development reflects a primary desire to block any further loss of the neighborhood to institutional expansion and a secondary desire to preserve a piece of Boston's natural history.

Parker Hilltop Urban Wild and Iroquois Woods

Figure 3.16 (top left) Parker Hilltop Urban Wild from The Meadow (adjacent to McLaughlin Playground).

Figure 3.17 (bottom left) Iroquois Woods from Iroquois Street.

Figure 3.18 (right) New England Baptist Hospital beyond the parking lot built on a portion of the Parker Hilltop Urban Wild.



The history of Harvard Quarry is also one of institutional expansion, but the trajectory of this site is quite different from that of Parker Hilltop. Quarrying of Roxbury puddingstone began on Mission Hill in 1850 and continued until 1910, leaving behind an open pit and partially excavated outcropping, bordered by a residential neighborhood on three sides and a commercial street on the fourth. As its name reflects, Harvard University eventually purchased the abandoned quarry with the intention of expanding the Harvard Medical Center into the site. The community successfully blocked these expansion efforts and Harvard's main physical impact on the site was to back-fill the pit in 1964, leaving the site to develop into the ecological community described in Weaver's 1978 letter.[54] While the ecological value may have been clear to a horticulturist, to the community the Harvard Quarry was not worthy of preservation in its unmanicured state. The unmanaged open space coupled with low-quality retail on the site's lower portion to create an ideal environment for drug dealing and crime, and Mission Hill residents saw this physical remnant of an industrial past as blight.[55]

In an effort to remove these negative elements from the community, Mission Hill Neighborhood Housing Services initiated the redevelopment of the site in 1996. The resulting development is a $25 million mixed-use commercial center on the lower portion of the site and a traditional passive park on the upper portion, featuring grass and scattered trees while preserving the ledge itself and the existing trees at the park's edges.[56] The design for the Urban Wild grew out of a series of community workshops and was guided by an Open Space Committee. Through this process, community members voiced "preferences for the Upper Ledge park to retain a strong natural character that interprets natural and cultural history of Mission Hill and enhances the grand views the site affords."[57] In comparison to ball fields or a play ground, the argument can be made that the resulting Urban Wild remains close to the natural character of the site, although few of the qualities described in Weaver's 1978 letter remain and any potential for significant ecological value has been eliminated. In their choices over what social and ecological values to fight for, Mission Hill community members seem to have responded to the history of Harvard Quarry and Parker Hilltop over their worth as locations for urban interactions with nature. While it is clear Mission Hill residents prize green space, the *type* of green space desired is a stark contrast to the assumptions of the 1976 Urban Wilds report.

Urban Wilds as public space in greater Boston

To assess whether the impetus to preserve an Urban Wild from development in another part of Boston is indicative of a desire to use this space for nature-based recreation or is tied to the social history of the neighborhood, it would be necessary to assess each Urban Wild in detail. Such research is outside the scope of this thesis, but significant

Puddingstone Park

Figures 3.19 -3.22 Puddingstone Park on the site of Harvard Quarry

investments of time and energy into several Urban Wilds over the past decade suggest that the relationships between Urban Wilds and community members seen in Mission Hill may apply to greater Boston as well.

Aside from Harvard Quarry, there have been two recent examples of the conversion of former industrial sites designated as Urban Wilds into manicured parks: Condor Overlook in East Boston and Reservation Road in Hyde Park. In some ways the final design for these sites can be attributed to the fact that Reservation Road is located in Mayor Menino's neighborhood, while the landscape architect for Condor Overlook, Hargreaves Associates, was chosen and paid for by the Boston Foundation and was uninterested in simply mirroring nature following the site remediation.[58] At the same time, each site featured a community process and heavy involvement of community groups. This led to Boston's first skateboard ramp within Reservation Road Urban Wild,[59] and at Condor Overlook a striking similarity to Puddingstone Park with curvilinear paths, scattered boulders and, beyond a small wetland restoration, a distinct lack of features providing ecological value.

Condor Overlook Urban Wild

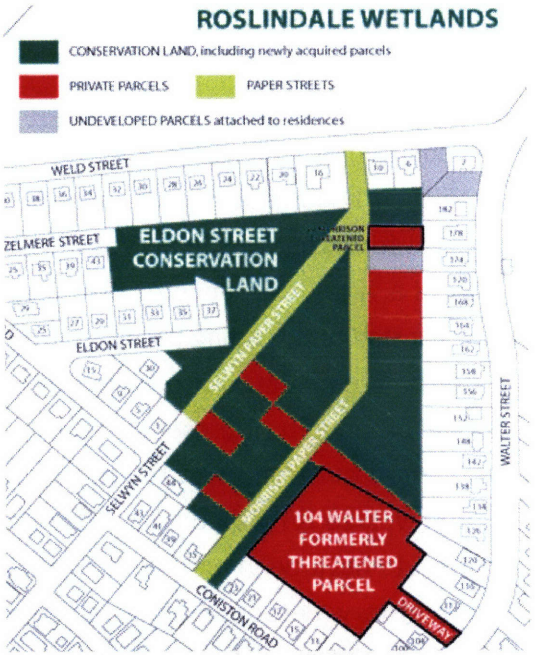
Figures 3.23 -3.25 Condor Overlook and the surrounding neighborhood, East Boston.

In contrast, the Eldon Street Urban Wild in Roslindale has been enlarged recently through the activism of the Longfellow Neighborhood Association in response to a development proposal to pave a street through the wetland and build a condominium building. Galvanized by the reminder that this wetland was not protected by public ownership, the newly formed Roslindale Wetlands Task Force went on to convince the City to transfer several tax-foreclosed wetland parcels to the Conservation Commission, bringing them under the management of the Urban Wilds Initiative.[60] While eleven wetland parcels remain in private ownership, this group has made significant progress toward preserving the wetland, altering it only to plant native species and remove rubble. These recent actions indicate the community's value of the Eldon Street wetlands, but the description of Eldon Street I Urban Wild on the Urban Wilds Initiative website, not updated regularly, paints a picture of the lack of engagement prior to the development threat:

> The area has been overrun by non-native, invasive species, especially multi-flora rose and buckthorn. At one time, a boardwalk permitted entrance into the wetter sections of the wild from Eldon Street. However, the overwhelming presence of multi-flora rose now makes this entry impossible.[61]

While the recent activities of the Roslindale Wetlands Task Force indicate that this community values the wetland, the record of the Urban Wilds Initiative website indicates that this value is not based in a long-term history of use for passive recreation.

Although the extrapolation of larger trends from these five individual sites is not an exact science, the community decisions on appropriate recreational use of these Urban Wilds indicates two things. First, when a site is perceived as blight, returning it to



Eldon Street Urban Wild

Figures 3.26 and 3.27 Map and photo from the Roslindale Wetlands Task Force web-site.

the naturalized condition necessary for ecosystem services and wildlife habitat is unlikely to be the preferred option. Remediation of a damaged site is an act of neighborhood improvement and the physical form that this improvement takes is a visual reference to the human intervention and funding poured into the site. A remediated site transformed into an urban nature preserve leaves no similar visual markers. The legacy of those involved is masked by vegetation that could have been on the site for its entire history. Responses to development threats on the other hand, elicit a desire to maintain the visual character of the neighborhood. This desire is tied to sense of place but in some cases does lead to recreational use as the residents work to restore a site they have saved from development.

From a policy perspective the most important element of this analysis is that thirty years of Urban Wilds preservation has hinged conceptually on the ability of these spaces to provide recreation, yet there is little indication that a community-based desire for this passive recreation has led to Urban Wilds preservation. An alignment of preservation strategies with the actual reasons that communities value these spaces may result in a greater ability to preserve not only the potential use of the Urban Wilds for passive recreation, but the actual ability of these sites to provide wildlife habitat and ecosystem services. In Mission Hill, expanding the base justification for conservation from recreation to quality of life would provide a justification for preserving Allegheny I and II, both small rock outcroppings too small to have significant recreational value. These sites impact quality of life both by creating a sense of place within Mission Hill and, in the case of Allegheny II, providing a pathway that allows residents to cut across a steep hill they would otherwise be required to climb up to move across. The contradiction between the stated value for passive recreation and the range of actual reasons Bostonians value particular Urban Wilds indicates that in other cities, it may be preferable to create an interagency management team to address public space, ecological values, and quality of life equally, as appropriate to individual sites.

Conclusion: A whole greater than the sum of its parts

Although not every site provides ecological and social value to an equal degree, today the Urban Wilds are not managed to give preference to any one value. This has provided a testing ground for the conflicts that exist when working toward multiple goals on one site. The greatest conflict seen in the Boston Urban Wilds is between threats to personal safety (perceived and actual) and meeting wildlife habitat and stormwater goals through shrubs as groundcover. In the past, enthusiastic volunteers have inadvertently created ideal locations for illegal behavior out of the public

eye at Parker Hilltop and Nira Rock (in Jamaica Plain) through restoration work guided by shrub and tree clusters found in rural woodlands. In both cases, these Wilds are stewarded by the Urban Wilds Initiative, and the Initiative Coordinator stepped in to balance ecologically ideal vegetation patterns with the need to discourage illegal activity in these public spaces.[62] Although this process does result in limiting the sites' ability to provide ecological values, having a coordinator in place to consider both sides of the equation seems to be an important factor in preserving the ability of an Urban Wild to absorb air pollution and runoff without encouraging illicit behavior.

Fortunately, the perception that wild space might attract criminal activity is more prevalent in Boston than crime in Urban Wilds. While a lack of crime is clearly positive, the perception of its potential does pose a challenge to the broad based community support necessary to sustain individual Urban Wilds. By addressing the interface between a Wild and the adjacent street, relatively small design interventions shift the perception of an Urban Wild from simply a vacant lot to a green space someone cares for. In Mission Hill, examples of such an intervention exist at Iroquois Woods and at the Garden of Art, a community-stewarded open space with semi-wild vegetation. The paths created by the Friends of Iroquois Woods provide a physical marker of their restoration work in the form of branches, stones, and concrete chunks lining the paths. Even when no one is present in Iroquois Woods, it is clear to the passer-by that the surrounding community both loves and watches over this small space. The Garden of Art has addressed the border between the sidewalk and the site with a wooden fence cheerfully painted by neighborhood children and local art students. Visually defining a Wild as a cared for space does not need to be as work intensive as hand painting a fence or creating paths, but could be as simple as keeping plants low and manicured directly adjacent to the sidewalk. These relatively simple steps create the physical impression of site maintenance and reduce the perceived threat of the Wild, while allowing the core of the site to fully meet its wildlife habitat and ecosystem service goals. A city or town considering the Urban Wilds model must be able to support this level of attention to the intersection of the Wild and the surrounding neighborhood. If such maintenance is not possible, neighbors will perceive some Wilds negatively while other Wilds will be well tended by Friends Groups and unthreatening to the surrounding community, as in Boston today.

For a city or town considering a green infrastructure system made up of existing open spaces, assessing the potentials and limitations of the Urban Wilds model in comparison to other alternatives will also be an important factor determining if distributed wild sites can provide the

Figure 3.28 (above) Pathway into Iroquois Woods

Figure 3.29 (below) Painted fence at the Garden of Art

desired environmental goal or outcome. This goal might range from solving a specific environmental problem, such as flooding or a high level of particulate in the air, to simply providing open space with added environmental benefits. The analysis of the Boston Urban Wilds indicates that the Urban Wilds model is better matched to some goals than others. The varied performance of individual sites in providing ecosystem services indicates that a city seeking to *alleviate* an environmental issue could look to existing open land as one part of a broader strategy. On the other hand, a community needing a *solution* to an environmental issue will need to couple conservation-based infrastructure with constructed green infrastructure.

The specific qualities of communities where the Urban Wilds model may be appropriate can be understood through the comparison of the Boston Urban Wilds to the remaining challenges facing urban green infrastructure (discussed

in Chapter 1). The qualitative and non-technical designation of the Urban Wilds remains sufficient even as much more sophisticated GIS- based alternatives are available, in part due to the nature of urban land. In urban areas, few habitat patches are large enough that characteristics such as core habitat and geometry of the patch edge have a major impact on their quality as habitat. Without a complex network of characteristics to analyze, GIS is not necessary to indicate where the best habitat patches are located. While a scientifically rigorous classification process will improve the political defensibility of the designated spaces in the long term, it may be more important to engage a broad community in the designation process and begin building support for conservation. Community participation in the designation process could incorporate technical sophistication, but does not require it. Not requiring sophisticated GIS abilities to implement, the Urban Wilds model is relevant to towns and cities that do not have the capacity to implement the type of analysis seen in the Maryland Green Infrastructure Assessment.

Urban green infrastructure that doubles as public space is feasible, but challenging. Trade-offs will be required in ecosystem services and wildlife habitat to create viable public spaces because public will to protect these spaces cannot develop unless the open space meets some portion of the surrounding community's recreational needs and are perceived as safe. In some communities, the recreational need is simply for a hospitable space to sit in the shade or take a walk, while in others, the need is for space for habitat gardening, as seen in Mission Hill's more actively used Urban Wilds.

The presence of a Friends Group positively influences the ability of wild space to function as public space in an urban neighborhood, yet many neighborhoods in Boston have not generated volunteer Friends Groups. For this reason, the Urban Wilds model is more appropriate in communities with a strong volunteer tradition already in place or the capacity to provide a high level of organizing support to form and nurture Friends Groups. Beyond volunteer Friends Groups, management is also an important element of wild space's viability as public space. A city not prepared to attend to the details such as site lines through vegetation, clear pathways and signage should not expect wild spaces to be widely used by community members simply because they are accessible to the public.

Finally, the question remains of a set of scattered sites' ability to act as an infrastructure system, with an impact greater than the sum of their parts. Unlike a system of sewer pipes or highways, when one portion of the Urban Wilds network is removed the services provided to Boston do not come

to a crisis level. The gains from the Urban Wilds add up to their larger total but as Urban Wilds are lost, this total decreases gradually, even imperceptibly to the casual observer. To truly act as infrastructure by providing ecosystem services, the Urban Wilds must be considered part of the larger, traditional infrastructure by the agencies and individuals who manage these systems. Stormwater must first be allowed to flow into the Wilds before the potential to absorb runoff can be realized. Before the trees in the Urban Wilds can be managed or even fully understood as a system supporting wildlife or ameliorating air pollution, they must be viewed as a subset of the larger urban forest, which includes trees in parks, yards and along streets. In Boston, the Urban Wilds are considered to be islands, conceptually linked but without a physical connection to the larger systems of the city. As islands of natural vegetation, the Urban Wilds network is not currently able to act systematically to provide ecosystem services, but this situation can be altered by a shift in perception, together with steps like allowing stormwater to flow into the Wilds. To truly act as infrastructure, urban land conservation must be coupled with constructed green infrastructure with the capacity to capture a greater volume of stormwater, such as bioswales or sand filters. This combination would maintain the two greatest values preserved through urban land conservation, wildlife habitat and public space, while expanding the model's weakest value, ecosystem services.

By removing the Urban Wilds from the real estate market, the process of urban land conservation has reserved the option to improve the ability of these sites to fully meet their potential to provide ecological and social value greater than the sum of its parts. Although not meeting its potential today, the Urban Wilds are permanently protected from development and are an untapped resource found in few other cities. To preserve this resource, the concept of a network of spaces has been crucial. If the Urban Wilds had no name and were simply isolated parcels of land spread throughout the city, most if not all of these sites would be lost to development today, as discussed further in the following chapter. The conceptual link between disparate places created by the 1976 report has perhaps done the most to allow the Urban Wilds to be greater than the sum of its parts. While the ability of these spaces to act as infrastructure can expand over time, preservation from development is the vital first step in this process. For its ability to spur urban land conservation alone, the Urban Wilds model is worthy of consideration by other cities and towns.

Chapter 4
Preserving Urban Wilds: Lessons from Boston

As implied by its name, the goal of *Boston Urban Wilds: A Natural Area Conservation Program* was not only to identify the Urban Wilds and place them in the public eye but to be the first step in a *program* to systematically remove these sites from the real estate market. While the report did not lead to this outcome within the Boston Redevelopment Authority, it did lead to a wide range of tools used over the following thirty years of Urban Wilds preservation. Although these tools do not add up to a singular program, their broad nature is a key component of the Urban Wilds green infrastructure model. Different organizations have employed different strategies over time, which each have had a varied impact on the ability of individual Urban Wilds to meet the goals of providing public space, ecosystem services, and wildlife habitat. The following analysis assesses each strategy individually and seeks to determine how these tools have harmed or aided the ability of preservation to meet the underlying goals of the Urban Wilds concept.

Fee-simple purchase

One of the earliest strategies used in Urban Wilds preservation was fee-simple purchase from private landowners. Beginning in 1978, the Boston Natural Areas Fund purchased the first six permanently protected Urban Wilds, and these fifty acres of open space were then transferred to the Boston Conservation Commission. Eighty percent of the funding for these purchases came from state and federal sources.[1] The Metropolitan District Commission (now the Department of Conservation and Recreation) also began purchasing Urban Wilds during this period, focusing on the largest and most ecologically significant sites.[2] This early phase of outright purchase of Urban Wilds could not be sustained over the long term, largely due to shifts in funding availability, but this tool was crucial to establishing the

validity of the Urban Wilds as spaces worthy of preservation. The immediate and aggressive preservation of Urban Wilds by two levels of government was a tangible affirmation of the values voiced in the 1976 Urban Wilds report.

As a tool, fee-simple purchase does not directly impact the ability of an Urban Wild to address any specific ecological or social values. Before the Parks Department took over the role of management, the transfer of Urban Wilds to the Boston Conservation Commission ultimately led to an inability to address any of these values, but this problem was tied to the initial lack of consideration of long-term stewardship. As its name highlights, fee-simple purchase is in fact fairly simple to accomplish when funds are available, and offers an easy way to not only begin protecting a green infrastructure network, but to rapidly lay the groundwork for the more complex tools that may be necessary in the future.

Transfer between agencies

The second tool which was used in both the early and later phase of Urban Wilds preservation was the transfer of Urban Wilds from government agencies without preservation or conservation in their mission to agencies better able to preserve the Urban Wilds as open space. Initially, a few Urban Wilds were transferred to the Conservation Commission, and more recently the Urban Wilds Initiative has begun to aggressively seek the transfer of the remaining Urban Wilds owned by City of Boston agencies to the Parks Department. This strategy is somewhat more complex than fee-simple purchase, as agencies with a mission to develop property are typically not inclined to relinquish land. Early advocacy on the part of the Conservation Commission was successful in encouraging the transfer of tax-foreclosed properties, while more recent advocacy by the Urban Wilds Initiative has led to successful negotiations with development-based agencies, such the Department of Neighborhood Development. A few notable exceptions do remain in the hands of non-conservation oriented agencies and seem likely to remain so, such as the 152-acre Wood Island Bay Marsh, owned by Massachusetts Port Authority (MassPort). Wood Island Bay Marsh is a small fragment of Wood Island Park, which was destroyed with the expansion of the Logan Airport.[3] This particular case illustrates that while some properties owned by government agencies may be a strong source of green infrastructure, if a property selected for the network is considered central to the mission of the agency that owns it, the chances of transfer are slim. Also significant is the fact that, while not every Urban Wild owned by a government agency has come under permanent protection, no government-owned Urban Wild has been lost to development.

Zoning regulation

Zoning regulation, the second major tool used by the city of Boston to push preservation of the Urban Wilds, has not had a similarly positive impact on the fate of the privately owned parcels. Two new zoning designations were created in the mid-1980s which, in theory, provided a tool to better preserve the Urban Wilds, but the legacy of these tools is not particularly positive. Within the new set of Open Space (OS) designations, an Open Space-Urban Wild designation was created that on the surface appears to provide protection for a property zoned as OS-UW. Due to the fact that such a designation strips any ability to make an economic gain by developing the parcel, this zoning designation can only be applied with the agreement of the owner. A second designation created in the mid-80s, the Conservation Protection Sub-District, is intended to more broadly preserve the aesthetic character created by the Urban Wilds, but not their ability to provide public space, ecosystem services, or habitat. However well intentioned, this designation in fact simply limits the development density on the site to levels lower than the surrounding community, while giving the residents authority to challenge development proposals on aesthetic grounds through the required public review process. The development of married seminarian housing at Hellenic Hill, an Urban Wild owned by Hellenic College adjacent to Jamaica Pond, provides an example of the values protected by the Conservation Protection Subdistrict, as described in a Boston Natural Areas Fund 1994 newsletter:

> Neighborhood residents...expressed concerns to the BRA that the proposed development would sully the views from the Jamaica Pond Boathouse and surrounding vantage points. New zoning laws were passed in September that call Helenic Hill a Conservation Protection Subdistrict and state that any development on the hill must be 'sensitive'. As a result, Hellenic College has entered into dialogue with [community groups] to develop plans that will address the concerns of all those involved while maintaining the natural beauty of the hill. The original building proposal as been reworked to ensure that the buildings will not be visible from the pond and to ensure that additional trees will be planted and cared for. Balloon tests were conducted in November to determine whether the buildings would in fact be 'invisible.'

While neighborhood residents may have also been concerned about this building in the center of the Urban Wild impacting wildlife habitat or increasing runoff in the pond, the Conservation Protection Subdistrict does not empower community members to raise these issues and does not allow the Boston Redevelopment Authority to base their decision on them.

A second problematic element of these zoning designations is the fact that the Open Space Urban Wild designation and Conservation Protection Subdistrict down-zone the properties which they are applied to, thereby lowering their

value as real estate. This reduction in real estate value then limits the ability to employ one of the most common conservation tools in the larger land preservation movement: partial or complete property easement donations in return for tax benefits to a private landowner. Few Urban Wilds have been preserved through this mechanism, in large part because no organization has been established to set-up the organizational infrastructure necessary to take full advantage of this tool in Boston. In other communities, establishing an urban land trust offers a very strong option for preserving green infrastructure, but it will be necessary to ensure that zoning is aligned with this strategy, rather than in opposition to it as in Boston.

Negotiation

In the case of many private Urban Wilds, a development proposal has sparked a negotiation of some sort involving the Boston Natural Areas Fund, community residents, and an assortment of Boston agencies. In eleven cases, this negotiation process has resulted in a portion of the Urban Wild entering permanent protection, while another segment of the Wild was developed. Most of these cases resulted in the permanent protection of Urban Wilds over ten acres in area and can be considered strong successes, but the history of negotiations which do not result in actual land preservation is not as positive. Because many community members appreciate the Urban Wilds for their aesthetic qualities alone, they become engaged in preserving a Wild only after a development has been proposed. At this point, if the owner does not want to preserve a portion of the site, the only option available through negotiation is to limit the intensity of development by attempting in some way to retain the aesthetic qualities of the Urban Wild without the Urban Wild itself. The extended negotiation over St. Sebastians's Urban Wild in Allston-Brighton demonstrates the trade-offs involved in this type of negotiation, resulting ultimately not only in the loss of an Urban Wild but in the potential to retain any public value in the development itself. As described by Rafael Mandelman, in his Kennedy School of Government a policy analysis paper on the Urban Wilds written in 1999,

> Developers had been proposing projects for the St. Sebastian's property for years. In the early eighties, the neighborhood had successfully fought off a developer's proposal to build eight 20-story buildings, a total of 1500 units, on the site. In the late eighties, a new developer, the Green Company, proposed a somewhat smaller building program of eight story and four story apartments and a few townhouses. Again, the neighborhood fought off the proposal. In the nineties, however, the Green Company proposed building 46 single family houses on the site. By then however, Allston-Brighton's PZAC had designated St. Sebastians's a [Conservation Protection Subdistrict], which lowered the allowed density on the St. Sebastian's property from 46 single-family homes to 27

single-family homes. The BRA was apparently inclined to recommend granting the developer a variance to allow the project to proceed, but the neighborhood secured a mayoral intervention. Ultimately, the neighborhood and developer negotiated a plan for development of ten single family luxury homes at the center of the site, with a 30-foot conservation restriction around the development to protect wooded areas. Through the neighborhood lost the fight to save the Wild, their aggressive use of the CPS leverage allowed them to help shape the size and structure of the project.[4]

During this same time period, housing prices in Boston increased by 234%, compared to a national increase of 112%. Today, nearly a quarter of Bostonians pay more than 50% of their income for housing, while half of the population pays more than 30% of their income for housing.[5] While the original proposal of 1,500 apartments was clearly in excess of what this 6.5 acre site could reasonably absorb, the eventual negotiation down to ten houses designed to sell for the highest possible price did nothing to alleviate Boston's housing crisis, yet eliminated all other public values the site once held.

Allston-Brighton provides a second example of the power of the Urban Wild designation to aid neighbors in blocking developments that address important, but unpopular, planning goals. Again as described by Mandleman, the neighborhood "succeeded in killing a recent proposal to develop twenty to thirty units of housing for low-income, unwed, teen mothers on the three-acre Crittendon Hospital Urban Wild. A series of community meetings, one of which drew as many as 300 neighbors, a letter-writing campaign, and ultimately the opposition of the Mayor, doomed the project."[6] It is interesting to note that if this Urban Wild were a public park, redevelopment would be required to provide the same level of public benefit found in the park, such as a home for teen mothers or a school, and the proposal that the neighborhood blocked would be one of the only legal options for the redevelopment. The privately owned Urban Wilds in Boston seem doomed to the opposite fate if owned by an individual determined to develop their land, as neighbors are able to leverage Urban Wilds status to give credence to what may be nothing more than NIMBY reactions to development. If the Urban Wilds are truly valuable to an area larger than just the surrounding neighbors, it is not unreasonable to expect some public good to be maintained when these sites are developed, yet in Boston both zoning and patterns of advocacy have encouraged development proposals that both eliminate the Urban Wild and offer nothing to the wider community in return.

The Urban Wilds list

Although it was not the intention of *Boston Urban Wilds: A Natural Areas Conservation Program*, the list of Urban Wilds itself also became a preservation

tool immediately following the 1976 publication. Although it is difficult to truly verify today, based on the fact that the research leading to the Urban Wilds designation took two years and the work of multiple BRA staff members, it seems likely that the list included virtually all of the sites meeting the Urban Wilds definition established at that time.[7] While the original definition of the Urban Wilds was fairly broad, ranging from a woodland that remained uncut through Boston's development to a large traffic circle with several specimen trees, what exactly an Urban Wild is became even more unclear as time went on. As the physical development in the city shifted, new spaces that met the definition of an Urban Wild emerged, but no organization had the resources to comprehensively resurvey these spaces. As a result, they have remained outside of the Urban Wilds network, but in the public eye. Today, the Boston Natural Areas Fund, the City of Boston Urban Wilds Initiative, and the Massachusetts Department of Conservation and Recreation (once the Metropolitan District Commission) have different definitions of what an Urban Wild is, leading to confusion on the part of community members over how the Urban Wilds fit into their efforts to conserve open space. While the designation as an Urban Wild was originally a strong preservation tool in itself, its power has eroded through this confusion over the definition, along with the failure of the list to fully take into account the natural resources of the city today.

In reaction to this situation, the Boston Natural Areas Fund and the Urban Wilds Initiative have taken two different approaches to the continued use of the original list as a preservation tool. BNAF sees the Urban Wilds as a fading tool because in the near future all the designated Urban Wilds will either be under either some form of preservation or will be developed.[8] BNAF works to protect many more green spaces than are found on the 1976 list and in the words of on Mission Hill resident, their strategy can be seen as using the Urban Wild designation as a "card to pull out of your pocket"[9] when it will aid a community that has approached the organization for help. The BPRD Urban Wilds Initiative on the other hand, has sought to create a more rigorous structure for what spaces might be considered Urban Wilds. These spaces come into the Initiative's management under the term Natural Areas, meaning areas not found on the 1976 list but meeting the Parks Department's interpretation of what could be included on the list today. A point system contained in the unpublished *Urban Wilds and Natural Areas Management Plan* guides the work of the Urban Wilds Initiative to bring new properties into Parks Department management under the Natural Area designation. The energies of the Coordinator are directed toward high-scoring Urban Wilds and Natural Areas based on characteristics ranging from

percentage of native species to area of edge habitat to presence of trash and graffiti on the site.[10] These two methods of using Urban Wilds list as a preservation tool have a split impact on habitat preservation, ecosystem services and public space. In the case of the Urban Wilds Initiative, the expansion of the Urban Wilds list in concept but not in name has the impact of supporting social and ecological values while preventing the Initiative from utilizing the power of the Urban Wild designation as an advocacy tool. The Boston Natural Areas Fund, on the other hand, has not backed away from employing the power of Urban Wilds designation, but their lack of interest in expanding the list has served to diminish the power of this tool as the single point in time captured by the 1976 list fades further into Boston's history.

Urban Wilds Preservation in Mission Hill

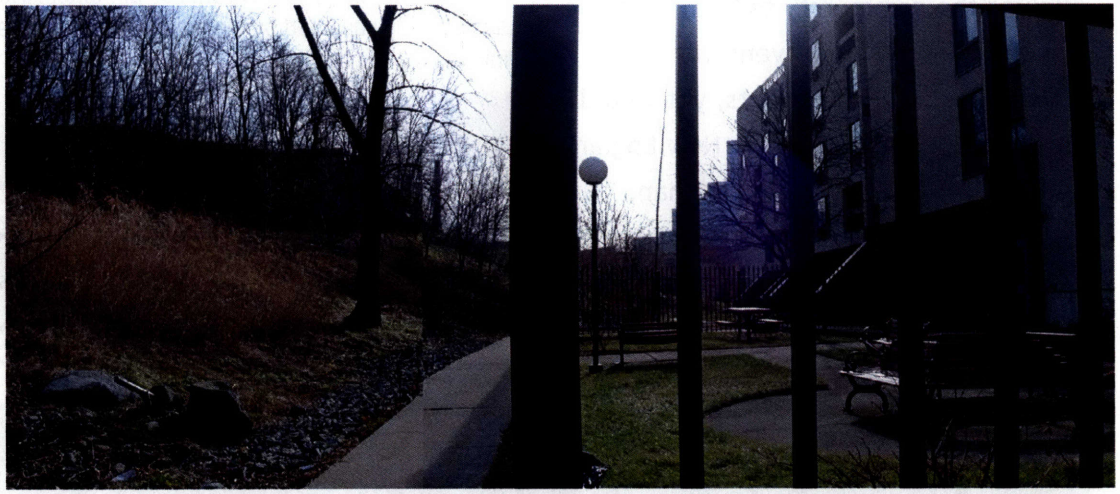
Mission Hill provides a window into the use of these conservation tools a within the context of a small neighborhood. Of Mission Hill's six Urban Wilds designated in 1976, only Judge Street has been lost to development. Allegheny I and II remain undeveloped but still unprotected from development, Parker Hilltop, Harvard Quarry, and Back of the Hill are permanently preserved as open space, and Iroquois Woods has joined the Urban Wilds as a Natural Area supported by the Urban Wilds Initiative and protected from development for forty-years through a conservation easement. While fairly dense, Mission Hill does still have a number of small naturally vegetated open spaces. One of these was transformed into the Garden of Art by community residents eight years ago, but no form of conservation restriction protects it from future development. The proximity of these spaces to each other highlights the need for a range of strategies to achieve preservation even in the context of the same neighborhood.

Both Parker Hilltop and Back of the Hill are the result of a compromise between the one party's desire to develop an Urban Wild and the broader community desire for conservation. In both cases, the result was development on one portion of the site in return for the permanent protection of the remainder. At Back of the Hill, the apartment building constructed in the Urban Wild was one of the first structures built in the area devastated by the Lehey Clinic urban renewal disaster (discussed in Chapter 3) and it is difficult to criticize this clearly important development. Nonetheless, this development is an example of the danger in conservation for conservation's sake, with the needs of functional public space not incorporated into the final site plan. The apartment building was located in the flat portion of the site, covered in loose fill by the 1970s but once a series of small ponds.[11]

Back of the Hill Urban Wild

Figure 4.1 (top) By placing a fence between the official public space of the building and the Back of the Hill, adjacent development discourages residents from using the Wild as public space.

Figure 4.2 (bottom) The parking lot and retaining wall design creates the impression that Back of the Hill is simply a private parcel adjacent to the apartment building.



The hillside brought into permanent protection is too steep to provide accessible public space, although it is fully forested and is therefore providing both wildlife habitat and a comparatively high level of stormwater and air pollution absorption.

Skewed more clearly toward a land use beneficial to only the immediately adjacent residents in return for the loss of a Wild, the negotiation over Parker Hilltop resulted in preservation of 1.5 of four total acres in return for a parking lot. The neighbors found this use desirable because it will attract fewer cars than the buildings and parking garage originally proposed on the site, yet the parking lot offers no social benefit in return for the loss of two-thirds of the Wild. The Iroquois Wood conservation easement did result from this process, but this disconnected site that was once used by the hospital for a dump in no way replicates a continuous four acre site. A second problematic element of this negotiation is the almost inevitable future conversion of the

parking lot to buildings similar to those blocked by the neighbors in exchange of a portion of the Wild. While only time will tell, it seems likely that the New England Baptist Hospital has leveraged the Urban Wild designation to create the appearance of preservation while laying the groundwork for future development without the roadblock of a natural area.

Though development is the lifeblood of a city, it is rare that it must take place in a fixed location on a specific parcel. In the case of Back of the Hill, it can be argued that due to the larger social and economic context, development on this parcel was crucial, yet slight alterations to the site plan could have created accessible public space and preserved segments of both the woodland and the wetland. Incorporating values more nuanced than preservation alone into the negotiation process will be necessary to achieve the preservation of social and ecological values on other sites in Boston today. Parker Hilltop required not a stronger negotiation strategy but stronger regulatory tools to give the New England Baptist Hospital an incentive to leave the full hilltop as a natural area. Here, a transfer of development rights to the lower portion of Mission Hill would have allowed the community to both preserve the open space and prevent increased traffic on residential streets, yet would have provided an option for New England Baptist equal to, if not better than, developing Parker Hilltop. Negotiations that compromise social, ecological, and development value could be avoided

Parker Hilltop Urban Wild

Figure 4.3 (top) The parking lot on a portion of Parker Hilltop Urban Wild that resulted from a negotiation to block the construction of two buildings and a parking garage.

Figure 4.4 (bottom) The experience of Parker Hilltop is negatively impacted by the adjacent six-foot chain link fence and parking lot.

though strong regulatory tools that give property owners a financially equivalent method of choosing land conservation.

In both the cases of Parker Hilltop and Back of the Hill, without designation as an Urban Wild it is likely that the community had too little justification to even begin these negotiations, highlighting designation as an important tool in its own right. Unfortunately, as discussed above, the power of this designation is slowly eroding through the evolution of the city around the 1976 list and the blurring of the definition of an Urban Wild. Mission Hill provides two examples of this challenge. The conversion of Harvard Quarry into Puddingstone Park replaced the vast majority of the site's 'wild' space with a traditionally planted and manicured park, yet the Boston Natural Areas Fund's *2006 Urban Wilds Report* will list the space as an Urban Wild.[12] While the Puddingstone Park has preserved the social value of Harvard Quarry, it has not preserved Harvard Quarry's ecological values. The continued designation of Puddingstone Park as an Urban Wild is an example of the expanding definition, that makes it very unclear what differentiates an Urban Wild from other forms of open space. If an Urban Wild is no different from any other open space in Boston, the power of the designation as a preservation tool is lost.

The Garden of Art provides an example of the challenge faced by a naturally vegetated area not listed as an Urban Wild in 1976, but meeting the definition today. Owned by the Department of Neighborhood Development, the Garden of Art was slated for development as artist housing in the late 1980s. The site remains undeveloped today due to a failed design process followed by a recession, and finally a letter writing campaign to gain permission to turn the site into a park. Working with the Massachusetts College of Art, Wentworth Institute of Technology, neighbors and local children, the Little Brothers of St. Francis have filled the park with art, but the site's landscape remains relatively wild.[13] Meeting the original definition of an Urban Wild to a much greater degree than Puddingstone Park, the Garden of Art offers both the social and ecological values of an Urban Wild. Sadly, this space has no form of permanent protection. As the 1976 list has not been expanded to incorporate parcels that were omitted or emerged after this year, the Garden of Art's fate will be decided purely on its merits as an isolated park, rather than its value as a portion of the larger system formed by the Urban Wilds. This situation indirectly decreases the power of Urban Wild designation, as it underscores the fact that through the evolution of Boston over the past three decades, Urban Wilds designation has become an increasingly poor indication of a site's true importance within Boston's open space network.

In contrast, Iroquois Woods demonstrates

The Garden of Art

Figure 4.5 (top left) The Garden of Art is one of only two patches of trees on Parker Street.

Figure 4.6 (top right) Gazebo built by Wentworth Institute of Technology students.

Figure 4.7 (bottom) Chairs and benches painted by the Massachusetts College of Art students and neighborhood children.

the importance of the Urban Wild Initiative's decision to support properties beyond the 1976 list. Emerging from the same negotiation as Parker Hilltop, Iroquois Woods is a one-acre sliver of woodland. While other Urban Wilds in Mission Hill provide either social or ecological benefits, Iroquois Woods provides both values, even acting as a place for active recreation in the form of volunteer restoration, the natural area parallel to community gardening. The Friends of Iroquois Woods have utilized the space's support by the Initiative to attain grant funding for ongoing restoration work. Using their connection to the Urban Wilds as a preservation tool, the Friends of Iroquois Woods plan to further leverage the site's connection to the Parks Department while advocating for a permanent conservation restriction on the site. More than just an attempt to improve the ecology of the site, the restoration work aims to transform Iroquois Woods into an integrated and well-loved element of the neighborhood's open space network, building community support for the eventual battle to make the conservation easement permanent. In the words of Dennis Pultinas, a major force behind the restoration efforts, the goal is to make the statement to the New England Baptist Hospital that, "if the city acknowledges that this site is important, as Baptist Hospital you also have to acknowledge this."[14] While the results of this effort are yet to be seen, Iroquois Woods provides one of the best examples in Boston of the ability of Urban Wilds designation to galvanize residents to improve both the ecological and social value of a site, and to use designation as a powerful conservation tool.

Beyond the success of Iroquois Woods, Mission Hill's Urban Wild conservation history most clearly illustrates the challenges faced in preserving social and ecological values through negotiation, and the need for stronger incentives for effective conservation of private property. As the balancing act between development and open space will be a feature of any similar Urban Wild system, these regulatory tools should be a primary focus of advocates beginning the conservation process. To put these regulatory tools in place, it may be possible to capitalize on the early excitement that an Urban Wilds program is likely to generate. In Boston, this early excitement was leveraged to rapidly preserve the first sites. In other communities, it may be a reasonable trade-off to focus somewhat less energy on preservation of individual parcels while laying the groundwork for future preservation by advocating for the necessary regulatory tools.

Chapter 5
Urban Wilds in Other Places: recommendations for other cities and towns

Although other forms of green infrastructure have emerged since the Boston Urban Wilds were identified, the advantages of this relatively simple model still provide a strong option for cities with remaining open spaces and limited funding to pursue the technical and capital intensive work of constructing green infrastructure. Drawn from the three decades of the Boston Urban Wilds evolution, the following recommendations provide a framework for other cites and towns considering the Urban Wilds model.

Designation Recommendations

The initial act of designating the spaces now considered Urban Wilds was the single most important step taken toward preserving the ecological and social values of these spaces. Definition as an Urban Wild conceptually links scattered sites and lays the groundwork for community support for conservation. The intention of the Designation Recommendations is to leverage the power of the act of naming a space an Urban Wild and thereby create the conditions for preservation efforts sustained over decades.

Define explicitly the types of spaces that make up the network.
In the case of the Boston Urban Wilds, definition was problematic from conception due to the use of the word 'wild,' a word generally understood to have a connection to wilderness and nature without human intervention. This term was confusing when applied to both cultivated and genuinely wild open spaces and the exact definition of an Urban Wild became more confusing as each group engaged in preserving these spaces interpreted the definition differently. This reinterpretation of the initially broad definition has diluted the power of the Urban Wild designation to convey to the general public that a given parcel of land is special for specific reasons and should therefore be preserved. A carefully crafted definition will allow easy communication of a designated space's unique ecological and social values in comparison to other types of open space.

Think in terms of ecological systems rather than isolated green patches.
While the Boston Urban Wilds designation process considered ecological systems as elements of these sites' value, the connections between the elements of this system and the Boston's larger urban ecology were not considered rigorously. Thinking in terms of ecological connections will help to prioritize the spatial distribution of individual sites. For example, small sites may be ideal stepping-stones between existing parks in one part of a city while in another, a large wild might be necessary to achieve a similar level of species diversity.

Build an assessment of the attainable social and ecological values at each site into the initial designation.
It is difficult to simultaneously provide wildlife habitat, ecosystem services, and recreation and on some sites, it is impossible. In Boston, variation in soils and slope renders some areas of the city more appropriate for green infrastructure that addresses water issues, while the proximity to larger open spaces, such as the Arnold Arboretum, makes other portions of the city ideal locations for successful wildlife habitat. Social characteristics of the surrounding neighborhood may be incompatible with some ecological goals. For example, the goal of maximizing wildlife habitat may conflict with the needs of a neighborhood

with high crime or no space for active recreation. Assessing the potential of a given site to meet one or more broad goals will facilitate management decisions that augment the inherent capability of individual sites. Clearly stating this goal will also encourage the best match between the particular site and the agency responsible for its conservation and stewardship. In Boston, this step would direct sites appropriate for recreation to the Parks Department, sites appropriate only as infrastructure and wildlife habitat (such as Back of the Hill) to the Environment Department, and sites valuable for their contribution to quality of life to the Boston Redevelopment Authority.

Create a mechanism to expand the initial list over time.

The Boston Urban Wilds experience indicates that a fixed list of spaces that make up the system cannot respond to the evolution of the city around these spaces, and thus gradually weakens designation as a preservation tool. As seen in Boston, it may not be possible to comprehensively resurvey the city in the future, so a method is needed to designate additional properties individually and over time. The specific method could be a simple statement in the original planning document that spaces meeting an established definition will be added to the list or could more proactively use community members' knowledge of their neighborhoods to recommend additions to the network on a regular basis.

Preservation Recommendations

After Urban Wilds are defined and designated, the hard work of preservation begins. This process evolves over decades and each individual conservation decision impacts the opportunities and community support for future conservation. The Preservation Recommendations aim to maintain Urban Wilds conservation over time through strategic preservation decisions at individual sites.

Preserve only spaces that fully meet the initial definition.

As a preservation program is established, there will be temptation to meet community desires for a wide variety of open spaces through the funding and program created to preserve Wilds specifically. While such open spaces may be valuable and worthy of preservation, achieving this goal through an Urban Wilds program will cause problems for preservation in the future. Close attention to a rigorous definition may require turning down opportunities to

preserve open spaces that do not fully meet the established definition.

Employ preservation tools that provide an incentive for private property owners to choose conservation.

A major challenge for Boston has been the lack of preservation methods that allow Urban Wilds to be removed from the real estate market without outright purchase. When purchase is not possible, several methods could be employed to avoid the situation typically seen in Boston, where attempting to limit the extent of development is the only option. An urban land trust could work with property owners in advance of development proposals, using the tax advantages of easement donation and purchase to preserve the network at a much lower cost by avoiding the outright purchase of land. A city agency could aggressively seek conservation easements in the same manner. From the point of view of land use regulation, a mechanism to transfer development rights from parcels in the network to more appropriate locations would not only allow more land preservation, but would eliminate the tendency of open space preservation to limit other important planning goals, such as the creation of affordable housing or social services.

Choose conservation opportunities strategically to better meet ecological goals.

It is likely to take decades to create a network of Urban Wilds functioning as ecological infrastructure across an entire city, but the strategic direction of conservation efforts will allow local connections between Wilds to develop long before the larger system is in place. After designating the initial list of Wilds, it will be necessary to strategize about where to focus conservation energy. While the inclination may be to choose conservation options based on the inherent qualities of a site in isolation, a continual focus on the connections to other sites that have already been preserved will increase the benefits of individual sites. For example, this strategy might focus conservation efforts on several small sites that could act as stepping-stones for wildlife in lieu of working toward preserving a single, but physically isolated, large site.

Seek opportunities to improve the existing open space network.

In communities where the need for active recreation has not been met, an Urban Wild may not be perceived as a welcome addition to the open space network. The ecological goals addressed on particular sites can be combined with passive recreation, but perhaps only after the desire for active recreation has been fulfilled. Active recreation is compatible with green infrastructure addressing water quality, but it is not compatible with ecosystem services relying heavily on trees or with the preservation of wildlife habitat. Addressing these conflicts will allow conservation work to be met with support from community

members, rather than anger from soccer players and dog walkers.

Leverage initial excitement about the idea of preserving green infrastructure to create the conditions for long-term conservation at a slower pace.
By moving the concept from the page of an attractive study to a permanent part of Boston's open space network, the immediate and aggressive Urban Wilds preservation capitalized on initial excitement about the broad concept and laid the foundation for later preservation. In large part because the idea had become a physical reality, this early conservation success allowed the Urban Wilds to be incorporated into later planning documents, which led, in turn, to more recent conservation efforts. The initial interest in the idea of urban conservation could also be leveraged to put strong regulatory tools in place in advance of negotiations over the private property designated as an Urban Wild.

Consider constructed green infrastructure as a part of the system.
In combination with conservation, the strategic use of constructed green infrastructure will allow an approach similar to the Urban Wilds to have a greater impact on ecological values, yet maintain the public space and habitat values constructed green infrastructure struggles to achieve. It will be necessary to incorporate constructed green infrastructure into the initial definition, if it is a possible future addition to the system.

Create a partnership between the City and a non-profit to ensure continued advocacy over time.
Crucial to the Boston Urban Wilds continued success has been its ongoing relationship to government agencies. The fact that the original report was published by the Boston Redevelopment Authority and Wilds immediately and rapidly came under City ownership cemented this relationship, and validated the concept in a way that designation and conservation only by a non-profit organization could not. At the same time, the role of the Boston Natural Areas Fund has been to fill the gaps in advocacy by the City, keeping preservation alive in several instances. BNAF's formation immediately following the publication of *Boston Urban Wilds: A Natural Area Conservation Program* was a major factor in the initial Wilds preservation and the organization was again crucial to preserving the idea of the Wilds in the 1980s, when the City of Boston had essentially forgotten their importance. The combined impact of advocates inside and outside the city government has been to provide a level of conservation success that would not have been possible with only one of the two types of organization.

Stewardship Recommendations

Conservation protects a Wild from development, but it is stewardship that allows this space to meet its potential ecological and social value. The Stewardship Recommendations are intended to guide this long-term process.

Place an equal emphasis on preservation and maintenance

The broader experience of the land conservation movement indicates that, as seen in the Urban Wilds, energy is typically focused disproportionately on land preservation over long-term stewardship. In an urban area, providing continued ecological or social value without some form of maintenance is not possible, but it will be necessary to ensure that the organization selected to manage the green infrastructure system can do so without compromising the social and ecological goals of the system. This issue remains particularly problematic in Boston, although it is nowhere near the crisis level seen at the end of the Conservation Commission's management of the Urban Wilds. Internal conflict at the Parks Department has limited maintenance funding, forcing management to rely on the dedication of Friends Groups. While active Friends Groups are a very positive addition to Urban Wild management, this strategy results in unmanaged Wilds along with some that are well managed.

Use maintenance and restoration to continue work toward defined ecological goals. Beyond directing land preservation efforts, the original ecological goals defined for a site should also shape long-term stewardship in order to preserve or work towards these specific values. For example, if the goal for a particular Urban Wild is to address air quality, management energy should be directed at nurturing the tree canopy. Alternatively, if the goal at this site is to address stormwater runoff, stewardship should focus both on the tree canopy and on encouraging a robust understory of shrubs and smaller plants. Because the ecology of urban sites can evolve rapidly, a site meeting a specific goal when it was preserved may no longer meet this goal five years later if stewardship planning does not revisit the original ecological goals.

Seek a balance between personal safety and Urban Wilds ecology.

Because they are an unusual form of urban public space, Urban Wilds will remain threatening to some community members. To maintain general community support, it may be necessary to soften the intersection of the Wild and the surrounding neighborhood by creating a visual indication that someone cares for this site. To ensure that restoration work does not create situations that are a genuine threat to public safety, it will be necessary for an organization that equally values public space and ecology to provide oversight of restoration work.

In Boston, the Urban Wilds Initiative currently plays this role.

Encourage Friends Groups as Urban Wilds ambassadors. As invasive trees are removed and exotic plants are ripped out, restoration and maintenance work can be counter-intuitive to the outside observer. Friends Groups are not only a positive force in restoring degraded sites, but are also extremely important as ambassadors of an individual site to its neighbors. It is important to remember that volunteer Friends Groups have more in common with community gardeners than they do with the Parks Department landscaping crew. These individuals spend their time doing volunteer restoration work because they find it fun, but to continue to find this work rewarding, rather than frustrating, these habitat gardeners will require support from a city agency or non-profit organization. Similar to community gardeners, habitat gardeners will be most successful if support is available, such as tool loans, mulch deliveries, and funds to improve their adopted space.

Do not underestimate the importance of a bold idea.
The Urban Wilds were conceived by one individual who went to great personal lengths to turn this concept into something that could be realized, but then left his work for others to carry on. This initial work could have met the fate of many planning studies and remained simply a report on a shelf yet it did not, in large part because of the people who took up the work that Elliot Rhodeside began. The ideas contained in *Boston Urban Wilds: A Natural Areas Conservation Program* were powerful enough to capture the imagination of a series of highly effective advocates who set out to make this idea a reality and who continue this work today, both at the Boston Natural Areas Fund and within the Parks and Recreation Department. Without the long-term dedication of these individuals to the importance of preserving the values the Urban Wilds stand for, the Urban Wilds would today be nothing more than a series of development projects, and in the words of the 1976 study, "we and future generations of Bostonians would be much poorer without them."

Appendix 1
CityGreen Methodology

To utilize the CityGreen program, it was necessary to first compile baseline data on Boston's land cover, which I acquired from three sources. I attained land use data from MassGIS, which was created by the University of Massachusetts, Amherst. In this data set, the state is broken into 21 land use categories based on aerial photographs, such as commercial or high density residential. The second citywide land cover that I mapped was the street extent, which I considered to approximate the impervious surfaces in Boston. The street location data was supplied by the City of Boston through the MIT GeoData Repository. Finally, I incorporated the Boston Parks and Recreation Department data on parks and open spaces within the city, which includes all open spaces in Boston ranging from privately owned Urban Wilds to State to Federal parks. This data set was created in the year 2000 and therefore does not include the most recent additions to Boston's open space network. For analysis at the scale of the city, I categorized these open space based on the typical amount of tree canopy found in, for example, a reservation versus a playing field. At the neighborhood level, I used aerial photographs and site visits to map the tree canopy within Mission Hill's Urban Wilds as well treed areas not considered Urban Wilds but with similar characteristics.

After compiling the land cover data, I used CityGreen to reclassify Boston's land uses into the CityGreen land cover categories. For example, I reclassified

streets as paved impermeable surfaces that drain to sewers and community gardens as row crops. Using these land cover classifications, CityGreen calculates the impact on air and water quality of replacing trees with a user-defined land use, such as commercial development. I generated all of the data reported in this thesis by modeling the replacement of the Urban Wilds with generalized 'urban' development. This analysis incorporates slope based on a digital elevation model, general soil classifications (A, B, C and D), precipitation and air quality data. City-specific soil, air quality and precipitation data are incorporated into the CityGreen program. I supplied the digital elevation model, which I attained from MassGIS.

The final step in the CityGreen analysis is to run the an analysis of a defined area. I ran an analysis of the entire city of Boston, Mission Hill, and the individual Urban Wilds in Mission Hill. The program makes the following calculations, which supplied the data found in Chapter 3:

- Total tree canopy in the area defined for analysis.
- Air pollution removal by the tree canopy in pounds of pollution removed annually, including carbon monoxide, ozone, nitrogen dioxide, particulate matter, and sulfur dioxide.
- Carbon storage and sequestration by the tree canopy in total tons stored and tons sequestered annually.
- Impact on water quality of the specified land use change (here, forested Urban Wilds to urban development) including the resulting increase in stormwater runoff and the change in contaminate concentration in stormwater runoff from the area defined for analysis. The contaminants included in this calculation are biological oxygen, cadmium, chromium, chemical oxygen, copper, lead, nitrogen, phosphorus, suspended solids, and zinc.

Appendix 2
Boston Urban Wilds status

The Boston Natural Areas Fund has tracked development in the Urban Wilds since 1976. The assessment of Urban Wild development included in this thesis is based on the following data provided by the Boston Natural Areas Fund and the Boston Parks and Recreation Department.

Acronym Key

BNAF number: In *Boston Urban Wilds: A Natural Area Conservation Program*, each Wild was given a number. These numbers are used by BNAF to track the fate of the Wilds today. A number followed by a letter indicates that a portion of the Wild has been protected or developed and a second portion of the site falls under another category (protected, unprotected, or developed).

BCC: Boston Conservation Commission

BNAF: Boston Natural Areas Fund, now Boston Natural Areas Network

BPRD: Boston Parks and Recreation Department

COB: City of Boston

CR: Conservation Restriction

DCR: Massachusetts Department of Conservation and Recreation (includes land preserved by the Metropolitan District Commission)

MBTA: Massachusetts Bay Transit Authority

TTOR: The Trustees of Reservations

Protected from development

BNAF Number	Name	Neighborhood	2004 Status	Ownership	Acres 1976	1990	2004
01-03	Belle Isle Marsh	East Boston	Protected	DCR	139.4	152	152
01-09	Condor Street Beach	East Boston	Protected	BCC	8.9	8.9	8.9
01-10	Condor Street Overlook	East Boston	Protected	BPRD	10.4	10.4	10.4
01-12	Golden Stairs	East Boston	Protected	BCC	0.2	0.2	0.2
09-01	Harvard Quarry	Mission Hill	Protected	Private	6.6	6.6	4.6
09-05b	Back of the Hill	Mission Hill	Protected	BCC	3.4	3.4	3.4
09-06	Nira Avenue Rock	Jamaica Plain	Protected	BPRD	1.5	1.5	1.5
09-12	Lawrence Farm	Jamaica Plain	Protected	TTOR	25.9	25.9	25.9
09-13	Bussey Brook	Jamaica Plain	Protected	BPRD/Arnold Arboretum	20	20	20
09-14	Parker Hilltop	Jamaica Plain	Protected	CR/COB	4	4	4
09-18	Hellenic College	Jamaica Plain	Protected	CR Institutional	35.6	25.6	25.6
10-07	Puddingstone Garden	Roxbury	Protected	BCC	0.6	0.6	0.6
10-10	Cedar Street	Roxbury	Protected	BCC	0.5	0.5	0.5
11-01	Patten's Cove	Dorchester	Protected	DCR	9.2	9.2	9.2
11-02	Savin Hill Cove	Dorchester	Protected	DCR	28.9	28.9	28.9
11-03	Boston Gas Easement	Dorchester	Protected	DCR	3.2	3.2	3.2
11-04	Fernald Terrace	Dorchester	Protected	BCC	0.06	0.06	0.06
11-05	Troy Landfill	Dorchester	Protected	DCR	19.1	19.1	19.1
11-10	Geneva Avenue Cliffs	Dorchester	Protected	BCC	1.5	1.5	1.5
11-12	O.G. Kelley	Dorchester	Protected	DCR	19	19	19
11-13	Taylor Street	Dorchester	Protected	DCR	0.1	0.1	0.1
11-15	Penn Central RR	Dorchester	Protected	DCR	3.3	3.3	10.6
11-16	Schoolboy Track	Dorchester	Protected	DCR	51.4	51.4	51.4
11-17	Hallet Street Brook	Dorchester	Protected	DCR	3.4	3.4	3.4
11-19	Hilltop Street	Dorchester	Protected	BPRD	1	1	1
13-01c	Bakalar	West Roxbury	Protected	private	17	17	17
13-02	Allandale	West Roxbury	Protected	BCC	10.6	10.6	10.6
13-03a	Souther	West Roxbury	Protected	CR/private	17	2.4	2.4
13-03b	Souther	West Roxbury	Protected	CR/COB	17	14.6	14.6
13-04	Hancock Woods	West Roxbury	Protected	DCR	52	47	47

Protected from development continued

BNAF Number	Name	Neighborhood	2004 Status	Ownership	Acres 1976	1990	2004
13-08	Dump Shoreline	West Roxbury	Protected	BCC	8.9	8.9	8.9
13-09a	Rivermoor	West Roxbury	Protected	Army COE	24.6	24.6	8.2
13-09d	Rivermoor	West Roxbury	Protected	DCR	24.6	14.9	14.9
13-17	Hancock Leatherbee Woods	West Roxbury	Protected	BNAN	7.9	7.9	7.9
13-18	Sawmill Brook	West Roxbury	Protected	DCR	68.8	68.8	68.8
14-02	Sherrin Street	Hyde Park	Protected	BCC	30.2	30.2	30.2
14-03	Monterey Hilltop	Hyde Park	Protected	BCC	6.5	6.5	6.5
14-04a	Boundary I	Hyde Park	Protected	DCR	16	9.8	9.8
14-04b	Boundary I	Hyde Park	Protected	BPRD	16	7.1	7.1
14-05	Boundary II	Hyde Park	Protected	DCR	44	17	44
14-06	Dell Avenue Rock	Hyde Park	Protected	BPRD	1.3	1.3	1.3
14-07a	West Street	Hyde Park	Protected	DCR	1.5	0.6	0.6
14-08a	Railroad Avenue	Hyde Park	Protected	DCR	1.2	1.2	1.2
14-08b	Railroad Avenue	Hyde Park	Protected	BCC	0	2.1	2.1
14-15	Belnel	Hyde Park	Protected	DCR	1.3	1.3	1.3
14-16a	Dana Avenue	Hyde Park	Protected	DCR	1.9	0.2	0.2
14-18a	Allis Chalmers	Hyde Park	Protected	private	3.4	1.6	1.6
14-20	Mother Brook II	Hyde Park	Protected	BCC	6	8.7	8.7
14-21a	Mother Brook III	Hyde Park	Protected	DCR	0	0.5	0.5
14-21b	Mother Brook III	Hyde Park	Protected	BCC	4.5	1.8	1.8
15-01	Gladeside I	Mattapan	Protected	BPRD	4.5	10	10
15-04	Willowwood Rock	Mattapan	Protected	BCC	0.2	0.2	0.2
15-08	Baker Chocolate Seawall	Mattapan	Protected	DCR	1.5	1.5	1.5
						Total	**734**

Unprotected from development

BNAF Number	Name	Neighborhood	2004 Status	Ownership	Acres 1976	1990	2004
01-01	Don Orione	East Boston	Unprotected	Private	9.5	9.5	9.5
01-02	Tower Street	East Boston	Unprotected	Private	0.5	0.5	0.5
01-04	Bayswater Street	East Boston	Unprotected	Private	10	10	10
01-07	MBTA Extension	East Boston	Unprotected	MBTA	0.6	0.6	0.6
01-08	Wood Island Bay Marsh	East Boston	Unprotected	MassPort	152	152	152
02-03	Charlestown Overlook	Charlestown	Unprotected	BRA	0.7	0.7	0.7
08-01	Turnpike Overlook	Allston-Brighton	Unprotected	Highway	7.2	7.2	7.2
08-02	Crittenton Hospital	Allston-Brighton	Unprotected	Institution	3	3	3
08-04	Cenacles	Allston-Brighton	Unprotected	Institutional	17.5	17.5	17.5
08-06	Mount Saint Joseph's	Allston-Brighton	Unprotected	Institutional	6.5	6.5	6.5
08-07	Kennedy Rock	Allston-Brighton	Unprotected	Institutional	2	2	2
08-08	Leamington Rock	Allston-Brighton	Unprotected	Private	0.5	0.5	0.5
08-09	Saint John's Seminary	Allston-Brighton	Unprotected	Institutional	42	42	42
08-10	Foster Street Hill	Allston-Brighton	Unprotected	Private	5.7	5.7	5.7
08-12	Foster Street Rock	Allston-Brighton	Unprotected	Private	5	5	5
09-02	Alleghany I	Mission Hill	Unprotected	Institutional	0.2	0.2	0.2
09-03	Alleghany II	Mission Hill	Unprotected	Institutional	1	1	1
09-09	Chapman Runyon	Jamaica Plain	Unprotected	Private	12.3	12.3	12.3
09-10	Showa Women's Institute	Jamaica Plain	Unprotected	Institutional	39.9	39.9	39.9
09-11	Daughters of Saint Paul	Jamaica Plain	Unprotected	Institutional	11.6	11.6	11.6
09-15	Oakview Terrace	Jamaica Plain	Unprotected	Private	0.4	0.4	0.4
09-16	Rock Hill	Jamaica Plain	Unprotected	Private	0.5	0.5	0.5
09-17a	Williams Street	Jamaica Plain	Unprotected	Private	4	4	4
10-01	Dudley Cliffs	Roxbury	Unprotected	Private	1.7	1.7	1.7
10-03	Alpine	Roxbury	Unprotected	Private	2.5	2.5	2.5
10-04	Juniper Terrace	Roxbury	Unprotected	Private	1.6	1.6	1.6
10-06	Warren Gardens	Roxbury	Unprotected	BRA	1.5	1.5	1.5
10-09	John Eliot Square	Roxbury	Unprotected	Private	0.1	0.1	0.1
10-11	Saint Monica's	Roxbury	Unprotected	Private	1.3	1.3	1.3
10-12	Rockledge Street	Roxbury	Unprotected	Private	0.5	0.5	0.5
11-07	The Humps	Dorchester	Unprotected	Private	0.8	0.8	0.8

BNAF Number	Name	Neighborhood	2004 Status	Ownership	Acres 1976	1990	2004
11-07	The Humps	Dorchester	Unprotected	Private	0.8	0.8	0.8
11-09	Eldon Street	Dorchester	Unprotected	BPRD	1.8	1.8	1.8
11-14	Right of Way Shores	Dorchester	Unprotected	Private	6.3	6.3	6.3
11-18	Keystone Shoreline	Dorchester	Unprotected	Private	0.6	0.6	0.6
11-20	Granite Avenue Ledge	Dorchester	Unprotected	Private	0.2	0.2	0.2
11-23a	Calf Pasture	Dorchester	Unprotected	public	89	20	20
11-24	Adams Rock	Dorchester	Unprotected	Private	0.4	0.4	0.4
11-25	Huntoon Rock	Dorchester	Unprotected	Private	0.2	0.2	0.2
12-01	Metropolitan Avenue	Roslindale	Unprotected	Private	2.5	2.5	2.5
12-04	Eldon Street	Roslindale	Unprotected	BPRD	11	11	11
12-05a	Canterbury II	Roslindale	Unprotected	Private	68	8	8
12-05b	Canterbury II	Roslindale	Unprotected	public	0	60	60
12-06	Boston State Hospital	Roslindale	Unprotected	Private	34	34	34
13-01b	Bakalar	West Roxbury	Unprotected	Private	43	12	12
13-05	Waverly Road	West Roxbury	Unprotected	Private	1.8	1.8	1.8
13-07	Oak Ridge	West Roxbury	Unprotected	Private	0.3	0.3	0.3
13-09b	Rivermoor	West Roxbury	Unprotected	Private	24.6	1.2	1.2
13-09c	Rivermoor	West Roxbury	Unprotected	Private	24.6	0.5	0.5
13-11	New Haven Street	West Roxbury	Unprotected	Private	9.7	9.7	9.7
13-12	Roxbury Latin School	West Roxbury	Unprotected	Institutional	76.4	76.4	76.4
13-13	West Roxbury Quarry	West Roxbury	Unprotected	Private	70	70	70
13-16	Dana Road	West Roxbury	Unprotected	Private	0.9	0.9	0.9
13-20b	W Roxbury High School	West Roxbury	Unprotected	Institutional	10	10	10
14-07b	West Street	Hyde Park	Unprotected	Private	1.5	0.9	0.9
14-09	Sprague Pond	Hyde Park	Unprotected	Private	1.4	1.4	1.4
14-11	Euclid Street	Hyde Park	Unprotected	Private	3.9	3.9	3.9
14-12	West Austin	Hyde Park	Unprotected	Private	0.3	0.3	0.3
14-13	Pleasantview	Hyde Park	Unprotected	Private	0.5	0.5	0.5
14-14	Fairview Quarry	Hyde Park	Unprotected	Private	6.7	6.7	6.7
14-19	Mother Brook I	Hyde Park	Unprotected	Private	0.4	0.4	0.4
14-22	Neponset I	Hyde Park	Unprotected	Private	2	2	2
15-03	Penderdast Preventorium	Mattapan	Unprotected	Institutional	20.8	20.8	20.8
15-05	Woodhaven	Mattapan	Unprotected	Private	2.1	2.1	2.1
15-06	Blue Hill Rock	Mattapan	Unprotected	Private	0.8	0.8	0.8
15-07	Gladeside II	Mattapan	Unprotected	Private	1.1	1.1	1.1
						Total	**714**

Developed or filled

BNAF Number	Name	Neighborhood	2004 Status	Ownership	Acres 1976	1990	2004
01-05	US Naval Reservation	East Boston	Developed	Navy	15.8	0	0
01-06	Chelsea Creek Meadow	East Boston	Developed	Private	30.5	0	0
01-11	Govenor's Island Cove	East Boston	Filled	Private	203	0	0
02-01	Mystic Overlook	Charlestown	Developed	Private	0.7	0	0
02-02	Schrafft's Cove	Charlestown	Filled	Private	9.7	0	0
08-03	Saint Sebastian's	Allston-Brighton	developed	Private	6.4	6.4	0
08-05	Victory Gardens	Allston-Brighton	Developed	Private	1.5	0	0
08-11	Oakland Quarry	Allston-Brighton	Developed	Private	2.3	0	0
08-13	Wallingford Rock	Allston-Brighton	Developed	Private	3	0	0
08-14	Euston Path Rock	Allston-Brighton	Developed	Private	0.7	0	0
09-04	Judge Street	Mission Hill	Developed	Private	0.4	0.4	0
09-05a	Back of the Hill	Mission Hill	Developed	Private	8.1	0	0
09-07	Cranston Street	Jamaica Plain	Developed	Private	0.2	0	0
09-08	Sheridan Hillside	Jamaica Plain	Developed	Private	0.2	0	0
09-17b	Williams Street	Jamaica Plain	Developed	Private	5.3	0	0
10-02	Saint James	Roxbury	Developed	Private	0.5	0	0
10-05	Fountain Street	Roxbury	Developed	Private	2.5	0	0
10-08	Franklin	Roxbury	Developed	Private	2	0	0
10-13	Glen Hill	Roxbury	Developed	Private	1.4	0	0
11-06	Morgan Memorial	Dorchester	Developed	Private	1	0	0
11-11	R&S Machine	Dorchester	Developed	Private	11.3	0	0
11-21	Cedar Grove Ponds	Dorchester	Filled	Private	3.5	0	0
11-22	Lower Mills Gorge	Dorchester	Developed	Private	0.7	0	0
11-23b	Calf Pasture	Dorchester	Developed	Private	69	0	0
12-02	Canterbury I	Roslindale	Developed	Private	2.5	0	0
12-03	Grew Avenue	Roslindale	Developed	Private	12	0	0
13-01a	Bakalar	West Roxbury	Developed	Private	14	0	0
13-06	Parkway Pond	West Roxbury	Developed	Private	3.3	0	0
13-10	Spring Street Marsh	West Roxbury	Developed	Private	30.3	0	0
13-14	Rockview	West Roxbury	Developed	Private	1.2	0	0
13-15	Dragon Rock	West Roxbury	Developed	Private	1.2	0	0

Developed or filled continued

BNAF Number	Name	Neighborhood	2004 Status	Ownership	Acres 1976	1990	2004
13-19	Centre Marsh	West Roxbury	Filled	Private	5.3	0	0
13-20a	W Roxbury High School	West Roxbury	Developed	Institutional	30	0	0
13-21	Searle Road Rock	West Roxbury	Developed	Private	0.6	0	0
14-01	Sally Rock	Hyde Park	developed	Private	0.7	0	0
14-10	Readville Maples	Hyde Park	Developed	Private	2.8	0	0
14-16b	Dana Avenue	Hyde Park	Developed	Private	1.9	0	0
14-17	Margin Street	Hyde Park	Developed	Private	0.4	0	0
14-18b	Allis Chalmers	Hyde Park	Developed	Private	1.8	0	0
14-21c	Mother Brook III	Hyde Park	Developed	Private	2.2	0	0
14-23	Neponset II	Hyde Park	Developed	Private	3.2	0	0
15-02	Livermore	Mattapan	Developed	Private	30	0	0
						Total	**523**

Notes

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Figure 3.12 Likely Breeding and Resident Bird Species Based on Urban Wild Area. Mapped using data from Tilghman, 1987 and Goldstein *et. al.* 1986 and Boston Parks and Recreation Department.

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Figure 4.6 Garden of Art gazebo built by Wentworth Institute of Technology students. Author, 2006.

Figure 4.7 Garden of Art chairs and benches painted by the Massachusetts College of Art students and neighborhood children. Author, 2006.

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