GREEN INFRASTRUCTURE AND TRANSIT-ORIENTED MIXED USE DEVELOPMENT: THE ALEWIFE AREA OF CAMBRIDGE, MASSACHUSETTS

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INTRODUCTION

This paper is a case study of the progress on environmental and development fronts in this critical area of Cambridge, Massachusetts. Portions of the riverine system to the north (Little River and Alewife Reservation) have been restored and include public amenities, and the park to the east (Danehy Park) has been realized. The degraded industrial land uses that had comprised the bulk of the land use have made a transition to a dynamic, mixed-used neighborhood.

This paper presents both the public and the private strategies undertaken to accomplish these goals. These strategies are presented in three parts:

I. Public Infrastructure: Constructed Stormwater Wetlands and Larger Stormwater Management Goals
II. Site Development: Environmental Strategies
III. Urban Development Goals: Mixed-Use Neighborhood

KEYWORDS

public infrastructure design, sustainable site design, transit-oriented neighborhoods, constructed stormwater wetlands, urban development, mixed-use neighborhoods, urban development

DEFINING THE SITE

The site is located in the northwest corner of the city and is generally referred to as the Alewife area of Cambridge. Within the 370-acre Alewife area is a "Triangle" of land bounded to the south by rail lines, to the north by the Alewife Reservation with the newly constructed stormwater wetland, and to the east by a major arterial (Route 2 also known as the Alewife Brook

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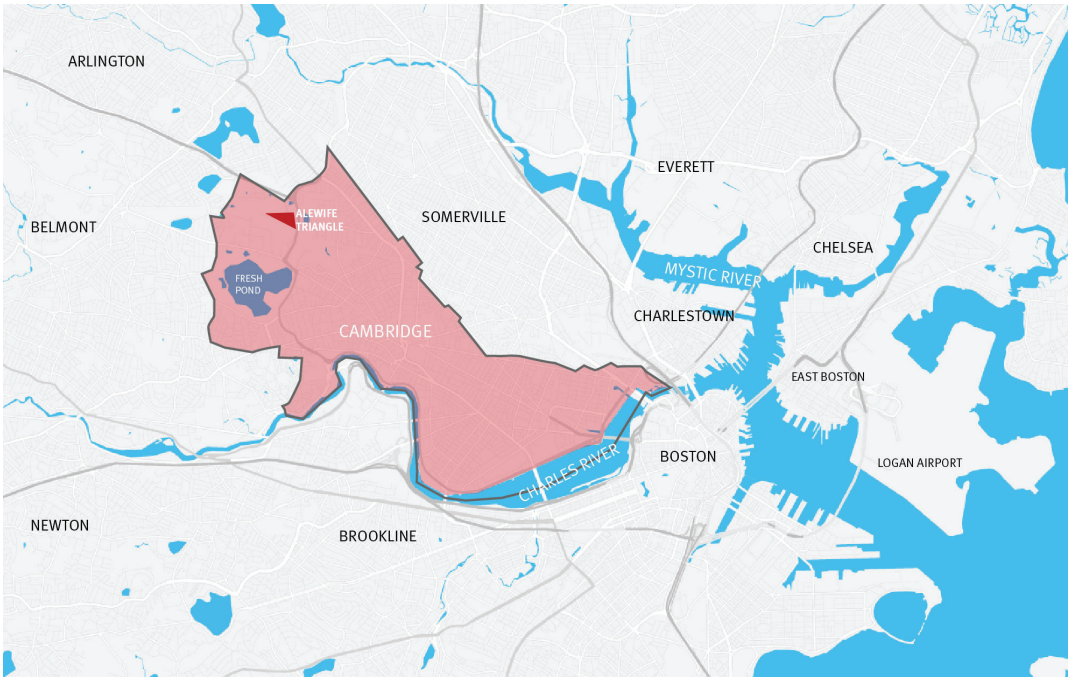
Parkway). See Diagram 1 for the illustration of the Triangle in the Alewife area of Cambridge and Diagram 2 for its location in the overall Boston-Cambridge metropolitan area.

FIGURE 1: Alewife Triangle Context, Courtesy of Arrowstreet.

FIGURE 2: Cambridge/Boston Context, Courtesy of Arrowstreet.

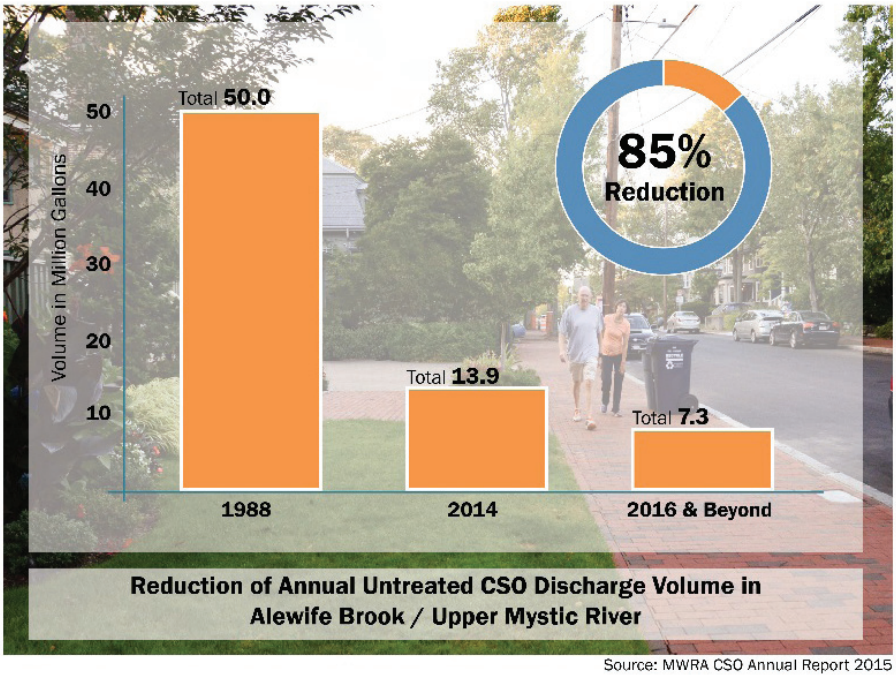


BACKGROUND: THE URBAN AND ECOLOGICAL CONTEXT

The Alewife section of Cambridge has supported industrial land uses since the mining of clays for brick making in the mid-1800s. Over the past 50 years, the area has been transitioning from an industrial landscape to office and research and development uses. In 1985 it also became the location of a terminus for an extended subway transit line. The area is adjacent to important water and open space resources: Fresh Pond Reservation (162 acres of open space surrounding and protecting the 155-acre Fresh Pond Reservoir) to the south and the Alewife Brook Reservation (120-acre state park and urban wild) to the north, which includes the Little River and its floodplains and wetlands, and Danehy Park (50-acre municipal recreational facility) to the east.

Topography in the area is relatively flat, and a significant portion of the area falls within the 2010 Federal Emergency Management Agency (FEMA) 100-year floodplain. Water quality in the Alewife Brook system is degraded due to its long history of industrialization, urban runoff, and discharges from Combined Sewer Overflows (CSOs). The City of Cambridge, in partnership with the Massachusetts Water Resources Authority (MWRA), has recently completed a series of sewer separation and stormwater management projects to reduce and control CSO discharges, significantly reducing untreated CSO discharges during the typical year.

FIGURE 3: Reduction of Annual Untreated CSO Discharge Volume in Alewife Brook / Upper Mystic River, Courtesy of MWRA Annual Report 2016.



The Alewife area of Cambridge was recently identified in the City's *Climate Change Vulnerability Assessment* (November 2015)[5] as an area vulnerable to additional flooding from increased precipitation associated with climate change. See further discussion below under hydrology of the area.

5. Climate Change Vulnerability Assessment Report – Part 1 (November 2015), http://www.cambridgema.gov/CDD/Projects/Climate/climatechangeresilianceandadaptation.aspx.

The industrial development of this land in the first half of the 20th century can be understood by its proximity to the major rail lines and highways that bisect the area. The predominantly industrial zoning of the area allowed virtually any use of land, except residential, with few if any height, setback, landscaping, or other requirements. This industry-based zoning reinforced these patterns.

1970s and Mass Transit

By 1979, privately owned land was 80% covered by industrial buildings or it was paved for parking. Most of this coverage occurred between 1940 and 1960. But by the 1970's most of the industrial uses, which included steel fabrication yards, were encountering economic difficulties, and the land became underutilized.

The City recognized that there was considerable development pressure and that the underutilized land represented a significant opportunity to shape future growth through zoning, regulation, and coordinated public-private initiatives. A pivotal infrastructure decision was made: a major mass transit line (The MBTA's Red Line) would be extended from Harvard Square out to Alewife. This connection has become the cornerstone for the renaissance for the area.

A major planning initiative in 1970 for the area, "*The Alewife Revitalization Study*[6]", identified the possibilities for office and other uses. Extolling its potential, the report described the larger Alewife study area as an underutilized industrial area now served by mass transit, as well as major arterials. It was also on its way to becoming surrounded on three sides by parkland. In addition to the Fresh Pond Reservoir (to south) and the Alewife Reservation (to the north), Danehy Park was created to the east on the site of the city's former landfill; closed in the 1970s, and capped with soils from the Red Line subway extension project in the 1980s, it opened to the public in 1990.

The first rounds of development since the 1970s brought primarily office and research & development uses to the Alewife area. A significant number of larger office buildings were built in this period. The predominant land use pattern for new office buildings was 8-10 stories of construction, some open space, and a predominant amount of surface parking. One residential building of 9 stories was built in 2003.

In the mid-2000s, re-development in this area began in earnest. The City has evolved its planning and its environmental goals for the area, recognizing the area's ecological sensitivity and its potential to provide much-needed, transit-oriented live-work neighborhood housing.

Beginning in 2003, the City worked with a group of residents, area business representatives, landowners, and institutions on a participatory community process to develop a vision for the area. This planning effort culminated in substantial zoning changes to implement these goals in 2006.

Immediately to the north of the project area, between Route 2 and the Little River, the City and the landowner (Discovery Park) worked on a project master plan to include environmental remediation—agreeing to remove impervious areas along the Little River (both parking and buildings) and to restore the area to open space in exchange for additional development rights elsewhere on site.

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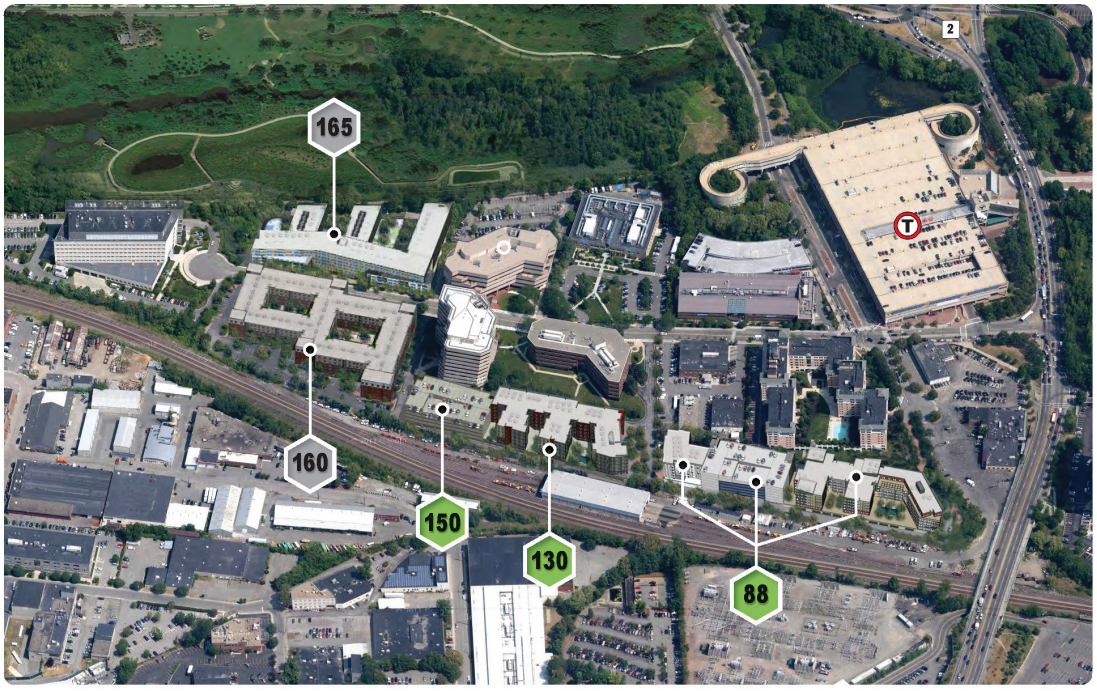
6. Alewife Revitalization: Alewife Urban Design Study Phase II (1979), http://www.cambridgema.gov/~/media/Files/CDD/Planning/Studies/Alewife/alewife_fishbook_1979.pdf?la=en.

FIGURE 4: Alewife Triangle: Before Zoning Change to encourage mixed use, c. 2005, Courtesy of Arrowstreet.

FIGURE 5: Alewife Triangle: After currently approved mixed use development, Courtesy of Arrowstreet.



Mixed Use and Environmental Infrastructure

The economic downturn that characterized the years following 2006 had only short-term impact on overall development. To address the needed improvements in flood and stormwater management, the City took a dual approach: requiring new development to provide greater protection and remediation, but also undertaking public improvements infrastructure in the Alewife Area.

Hydrology of the Project Area

The Alewife area is a sub-watershed within the Mystic River watershed. The Little River and Alewife Brook were realigned and a portion channelized during the area's industrial history. It has become shallower over time as a result of urban runoff and sedimentation. The Little River flows into the Alewife Brook which flows into the Mystic River through the Amelia Earhart Dam and into Boston Harbor. Flooding in the watershed is a result of overland flooding from the river system and is partially controlled by the Amelia Earhart Dam, built in the 1960s. The Amelia Earhart Dam helps protect the Alewife area from projected storm surge flooding in the near term, but the duration of flooding along the Alewife Brook is tied to the dam's ability to pump after an event. The flatness of the topography and the downstream dam system contribute to the flashiness of the Little River and Alewife Brook systems which are quick to rise, but slow to drain during significant floods.

FIGURE 6: Mystic River Watershed, Courtesy of Arrowstreet.

Though the Charles River offers the more commonly seen images of water in Cambridge, the Little River/Alewife Brook and surrounding areas are more vulnerable to precipitation driven flooding in the near term and potential storm surge flooding in the future.

Climate Change Vulnerability

The City has already begun to face significant challenges from a change in weather patterns. The first step to make Cambridge more prepared and resilient to climate change is to understand how the City is vulnerable or resilient in terms of impact on people, infrastructure, public health, and the economy. In 2015 the City completed Part 1 of its Climate Change Vulnerability Assessment (CVVA).[7] This report primarily covers Cambridge's vulnerabilities to increasing temperatures and precipitation. The Part 2 report will further analyze vulnerabilities related to sea level rise and storm surges.

It is projected that extreme rain events will increase in frequency and intensity.

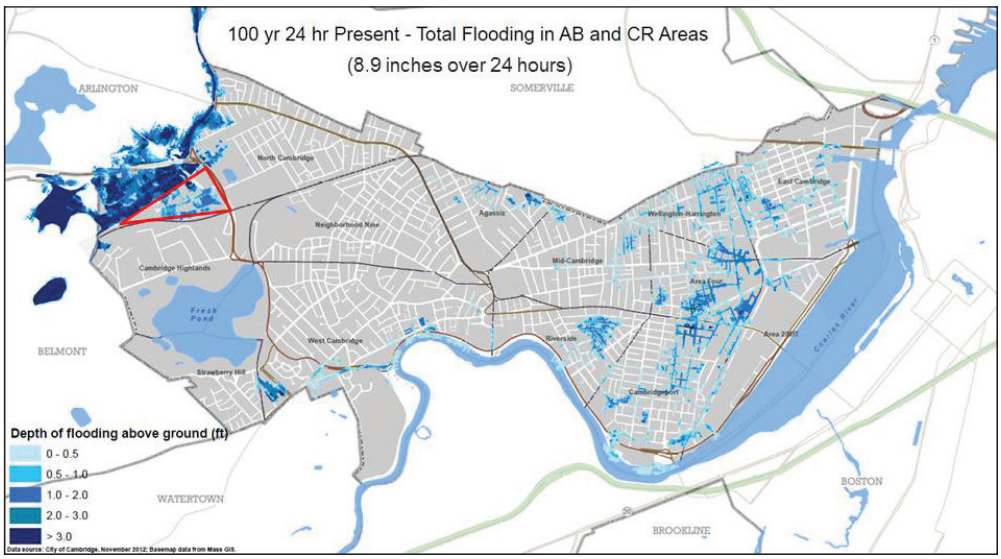
FIGURE 7: Cambridge Climate Projections, Courtesy of City of Cambridge Change Vulnerability Assessment Part 1 Appendix A (Nov 2015).

Precipitation Changes	Baseline 1971 - 2000	2030's (2015 - 2044)	2070's (2055 - 2084)
24-hour design storms			
10 yr (inches)	4.9	5.6	6.4
25 yr (inches)	6.2	7.3	8.2
100 yr (inches)	8.9	10.2	11.7

Climate projections used for Cambridge Climate Change Vulnerability Assessment

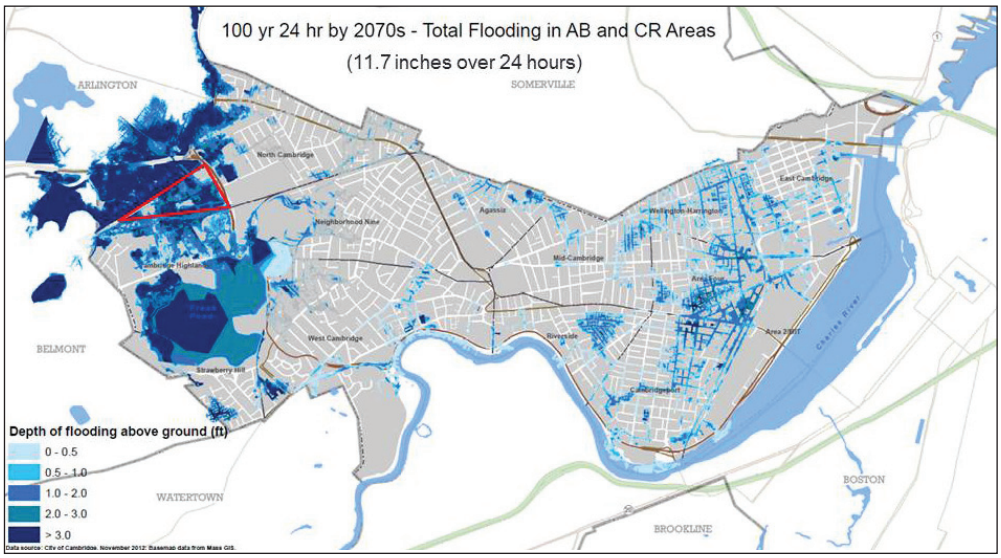
In the future, the Alewife section of the City will see continued and extended flooding due to the Alewife Brook overflowing its banks. Flooding in other sections of Cambridge will be a function of insufficient capacity in existing infrastructure.

FIGURE 8: Current Cambridge Flood Zone Map, Courtesy of City of Cambridge Change Vulnerability Assessment Part 1 Appendix A (Nov 2015).



7. Climate Change Vulnerability Assessment Report – Part 1 (November 2015), http://www.cambridgema.gov/CDD/Projects/Climate/climatechangeresilianceandadaptation.aspx.

FIGURE 9: Estimated 2070 Cambridge Flooding, Courtesy of City of Cambridge Change Vulnerability Assessment Part 1 Appendix A (Nov 2015).



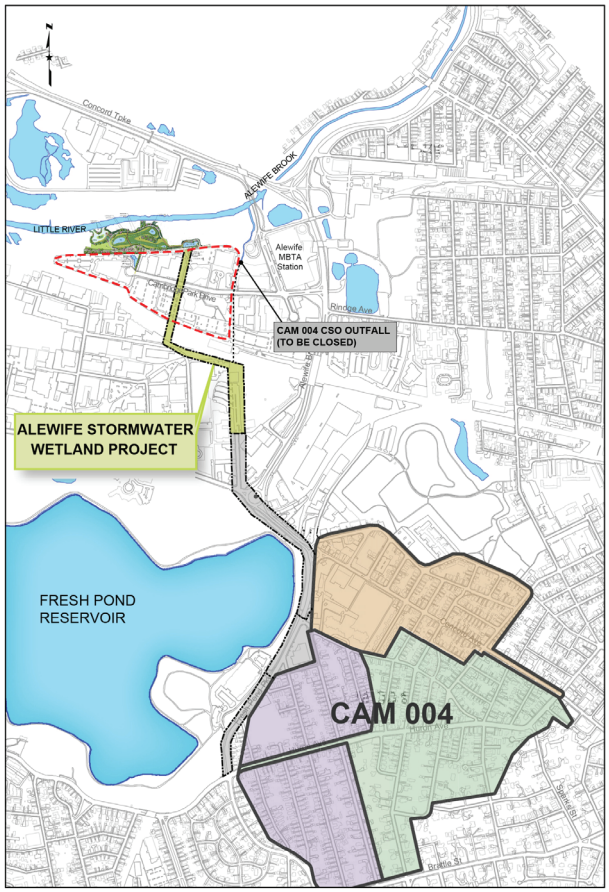
Both the Charles River Dam and Amelia Earhart Dam (both owned and operated by state agencies) provide some protection from precipitation-driven flooding due to pumping capacity. Inter-agency cooperation is crucial to provide protection of communities and infrastructure upstream of the dam systems. On Alewife Brook, riverine flooding would be worse if pumping at the Earhart Dam were compromised.

Preliminary findings of the part 2 CVVA report indicate that Cambridge is unlikely to be impacted by sea level rise and storm surges by 2030, due to flood protection from both dams. Flanking of the dams by the 100-year event is expected to occur before they are overtopped. The Part 2 report is expected to be complete in 2016.

PART I. PUBLIC INFRASTRUCTURE--CONSTRUCTED ALEWIFE STORMWATER WETLAND AND STORMWATER SEPARATION

Sewer Separation and Stormwater Management

A unique partnership among the City of Cambridge, the Massachusetts Water Resources Authority (MWRA) and the Massachusetts Department of Conservation and Resources (DCR) was formed to create a solution to the discharge of stormwater separated from a combined sewer system. Over 200 acres of combined sewers in west Cambridge needed to be separated as part of a court ordered cleanup of the Boston Harbor and its tributaries. The separation of the combined system meant a new stormwater outfall was needed to discharge stormwater to the Little River. Permitting requirements designed to protect water quality and control downstream flooding meant that this discharge needed to be detained and treated before discharging to the river. Working with the DCR, owner of the Alewife Reservation, the city, and its engineering team of Kleinfelder, MWH Global, and Chester Engineers (formerly BioEngineering Group) were able to find a solution that met the permitting requirements, but also resulted in a design to simultaneously meet the DCR's Master Plan goals for the Alewife Reservation: construction of a stormwater wetland that would provide environmental and recreational enhancements that support the reservation's health and usefulness.



ALEWIFE CSO CONTROL, SEWER SEPARATION AND STORMWATER MANAGEMENT PROJECT

FIGURE 10: West Cambridge Sewer Separation and Alewife Stormwater Wetland Areas, Courtesy of City of Cambridge.

FIGURE 11: View of the main wetland basin and boardwalk, Courtesy of City of Cambridge.

The stormwater wetland design includes features that provide public benefits and ecological value, meeting the Alewife Reservation Master Plan goals:

- Improve water quality and restore natural hydrology
- Protect and enhance wildlife habitat
- Improve recreational, educational, and other cultural opportunities
- Provide for maintenance that minimizes costs and maximizes efficiencies

A major accomplishment, the Alewife Stormwater Wetland creates enhanced habitat within the Reservation. The construction of the 3.4-acre stormwater wetland included the removal of invasive plants and replanting native species: over 120,000 wetland and 4,000 upland native plants. Native plantings created diverse ecological communities that include deep, emergent, and high marsh, broadleaf floodplain, open water, and scrub/shrub and riparian woodland habitats to provide food and cover. Islands provide breeding grounds, and the Oxbow channel connected to the Little River provides improved spawning habitat for migratory fish such as Alewife and Blueback Herring.

FIGURE 12: Panoramic view of wetland basin under construction, Courtesy of City of Cambridge.

Social benefits are impressive. They include passive recreational amenities such as interconnected trails for recreational walking and running, access for bird watching, nature walks, and scenic overlooks. A multi-use pathway immediately adjacent to the wetlands provides connection to a multi-use path and the Alewife public-transit station. Outdoor educational items include informational signage, a stone amphitheater, interpretive signage, engraved boulders, and a trail/boardwalk system providing a close-up view of the wetland and adjoining Little River.

The completion of these improvements has created an opening to the Alewife Reservation and better access for area residents to the river's edge. No longer is the river cut off from view by overgrown and marginalized parkland or cut off from the neighborhood by graphitized industrial buildings. It is now an important piece of a growing multi-use area, a gem of the urban wild that supports the evolving vibrant urban environment.

Additional Water Quality Enhancements

According to EPA documentation, up to 40% of water quality impairments in the nation's waters is exacerbated by unmanaged stormwater runoff (EPA, 2005). In urban areas such as Cambridge, the highest concentration of pollutants is washed off the land surface with the first one-half to one-inch of stormwater runoff. The City wanted to ensure that the stormwater that would discharge to the newly constructed stormwater wetland was treated to the

FIGURE 13: Illustrative rendering of the Alewife Stormwater Wetland, Courtesy of City of Cambridge.

FIGURE 14: View of stormwater wetland, walkway, and boardwalk, Courtesy of MWH Global.

maximum extent practicable. Water quality treatment systems were incorporated into the sewer separation improvements in the upstream neighborhoods, including porous pavement, biobasins and deep-sumped catch basins (grit collection systems) to act as the first line of treatment before stormwater discharged to the Alewife stormwater wetland.

PART II. INTEGRATING ENVIRONMENTAL STRATEGIES INTO DEVELOPMENT: FLOODWATER, GROUNDWATER, STORMWATER AND SANITARY

In conjunction with the public infrastructure improvements described above, site development undertaken by the private sector has included strong environmental strategies, publicly vetted through City approval processes, including required reviews with the City's Conservation Commission.

Accordingly, numerous site development strategies have been implemented as part of private redevelopment in the area to mitigate flooding and storm impacts and to improve water quality within Alewife. The City of Cambridge has been the lead partner in educating

and promoting sustainable design practices, especially in this area of Cambridge. Specific design guidelines were implemented in 2006 by the City to ensure that the re-development of the Alewife area was done in a manner that would protect public infrastructure and improve the wetland resource areas and surrounding flood plain.

Development in this area must meet the regulatory requirements of the Clean Water Act, the Massachusetts Wetland Protection Act, and the City of Cambridge Regulations. Additionally, site design must address neighborhood concerns on potential climate changes and the increased potential for severe storms.

Specific environmental concerns of the neighborhood are as follows:

- Decrease impervious area
- Design to address increasing storm intensities
- Increase onsite groundwater infiltration
- Provide an overall reduction in stormwater runoff
- Provide additional onsite flood volumes
- Design critical areas to anticipated increased flood elevations due to climate change

A. Climate Change Considerations on Flood Elevations:

Design strategies to protect critical building infrastructure have been considered and implemented as part of the redevelopment of the area. As part of the potential climate change considerations, the first floor elevations of proposed buildings have been designed to be set significantly above the current FEMA 100-year flood elevation.

Additionally, recently permitted residential multifamily buildings have been designed such that all residential living units are located on the second floor, e.g., more than 10-feet above the current FEMA 100-year flood elevation. Other design considerations regarding flooding levels include: locating critical utilities on the upper floors and/or roofs of buildings and locating electrical switches and transformers above the FEMA 100-year flood elevation as high as is practical.

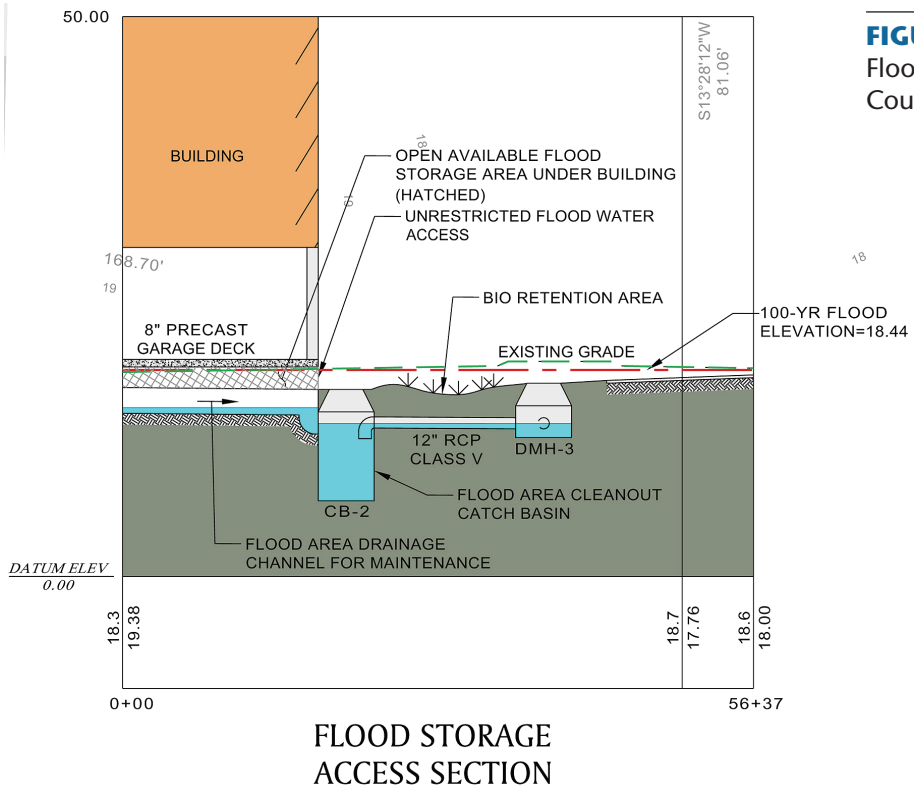
B. Compensatory Flood Storage

The redevelopment has been designed such that whatever volume of flood storage that exists on the site prior to redevelopment will remain unchanged after development so as not to impact the flooding in adjacent areas. Specifically, any displacement of existing flood storage capacity is required, under the Massachusetts Wetlands Protection Act, to provide compensatory flood storage. The compensatory flood storage must provide the same amount of flood storage volume at the same elevation as the flood storage lost due to development. This is identified in the regulations as "increment by increment" compensatory flood storage. Additionally, the compensatory flood storage must be hydraulically connected to the larger flood plain.

As a result, most projects in this area of Cambridge have carefully considered the flow characteristics and flood plain elevations, and as a result have provided flood storage in the lower parts of the buildings, including crawl spaces to offset the impacts on the flood plain from the redevelopment. These compensatory flood storage areas must, by regulation, have an unrestricted hydraulic connection to the floodplain, meaning that floodwaters must be able to enter and exit the flood storage areas freely. In most cases, the flood storage areas under the buildings have been designed to slightly increase the available flood storage onsite to address neighborhood flooding concerns as part of the property redevelopment. As flood waters rise

on the site, they enter the building crawl space through the grate as show in Figure 15. As flood waters recede, the water exits through the same grates.

FIGURE 15: Unrestricted access for floodwaters to enter building flood storage area, Courtesy of BSC Group.



FLOOD STORAGE
ACCESS SECTION

FIGURE 16: Building Flood Storage Section, Courtesy of BSC Group.

FIGURE 17: Building first floor with flood storage below, Courtesy of BSC Group.

FIGURE 18: Sanitary sewer holding tank installation, Courtesy of BSC Group.

C. Improved Alewife Water Quality

Intense past development has greatly impacted the water quality of the Alewife Brook and the Little River. As part of the redevelopment, stormwater runoff from impervious surfaces is treated in accordance with Best Management Practices (BMPs) to reduce suspended solids in the runoff prior to discharging to the wetland areas. Natural features such as Bio-retention areas and constructed stormwater wetland ponds along with subsurface infiltration systems have been installed to infiltrate the first flush of stormwater that generally contains the highest concentration of contaminates.

While the city continues to address the infrastructure separation, private development projects are required to provide an on-site, watertight, sanitary sewer holding tanks to collect building sanitary sewer flow during CSO events. The storage tanks provide approximately 12 hours of sanitary sewer storage for each building and are connected to the City's remote monitoring system. The City has the ability to remotely shutoff a building's sanitary sewer service connection to the City sewer main when there is a CSO event. Only after the CSO event passes is a building's sanitary sewer released to the City sewer system, by the City, thus preventing sanitary sewer from the redeveloped area to enter the Alewife Brook or Little River waters.

D. On-Site Stormwater Detention.

The increase of impervious area within the watershed area has contributed greatly to the area flooding. As such, the City stormwater design policy for the Alewife area requires that a stormwater management system specific to each redevelopment site be designed to provide a reduction in the proposed 25-year peak rate runoff to be comparable with the existing 2-year peak rate before being released into the City storm drain system. This requires on-site storm-water detention and groundwater recharge.

Methods for meeting the peak rate of the runoff reduction have been accomplished in a number of ways depending on the specific site characteristics, such as soil types, groundwa-ter levels, and runoff rates. Where groundwater levels are low, the stormwater management system can take advantage of significant groundwater infiltration to reduce stormwater runoff volumes and peak discharge rates. Where groundwater is high, or there are low permeable soils such as clay closer to the surface, watertight stormwater tanks have been used to detain the runoff and slowly release the runoff to the City drainage system. By collecting, treating, and slowly releasing the site's collected stormwater runoff, there is less impact to the down-stream City drainage infrastructure and Alewife area.

FIGURE 19: Watertight stormwater detention system, Courtesy of BSC Group.

E. Wetland Restoration.

As part of the Cambridge Discovery Park (a 1 million square foot office park and hotel located to the north of this area adjacent to the Little River and the Alewife Reservation), significant restoration of the 100-ft wetland buffer to the Little River was completed in 2010. The restoration included the removal of all buildings, pavement (parking) and structures, the installation of new wetland areas, a stormwater wetland pond, and the planting of over 100 trees and shrubs. Further, the buildings in this office park were also designed to provide flood storage and have been constructed with a first floor elevation, well above the 100-year flood elevation. In addition, this project removed several hundred parking spaces that had been constructed in the Alewife Reservation and converted the area to open meadow, wetlands, and pervious floodplain.

FIGURE 20: Stormwater wetland pond, Courtesy of BSC Group.

FIGURE 21: Removed parking lot and converted to a walking path to the MBTA train station, Courtesy of BSC Group.

FIGURE 22: Wetland re-creation within previous parking lot, Courtesy of BSC Group.

F. Increased Open Space and Permeability.

Other design strategies that have been completed to improve the area ecosystem and reduce stormwater runoff include providing increased open space and site permeability in order to increase stormwater runoff infiltration throughout the area. Together with the City, neighborhood groups, and developers, the combined site design strategies implemented throughout the redevelopment of the Alewife area have contributed to enhancing the area ecosystem and improving water quality.

PART III. DEVELOPMENT GOALS: URBAN, MIXED-USE NEIGHBORHOOD

There has been a massive public-private effort to address resiliency in the Alewife area. It is accompanied by a belief that there should be continued use of this area for transit-oriented, mixed-use development. The goal is to create a sustainable community within walking distance of major transit nodes. The City of Cambridge set a course that is a combination of resiliency goals (such as constructed and restored wetlands) and other urban goals (i.e., a sustainably located, mixed-use community). This community and the region are chronically short of housing, including affordable housing, which the City addressed when it modified its zoning in 2006.

This section is about the development goals for the transit-oriented community and the strategies to achieve these goals. The process of reviewing the design was a very public one with multiple informal meetings with neighbors and public interest groups, as well as the City-required approvals process.

The goals, in summary from the zoning ordinance, are:

1) Encourage mix of uses that will encourage walking, biking and transit use.
2) Enhance the capacity to store floodwater, recharge groundwater, and manage stormwater.
3) Introduce amenities and services that will benefit surrounding neighborhoods.
4) Introduce a significant amount of residential living and support retail services.
5) Create a sense of place that parallels other historic urban centers in Cambridge.[8]

8. Cambridge, MA Zoning Ordinance, Article 20.92 Alewife Overlay Districts, General Purpose, current as of April 2016.

The zoning is effectively transforming the Triangle into a mixed-use community: an area which in 2006 was substantially covered with open paved impermeable surface parking lots.

This Development and LEED Standards—Buildings and Neighborhood

Cambridge requires that these buildings meet standards for LEED Silver Certifiable, and individual projects have followed through with full Certification. The project at 160 CambridgePark Drive, Hanover's "CambridgePark", is Certified LEED Gold.

Though not registered under LEED for Neighborhood Development, the goals of LEED ND align closely with the principles guiding the design and development of this area. Specifically:

- Smart Location and Linkage
- Neighborhood Pattern and Design
- Green Infrastructure and Buildings

With respect to Smart Locations and Linkage, many of the design elements and development practices implemented in the Triangle area match these LEED-ND Goals. One hundred persent of the projects constitute infill development on previously developed land.

The site is within the 100-year floodplain, but it is an Infill Site, the importance of which LEED ND recognizes. The location has been through intensive environmental vetting with the City of Cambridge and the Commonwealth of Massachusetts to meet standards with similar intents as defined in LEED ND. (Note: Capitalized first letters are used here for terms defined and used by LEED-ND.)

There is excellent Access to Quality Transit and to Bicycle Facilities. There are significant provisions for bicycle parking, bicycle lanes, and connection to an extensive network of bike ways going into the city center and across the region.

With Respect to Neighborhood Pattern and Design, the Compact Development intent is well met. The density here would achieve 5 or 6 points out of a possible 6 points. The City requires inclusionary/affordable housing. The urban design scores well with respect to most of the LEED ND's criteria related to Walkable Streets. Buildings face the streets and the streets are pedestrian oriented.

There is excellent location in regards to LEED ND's recommended list of Mixed Uses. The LEED-ND-recognized mix of uses includes retail, restaurant, places of worship, commercial office (with well more than 100 jobs), and parks that are available within ¼ mile. (See Figure 23.)

Within ½ mile there is significant Access to Recreation Facilities, as well as to other regional resources, for example, cinemas and multiple hotels. Universal Design is a basic requirement of all site improvements and all building design. Streets are Tree-Lined.

With respect to Green Infrastructure and Buildings, the area scores very well on certification of buildings. As mentioned above, the City requires a minimum of certifiable, and some projects are certifying at the Gold level. Along with this come good marks on energy performance and indoor water use. Rainwater Management and Heat Island Reduction criteria are also well addressed.

Multiple steps have been taken to achieve a reduced parking footprint. The prior land uses were essentially 100% at-grade surface parking. There is now a very efficient use of land with respect to parking: the parking footprint is small and parking is shared with the adjacent office uses. The intent of a Connected and Open Community is well met.

Transit is essentially on site. The Alewife Station is a major hub for bus routes as well as the terminus for one of the region's most significant subway lines. Traffic Demand Management measures are in place, and there is a vehicle sharing program on site. Fees for parking spaces are separate from dwelling unit rentals.

The planning and design reflect "Best Practices" in civil engineering, landscape architecture, and architecture, with a heavy complement of public involvement. A full analysis of how well the neighborhood would score on a LEED ND checklist is not attempted, but the spirit in those principles is firmly embedded within this development.

FIGURE 23: Alewife Triangle: ¼ mile and ½ mile radii from residential developments, Courtesy of Arrowstreet.

DESIGN FOR A "SENSE OF PLACE"

Although sense of place does come up in some public review and to a degree in some LEED requirements, there are certain subjective but ultimately critical qualities that make a neighborhood a memorable and attractive place to live. The desire is to have a "there-there," particularly in a setting which has been so utterly lacking in those qualities: an asphalt-dominated no-human's land. Some observations follow here on specific strategies which emerged from this pursuit of creating a "sense of place," a frequent topic in design sessions and in the public process.

A. Identity and Sense of Place Created by 18-hour/7-day-a-week Activity

As much as buildings, activity defines a sense of place; few urban residential communities succeed in providing a sense of place without a mix of uses that creates activity 18/7. The Triangle has made the critical transition from its industrial and office roots to a place which has a significant number of residents. In some funky urban locations, initial occupancy by

artists, willing to live in less hospitable surroundings, forms the beginning of a residential community. Here, the (1) addition of the transit station, (2) the city's zoning change to allow a higher density of use if the new uses are housing and (3) the demand in the market for housing combine to bring about this critical change.

The mix of uses extends the hours of activity. People come to and from their homes well into the evening, long after workplace-only districts have gone dead. Feet, eyes, and interactions on the street provide a sense of life, safety, and identifiable community. Daytime activity can be workplace driven; evening activity can be residence driven; in a truly mixed-use neighborhood the result is a more diverse and extended cycle of daily and weekend activity.

FIGURE 24: Rendering of CambridgePark Drive plaza, Courtesy of Arrowstreet.

Street-front retail uses further epitomize active neighborhoods. But the hard truth is that the circumstances that really enable these uses to succeed require more foot traffic than most people imagine is necessary. Considerable time was spent in these projects on planning first floor uses so they would be as active as possible, with street-side cafes anticipated primarily at plazas and principal intersections. The uses that are more realistically viable along streets between major intersections include indoor-outdoor amenity spaces, a community meeting room, and "bike cafes" (repair gear, places to relax) which all make for a much better scene than unleased storefronts.

Provisions for conversion to future retail use are included. There are several aspects of this location that can create greater future demand for such uses. As the plan below indicates, there are a couple of underutilized parcels in this area that have a good chance of drawing pedestrian-generating retail based on prime visible locations along Route 2 and proximity to the transit station. An additional commuter rail station is planned for the rail lines at the south of the Triangle. A third major stimulus to street front retail uses is the planned construction of a pedestrian bridge over the rail lines to the "Quadrangle," which is an area that has similar uses to the Triangle. Office workers and residents in the Quadrangle are highly likely to use the pedestrian bridge to reach the Alewife subway station (or future Commuter Rail station), and the residents of the Triangle are likely to use that bridge to reach the significant retail and recreational open spaces just to the south and east.

FIGURE 25: Nolli plan, Courtesy of Arrowstreet.

In an interesting evolution of the City's approach to activating the streets, when the first two projects on this site (160 and 130 CambridgePark Drive) were under review, the Planning Board required some at-grade units. In 2014, when 88 CambridgePark Drive was under review, the City decided to only allow non-residential uses—amenity-spaces, retail, and bike related uses—along the ground floor street edge.

B. Identity and Sense of Place created by Pedestrian/Bike/Universal Mobility.

Living and working within a 5 minute walk of a major transit node provides the underpinning for a community that is far less dependent on automobiles (which constitute helpful activity only at slow speed). Commuter rail, bus, and several pedestrian and bicycle arteries contribute to pedestrian/bike/universal mobility activity on the street. It is already evident that people who live here typically do not own a car, or if they do, they don't use it during the week. Bicycling has quickly developed into a viable alternative means of transportation in Cambridge; even winter cycling is growing steadily. (Bike rental systems such as Hubway are operating year-round in Cambridge.) This site is well connected to pedestrian and cycling paths, including the Minuteman, which enable safe and direct cycling connections to areas all over Boston.

A major initiative is the aforementioned construction of a pedestrian and bicycle bridge over the tracks to the Quadrangle area, regional shopping options, and major recreational open spaces. As part of the design of each development site along the rail right-of-way and

FIGURE 26: Entry corner of 130 CambridgePark Drive.

along the southern edge of the Triangle, buildings are designed to accommodate a connection to a pedestrian/bicycle bridge. The city is currently conducting a feasibility study to determine which location is optimal.

C. Identity and Sense of Place created by Architecture and Open Space.

Architecture and landscape architecture have a distinctive character that can help define a location-specific identity. This is particularly true if the architecture is reinforcing the quality of plazas, (i.e. open squares) which create a node of activity at the intersection of multiple streets. At 130 CambridgePark Drive, the strong red colors and architectural focus at the entry corner facades draw residents and visitors to the building and the new urban plaza. These, taken together, create the kind of sense of place that is crucial in this kind of intervention. It transforms undifferentiated urban asphalt into a living community.

Across the same plaza, which is a leading candidate for the terminus of the pedestrian/bicycle bridge, the architecture again offers a distinctive character and scale. It is a smaller size and brings its own civic presence, see Figure 26 above.

A topic of considerable discussion was how architecture can impart scale, through its massing (views through as well as views to). The use of different types of balconies and terraces to bring residents to the indoor/outdoor transitions on upper floors, as well as the ground floor, was central to the public discussion about how to develop a sense of community life and residential identity.

The appropriate location of hardscape plazas and green landscapes, especially in densely urban locations such as this, reinforces the sense of community. The design includes specially designed playgrounds for younger children and older children. The design features landscaping that is native and brings plant material and planting patterns associated with the wetland that is part of the larger landscape into the palette within the built-up areas.

FIGURE 27: Approach from Transit station to housing at 88 CambridgePark Drive.

The goal is a place that has character, where the architecture and landscape architecture supports the activities that make for neighborhood and community.

CONCLUDING SUMMARY

The Alewife Area of Cambridge embodies some of the most significant issues facing urban ecology today. How do we restore essential natural systems including wetlands in prime locations and provide compatible sustainable transit-oriented communities in locations where people want to live and work? The strategies recently put in place include public initiatives, private initiatives, and public-private cooperation to transform an asphalt-covered environment into wetlands that are an environmental and social resource. Though challenges will remain in the face of continuing climate change, the area as it is built out is making progress towards a more livable and more resilient community.

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