



CITY OF CAMBRIDGE
COMMUNITY DEVELOPMENT DEPARTMENT

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To: Planning Board
From: City Staff
Date: June 21, 2018
Re: **Douglas Brown, et al., Zoning Petition**

The Planning Board will conduct a public hearing of this zoning petition on June 26, 2018. The City Council's Ordinance Committee will hold a hearing on June 27, 2018.

The petition, submitted by a group of Cambridge residents, proposes to modify the boundaries and the requirements of the Flood Plain Overlay District in Section 20.70 of the Zoning Ordinance. The petition also proposes to create a new Section 22.80 (within Article 22.000, Sustainable Design and Development) entitled "Green Factor," which would establish a scoring system to be applied to projects subject to the Project Review Special Permit requirements in Section 19.20 of the Zoning Ordinance. Staff were not involved in the preparation of the petition, but it references some City-led planning initiatives that are currently underway.

The intent of this memo is to provide background information on planning topics that are identified in the petition, and to provide an overview of the effects that the petition might have. The following topics are addressed:

1. *Context*

- Current Flood Plain Overlay District provisions
- Current zoning and other city standards related to this topic
- Current planning initiatives

2. *Petition Review*

- Proposed amendments to Section 20.70, Flood Plain Overlay District
 - Boundary changes and affected areas
 - Procedural requirements
 - Reporting requirements
 - Land use and intensity
 - Development standards (dimensional requirements, parking)
 - Flood protection/stormwater standards
 - Heat mitigation standards
- Proposed new Section 22.80, Green Factor
 - Potential effects

3. *Summary of Issues*

This information was prepared by the Zoning and Development staff in coordination with other Community Planning, Urban Design, and Environmental and Transportation Planning staff within CDD, and in consultation with staff at the Department of Public Works (DPW) and Conservation Commission.

Current Flood Plain Overlay District

Like other overlay districts, the Flood Plain Overlay District adds to and modifies the requirements of the underlying zoning districts in specified ways. This overlay district is different from most other overlay districts in that its boundaries are established by reference to the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Authority (FEMA), instead of other zoning district boundaries, street centerlines, or lot lines. Due to its irregular shape, it encompasses all or portions of lots across various base zoning districts, and some other overlay districts (including the Alewife Overlay Districts and Parkway Overlay District).

The Flood Plain Overlay District was established in 1982, and was amended in 2010 following a revision to the FIRMs that are applicable to Cambridge.

Current Requirements

The current Flood Plain Overlay District applies a set of performance-based requirements and procedures intended to preserve the ability of the flood plain to carry and discharge flood waters. These requirements do not directly modify development standards regulated in base zoning, such as use, building dimensions, or parking.

Procedurally, most types of development activity in the Flood Plain Overlay District require a special permit from the Planning Board – including construction of new structures (of any size), alterations to structures, and earthwork. Residential buildings with one to three units are exempt from requiring a special permit, but must still meet the overlay district requirements.

Along with a general determination of conformance with applicable city planning goals and objectives, the Planning Board's approval is based on a technical analysis verifying that the project will provide compensatory storage for any displacement of water retention capacity within the 100-year flood plain, and encroachment of the floodway will not result in any increase in flood levels during the occurrence of the 100-year flood. The Applicant must provide a report from a certified engineer with the required documentation, which is reviewed by the City Engineer and Conservation Commission.

Separate from zoning requirements, the Conservation Commission administers the Massachusetts Wetlands Protection Act (310 CMR 10.0) by reviewing, permitting, and inspecting projects in or adjacent to Cambridge's wetlands, floodplains and water bodies, and plays an important role in implementing the Massachusetts Stormwater Management Policy and Standards. Often, the Planning Board refers to the Commission's Order of Conditions in the conditions of the special permit.

Other City Environmental Development Standards

Stormwater Management Standards

Stormwater management associated with development projects is regulated by different entities – Federal, state and local. The goals of these regulations are to address the quality of water runoff, the quantity of water to be handled, and the rate at which it is discharged to the receiving water body. Development projects provide opportunities to enhance stormwater management by implementing a

variety of strategies and techniques such as reducing the amount of impervious coverage, increasing infiltration, increasing storage during storm events, and treating water through various means before it is discharged.

Key stormwater requirements include the Massachusetts Stormwater Management Policy and Standards, Cambridge's Concord-Alewife Stormwater Management Guidelines, Land Disturbance Regulations, Wastewater and Stormwater Drainage Regulations, and Stormwater Quality Best Management Practices.

In the Alewife area, stormwater discharges to the Little River and Alewife Brook, then to the Mystic River and ultimately into the Boston Harbor. As discussed above, much of the area is located within the 100-year flood plain. While the existing public drainage system can adequately convey smaller storm events, for intense rainfalls and larger events the system surcharges can cause flooding, backups, and ponding in various locations throughout the watershed.

The following is a summary of standards that the City routinely applies to development in the Alewife area, and in most cases throughout the city.

- “25-to-2” Requirement: This is a Cambridge-specific performance standard that the post-development discharge hydrograph for the 25-year 24-hour rainfall event must be less than or equal to the 2-year 24-hour rainfall event pre-development. The difference in the runoff volume must be stored or recharged on site.
- Post-development peak discharge rates cannot exceed pre-development peak discharge rates. This must be verified for the 2-year, 10-year, 25-year and 100-year 24-hour storm events.
- Loss of annual recharge to groundwater must be eliminated or minimized.
- 80% of the average annual post-construction load of Total Suspended Solids (TSS) must be removed.
- 65% of phosphorous must be removed from stormwater being released to the receiving water bodies.
- Construction-related erosion and sedimentation must be managed during construction.
- A long-term operations and maintenance plan must be developed and implemented.

These requirements are typically met through a variety of measures, including infiltration systems, porous asphalt, bio-retention areas (including rain gardens), green roofs, proprietary media filters, deep sump catch basins, on-site stormwater storage, and others. Regular maintenance and documentation is required to ensure that the improvements continue to function as designed.

It is important to note that stormwater management is different from compensatory flood storage (as required in the 100-year flood plain), which is in turn different from protecting against future sea level rise and storm surge flooding. Though all these issues are affected by climate change, they are distinct concerns that require different approaches to be appropriately addressed.

Zoning and City Ordinances

The Zoning Ordinance, sometimes along with other city ordinances, contains other provisions that relate to environmental development standards, including the following:

- Green Building Review requirements (Section 22.20). These are based on the LEED rating system, which includes standards for heat island reduction and rainwater management.
- Requirement for a Tree Study and compliance with the Tree Protection Ordinance (Chapter 8.66 of the Municipal Code) for development subject to review under the Project Review Special Permit, Multifamily Special Permit, or Townhouse Special Permit authority. Compensation for significant tree removal must be provided by replacing the equivalent tree caliper on-site or contributing to a public tree planting fund.
- Requirements for green area and/or permeable open space through the base or overlay zoning district requirements.

Current Planning Initiatives

Climate Change Preparedness and Resiliency (CCPR) Plan

The City's CCPR Plan is based on some key concepts and facts, summarized as follows:

Plan Ahead for a New Climate: The climate is already changing and the best science tells us that it will continue to change in a warmer and wetter direction and probably those changes will accelerate. Climate change requires the city to plan ahead for different patterns of temperature, humidity, precipitation, and sea level than those that have occurred in the past.

Climate is a Moving Target: Because climatic patterns are no longer stable, there is no one set of average factors for temperature, humidity, precipitation, and sea level that can be assumed. Communities now have to plan for different conditions at different time scales. This is difficult and complex because the amount and pace of change depends very much on how much carbon pollution is emitted and accumulates in the atmosphere.

Climate Projections: The City chose to take a rigorous, science-based approach to plan for climate change. A Climate Change Vulnerability Assessment (CCVA) was conducted first, in 2015, to serve as the technical foundation for the CCPR Plan. Working with climate scientists, the CCVA projected temperature, humidity, and precipitation rates for a near-term (2030) and long-term (2070) climate scenario. The National Climate Assessment was used for assumptions about sea level rise. The scenarios also took into account how these projections might differ if global carbon emissions follow a low-emissions (based on the Paris climate agreement targets) or high-emissions scenario. For 2030, the emissions track does not make much difference in the projections. However, for 2070, the projections diverge based on the low and high emissions tracks.

Projected Impacts: The climate projections were used with other data and modeling techniques to map impacts. The CCVA mapped urban heat islands, urban street and riverine flooding, and storm surge flooding. The projected impacts, which were made assuming that no action is taken to manage them, found:

- The number of days over 90 degrees Fahrenheit will increase from an average of 11 days per year to over 30 days by 2030. By 2070, about two-thirds of the summer could be over 90

degrees. With more days over 90 degrees, the frequency and duration of heat waves (i.e., 3 or more days in a row over 90 degrees Fahrenheit) will increase.

- Urban heat islands will expand and become more intense.
- Riverine and street flooding from precipitation will expand and deepen.
- Storm surge flooding related to sea level rise will become a new risk in Cambridge by about mid-century and particularly impact the Alewife/Fresh Pond area.

The CCVA also provided some insights into the character of the climate risks Cambridge faces. Key points include:

- Heat vulnerability is the more imminent risk. The urban heat island effect can add 5 to 10 degrees Fahrenheit to ambient air temperatures.
- The Charles River Dam and Amelia Earhart Dam (on the Mystic River) effectively protect Cambridge from sea level rise and storm surge flooding until about mid-century, if sea levels rise about 1.5 feet by then.
- The duration of flooding, for both storm surge and precipitation events, is likely to be relatively short, probably on the order of a day. This depends on the continued operation of pumps at the two dams. If the pumps fail, then the duration and extent of flooding may be greater.
- The Alewife area is the most exposed to future storm surge flooding risks.
- Storm surge flooding will carry salt water, which creates additional risks for physical structures and electrical systems.
- Flooding will carry biological and chemical contaminants from sewer overflows and ground-based contaminants.
- Storm surge flood risks are a regional problem.

CCVA as Climate Stress Test: With the impacts mapped, the City conducted a “climate stress test” to gauge what would happen to Cambridge physically and socially if it experiences more heat and more water under current conditions. Key physical assets, such as infrastructure and critical community facilities, and demographic data were overlaid onto the climate impact maps to rate and rank their relative vulnerability to climate change impacts. The assets and neighborhoods with higher vulnerability were prioritized for the CCPR Plan.

Planning for Climate Risks: There are some key points to keep in mind as Cambridge plans for climate change impacts:

- Planning for climate risks involves reducing projected risks where possible and increasing resilience to remaining risks. For example, storm surge flood risks could be reduced by installing downstream berms and barriers. Urban heat islands can be reduced by reducing impervious surface area and adding vegetation and shading.
- While there tends to be a focus on disasters, changes to average daily conditions must be considered. For instance, the number of cooling degree days (i.e., the number of days that buildings need air conditioning) are expected to exceed heating degree days around mid-century. There will also be implications for outdoor thermal comfort, vegetation management, and other issues.

- Existing buildings face significant exposure to climate risks.
- Redevelopment offers the opportunity to improve the resilience of properties that are currently at risk. Retrofitting properties can be more challenging.
- Flood risks cannot be completely eliminated by storage, conveyance, and barriers.
- The cost of business disruption exceeds property damage.
- Nothing can be done directly to reduce ambient air temperatures, but the amplifying effect of urban heat islands can be reduced.
- To be effective in reducing urban heat islands and mitigating stormwater runoff, green infrastructure needs to be deployed at sufficient scale and in appropriate locations.
- Some neighborhoods and populations are more vulnerable to climate change impacts. Social factors such as income, age, language spoken, living alone, and health can affect vulnerability. Greater social resilience involves improving the economic status of individuals and households and building stronger social connections.

CCPR Strategies: To create a citywide plan, the City is first developing two neighborhood-scale plans to inform the citywide plan. A plan has been drafted for Alewife and the process to develop a plan for The Port is underway. The CCPR Plan is being organized around four categories of strategies: (A) Prepared Community (i.e., social and economic resilience), (B) Adapted Buildings, (C) Resilient Infrastructure, and (D) Resilient Ecosystems. Implementation methods for these strategies will include regulations, incentives, education, capacity building, public infrastructure, and regional collaboration.

CCPR Actions: While the development of the CCPR Plan is in progress, actions are being taken:

- Cambridge is working with the 14 other cities and towns that have joined the Metro Mayors Climate Preparedness Agreement. A regional scale plan is being developed for the Mystic River corridor to reduce storm surge risks and Cambridge has worked with Somerville to advocate for a design of Draw 7 Park in the Assembly Square area adjacent to the Amelia Earhart Dam to raise elevations to block storm surges in the future. The City is assessing opportunities on the Everett side of the dam for similar opportunities. Cambridge has also participated on an advisory committee for the Climate Ready Boston plan for a storm surge barrier at the Schrafft Center site that would help protect eastern Cambridge.
- The Public Works Department is beginning construction of a major storm water storage facility in The Port to reduce precipitation driven flooding.
- As part of the Fresh Pond Reservation improvements, the hummocks along Fresh Pond Parkway have been elevated to the 2070 1% annual flood elevation to serve as a possible flood barrier to protect Fresh Pond.
- The process for the first Urban Forest Master Plan for Cambridge has been launched, which will develop a detailed strategy to maintain the city's existing tree canopy and expand it.
- The City is engaging institutional, commercial, and residential property owners and developers through the Compact for a Sustainable Future. All CCVA data is shared to inform the development of resilience plans for campuses and other private land. MIT is in the process of modeling campus flood risks using the same methods as the City. Harvard has modified recent

construction projects based on CCVA flood risk data. The City is also engaging with the MBTA, Eversource, and DCR on climate resilience planning.

- The Compact is working with its members to foster stronger business continuity planning. For example, a tabletop exercise was held based on CCVA scenarios and focused on the potential for disruptions to business operations to inform planning for increased resilience.
- The Commonwealth of Massachusetts has designated Cambridge under its Municipal Vulnerability Preparedness (MVP) program. The City was awarded an \$118,000 MVP Action Grant to implement resilience projects.

New Development Standards: While the CCPR process is underway, the development review process allows the City to work with developers to reduce the likelihood and impacts of future flooding along with meeting the water management standards described further above. This process has provided an opportunity to implement key recommendations from the CCPR as they have been developed.

For example, an “Alewife Preparedness Handbook” was created through the CCPR process to provide guidelines for protecting against flood risk. The handbook contains the following guidelines for new buildings, which have been incorporated into the project review process for development in the area and have been integrated into the designs of recently-approved buildings in Alewife:

- “Build / protect” based on the 2070 10-year (10% annual probability) flood elevation from precipitation or sea level rise / storm surge, whichever is higher. In most cases, this means locating occupied space above the 10-year flood level.
- “Recover” based on the 2070 100-year (1% annual probability) flood elevation from precipitation or sea level rise / storm surge, whichever is higher. This means employing flood resistant design and construction standards below the 100-year flood level, and often means locating uses with a higher sensitivity to flooding – including dwelling units, mechanical systems, and some utilities – above the 100-year flood level.

Through the CCPR process, the City has also created an online [FloodViewer](#), which allows residents and property owners look up the present-day, 2030, and 2070 projections for 10-year and 100-year flood elevations due to precipitation and sea level rise / storm surge for a particular site.

[Additional information about Climate Change Preparedness & Resilience planning is available on the CDD web site.](#)

Envision Alewife

The CCPR planning process is being conducted in parallel with the “Envision Cambridge” citywide comprehensive planning process. As with the CCPR, an early phase component of Envision Cambridge is an area plan for the Alewife neighborhood, called “Envision Alewife.” The process is being led by CDD along with consultants Utile and an “Alewife Working Group” comprised of residents and stakeholders, which had its most recent meeting in May of this year.

As a comprehensive planning initiative, the Envision Alewife study covers a broad range of planning topics, including land use, economic development, housing, transportation and mobility, public space,

and urban design. The key objective that has emerged through this process is to create an identity and sense of place for the whole Alewife District in the following ways:

- Better integrate the district with the rest of the city through new walking and biking paths, streets, and open spaces.
- Ensure that both new development and existing infrastructure, neighborhoods, and community resources are prepared for climate change, in particular the challenges of flooding and heat.
- Encourage forms of development, a mix of uses, and a range of improvements that will facilitate and encourage walking, biking, and transit use and reduce the growth of vehicular trips.
- Ensure that new development benefits the adjacent residential neighborhoods by introducing new amenities and services and creating neighborhood destinations.

There has been extensive coordination between the CCPR process and Envision Alewife process, in order to ensure that the recommendations related to climate change preparedness and resiliency are considered as an integral component of the City's other planning goals for the area.

One particular benefit of this coordination is that it provides an opportunity to consider the urban design impacts of new climate change mitigation strategies. One of the ongoing issues in Alewife has been the tension between the area's current urban design guidelines, which encourage buildings with active uses meeting the street, and the City's climate change preparedness standards, which often result in built spaces being raised above grade. The Envision Alewife study has considered both of these issues and has recommended approaches to building design that are intended to serve both objectives.

For example, in the Quadrangle area, Envision Alewife recommends a uniform "ground floor" elevation of 4 feet above grade, so that new buildings are built at a consistent level that is above the recommended flood elevation, and recommends sloped front yards or raised plinths (as opposed to exposed parking or other building structure) to promote visual and physical connections between the public street and ground floor spaces. Other measures are being considered to encourage a mix of uses in the area, including light industrial uses in the parts of the area where such uses still exist, while also mitigating climate change impacts.

[The latest zoning recommendations from the Envision Alewife process can be viewed in a presentation online.](#)

Proposed Amendments to Section 20.70, Flood Plain Overlay District

Boundary changes and affected areas

Currently, the Flood Plain Overlay District is coterminous with Zones A and AE (i.e., the “100-year” or 1% annual probability flood) as delineated on Middlesex County FIRMs. The petition proposes to expand the boundaries of the Flood Plain Overlay District by adding the following areas (see proposed additions to Section 20.72):

- Zone X (500-year / 0.2% annual probability flood) as delineated on Middlesex County FIRMs.
- Areas identified as having 1% annual (“100-year”) probability of flooding due to precipitation in 2070 according to the City’s Climate Change Vulnerability Assessment (CCVA).
- Areas identified as having 0.2% annual (“500-year”) probability of flooding due to sea level rise or storm surge in 2070 according to the CCVA.

The attached maps attempt to illustrate these combined boundaries, using information provided by the City’s engineering consultant for the CCVA.

According to the maps, roughly 6,000 of the roughly 13,000 land parcels in the city (about 46%) would lie partly or wholly within the proposed Flood Plain Overlay District. These parcels, in total, comprise just over 70% of the city’s total land area. In some cases, only a small portion of the parcel intersects with the district, and it is not clear whether some of the proposed requirements would apply to the entire parcel or to the portion that is within the proposed boundaries. The current Flood Plain Overlay District boundaries intersect with 261 parcels (approximately 2% of total).

As discussed further below, some of the procedural requirements of the Flood Plain Overlay District (in its current and proposed versions) differ for single-family, two-family, or three-family residential lots. Roughly 4,000 of such lots intersect with the proposed boundaries, or about 43% of the roughly 9,000 such lots in Cambridge. Among other types of parcels, roughly 2,000 out of 4,000 (about 50%) intersect with the proposed boundaries.

The proposed overlay district boundaries cover various other base and overlay zoning districts across the city; the current Flood Plain Overlay District affects only a small number of other districts. By adding new requirements across a broader set of other zoning districts, it can be more difficult to assess the full range of impacts, since it is necessary to compile the requirements of all base and overlay zoning districts in order to determine what is required for a particular lot.

The proposed boundaries are based on modeling projections that were intended to provide information about the relative flood vulnerability of particular sites (for example, through the aforementioned FloodViewer tool), and as a result, the boundaries are not as clear or precise as other zoning boundaries. It could be difficult for property owners to determine whether or not they are affected, and there could be further uncertainty if the models are revised over time.

Also, the proposed boundaries combine areas that currently perform the function of carrying and discharging flood waters, areas that are at risk of future flooding due to precipitation, and areas that are at future risk of storm surge flooding, categorizing all such areas as a “flood plain.” As noted above,

these different types of flooding require different approaches for protection and mitigation, and grouping them into a single category could result in the application of standards that are not appropriate to the type of flooding that is anticipated in a given area.

Procedural requirements

The petition would continue to require a Planning Board special permit for nearly all types of construction activity on a lot, including small and large structures, substantial modifications, and earthwork (Section 20.73). By expanding the boundaries of the district, many additional cases could require Planning Board review. Because there is significant time and expense involved in seeking a Planning Board special permit, property owners might be discouraged from making smaller improvements if they are not necessary or would not significantly increase the value of the property. This could also create additional permitting hurdles for projects intended to improve climate change resiliency, such as flood control berms and pavement removal.

As is currently the case in the Flood Plain Overlay District, single-family, two-family, and three-family residences would not be required to seek a special permit from the Planning Board. However, they would need to meet the existing and proposed standards otherwise applicable in the district (Current Section 20.73.1).

The petition states that a variance from the Board of Zoning Appeal (BZA) would be needed to diverge from the district standards, and proposes unique standards for granting such a variance. This raises potential concerns because the standards for a variance are based in state law. It is more common for overlay districts to allow the Planning Board to permit divergences from district standards, if Planning Board review is required. Otherwise, many cases would require both Planning Board and BZA review, increasing the length and uncertainty of the permitting process.

The petition retains the requirement for Conservation Commission review of a proposal (current Section 20.74.1, with additional provisions in proposed Section 20.75, paragraph 7). Within the current boundaries, projects in the Flood Plain Overlay District also fall within the jurisdiction of the Conservation Commission, but under the proposed boundaries, Conservation Commission reports would be required for projects that are not within the Conservation Commission's jurisdiction.

Reporting requirements

The petition adds a list of additional required reports (Section 20.75, paragraph 8) for development in the Flood Plain Overlay District, including a site hydrology report detailing impacts on surrounding properties, a report on soil/groundwater testing for potential contaminants, a stormwater plan, an emergency plan, and a tree study.

The stormwater plan and tree study are already required in some form for projects requiring a Project Review Special Permit; however, these would not currently be required for smaller improvements or alterations. These reports are provided to the Planning Board, but it is generally within the purview of the Department of Public Works (DPW) to determine whether the project conforms to the applicable standards.

The other proposed reports, while not currently required, have sometimes been requested by the Planning Board for particular projects. Emergency plans would normally be reviewed by city departments rather than the Planning Board to determine whether applicable guidelines are being met. Reports on soil conditions have been requested on rare occasions; however, soil remediation is regulated by the state Department of Environmental Protection (DEP) and it is not specified in the petition how these reports would factor into the Planning Board's review of a project. From a land use planning perspective, the existing soil conditions are the same regardless of what new uses are proposed, and it is through the development process that many contaminated sites are likely to be remediated.

As with the procedural requirements, the cost and effort required to produce these reports might be prohibitive in the case of smaller-scale construction, improvements, or alterations.

Land use and intensity

The petition does not explicitly change the allowed uses in the Flood Plain Overlay District, and does not change the allowed scale and intensity of use, which is usually regulated by Floor Area Ratio (FAR) limitations in the base or overlay zoning.

However, the proposed requirements could have substantial indirect impacts on use. The petition (Section 20.721, paragraph 2) would prohibit what are described as "Flood Design Class 4" structures, which include hospitals, fire/police stations, emergency vehicle parking, emergency shelters, emergency operation centers, power generating stations and other public utilities, fuel or water storage tanks, as well as facilities with "hazardous materials." This could create a non-conformity issue for some existing facilities that are affected by the proposed expansion of the overlay district – for example, Fresh Pond Reservation, which contains the City's water treatment facilities.

There are other elements of the petition that could have indirect impacts on allowed uses. For instance, provisions related to "hazardous storage and waste" (proposed Section 20.720) prohibit materials including benzene, chlorine, and "other such materials as determined by the relevant City authority," and prohibit storage below flood levels of unspecified "larger quantities" of substances including petroleum products. These limitations could affect laboratories, fuel stations, the City's water treatment plant, and other existing uses throughout the affected area. Proposed restrictions on unsecured materials could impact existing businesses that store building materials on-site. There could also be significant impacts on the viability of future industrial uses, which have been identified through the Envision Alewife process as a priority for economic development in the "Quadrangle" area.

Development standards

The petition proposes new prescriptive development standards, which are not included in the current Flood Plain Overlay District. It is difficult to assess the full range of effects of these proposed new standards, since they would need to be applied along with existing base and overlay district standards for each individual lot. However, staff have attempted to summarize the proposed changes below. The impacts can greatly differ depending on the particular location and characteristics of a lot.

Yards (Setbacks), Open Space, and Trees

The petition proposes new requirements for setbacks (Section 20.77), open space (Section 20.710), permeable area (Section 20.711), and tree canopy coverage (Section 20.712) that would, in most cases, be more restrictive than base zoning. Within the base zoning districts, these standards tend to vary in order to fit the expected patterns of development in that district. A single, uniform set of standards across a large area could have unanticipated effects on those development patterns, particularly in higher-intensity districts.

The table below relates the proposed standards to the range of standards applicable in other districts.

Standard	Current Zoning (Overview Only)	Proposed Zoning
Setbacks	Mostly determined by formula based on building height and length; front yard ranges from 5 feet (high density) to 25 feet (low density) in residential districts; sometimes zero in commercial districts. 15 feet minimum (front) in Alewife Overlay Districts.	25 feet
Open Space	Ranges from 10% (high density) to 50% (low density) in residential districts; sometimes zero in commercial districts. 15% minimum in Alewife Overlay Districts.	30%
Permeable Area	Ranges from 5% (high density) to 25% (low density) in residential districts; sometimes zero in commercial districts. 25% minimum in Alewife Overlay Districts, may be reduced if Concord-Alewife stormwater guidelines are met.	30%
Trees	Some development requires mitigation for tree removal per Tree Protection Ordinance; some districts require street tree plantings.	30% canopy coverage

While there are benefits to increasing open space, permeable area, and vegetation, there might be challenges in meeting all of these proposed standards on a given lot. For example, a 25-foot setback requirement would be much more difficult to meet on smaller lots than on larger lots. It also might not be practical to accommodate equal amounts of tree canopy coverage and open space on a lot, given that it is not clear how tree canopy coverage would be measured – at the time of establishment or accounting for future growth – and the density of tree coverage could interfere with some of the functional requirements proposed for the open space on a lot, which are discussed further below.

There would also be conflicts between the proposed 25-foot setback requirement and the urban design standards being recommended through the Envision Alewife process, which suggests a vision for urban development where buildings create a more continuous street frontage and engage more directly with streets and public spaces, similar to historic development in other parts of Cambridge. The goal is to foster a pedestrian-friendly realm that promotes street-level activity.

Another proposed standard (Section 20.712) would require a “tree hearing” for removal of existing trees above 6” caliper. It should be noted that the removal and replacement of trees on private property is currently controlled by the Tree Protection Ordinance, which is referenced in the Zoning Ordinance but is a separate chapter of the Municipal Code. The City has hired a consultant and appointed a study committee to develop an Urban Forestry Master Plan, using a data-oriented process to make recommendations on a range of measures, including potential changes to the Tree Protection Ordinance. A “tree hearing,” as it is commonly known, refers to the requirements of Massachusetts General Laws Chapter 87 for the removal of public shade trees, but not trees on private property.

Building Elevation and Height

One way that the petition addresses flood risk is through requirements for the elevation of structures and certain building functions in relation to modeled flood elevations. There are several different standards referenced in different sections of the petition, including the following:

- The following areas must be above the “highest” 500-year flood elevation: lowest finished floor of interior space, critical mechanical and utility systems, emergency building access/egress, hazardous/volatile materials storage “including fuel in vehicles,” utility shut-offs and disconnects (Section 20.75, paragraph 10).
- The lowest floor must be elevated two feet above the 500-year flood elevation (Section 20.714).
- Critical facilities must be elevated three feet above the 500-year flood elevation (Section 20.714).
- Ground floor ceiling heights must be 15 feet or higher (Section 20.715).
- Residential units must be located on the second floor or higher (Section 20.715).

These overlapping standards are not consistent in all cases. Although it is generally assumed that the most restrictive standards would control, the inconsistencies may cause confusion. It is also not specified in some sections which “500-year flood elevation” is being referenced.

In general, these standards take a similar approach to the guidelines being developed through the CCPR process by recommending that certain measures be taken to protect and recover from different anticipated flood levels. However, the proposed flood levels and resulting elevations are significantly higher than the City’s recommendations based on the latest vulnerability models and preparedness plans (described on pages 4-5).

The 0.2% annual (500-year) anticipated 2070 flood levels due to sea level rise and storm surge are not currently available for each lot using the FloodViewer tool, so it is difficult to make a precise comparison. To provide some illustration, in the Alewife Quadrangle area, the 0.2% (500-year) elevations can be over one foot higher than the 10% (10-year) elevations, which are the City’s recommended “protect”

elevations. Based on the CCPR guidelines, Envision Alewife has recommended building ground floors at a uniform 4-foot elevation above grade. Per the petition, if the lowest floors are required to be 2 feet above the predicted 0.2% annual levels, the lowest floors of buildings could be required to be more than 7 feet above grade.

The proposed prohibition on “fuel in vehicles” below the 500-year flood elevation could be interpreted to require the lowest levels of any structured parking to be built several feet above grade, which could make it more difficult to provide access and egress. It would also result in structures with enclosed or unenclosed empty space at grade. Requiring the elevated lowest floor to have a minimum 15-foot height, and allowing residential units only on the second floor, would require any residential space to be even further separated from the ground level.

As well as creating limitations on new development, these standards could make many properties non-conforming. In existing neighborhoods, all residential ground floors would become non-conforming, even if those ground floors are above anticipated flood levels. Bringing existing structures into conformance would require extensive alterations in many cases.

The effects of these standards would also be in tension with the city’s urban design objectives, which encourage pedestrian-friendly streetscapes with active uses on the ground floors, and parking located below-grade or shielded from view where possible. Like the proposed setback and open space requirements, these standards would also conflict with the Envision Alewife urban design objectives by further separating occupied spaces from the public realm.

The petition does provide a form of relief by allowing building heights to be “measured relative to grade or 500-year flood elevation” and by allowing existing buildings to be raised “by right” to meet the proposed standards (Section 20.714). The Planning Board would be allowed to waive other applicable height limitations if other requirements (including FAR limitations) are being met (Section 20.728). In cases where such relief could be practically used, it is likely to result in a wide variation in potential building heights, depending on the dimensions of lots. Along with setback and open space requirements, it could result in a “tower in a park” pattern of development that varies from the city’s current urban design objectives, which prefer pedestrian-friendly buildings with active ground floors, as well as the specific urban design outcomes suggested by the Envision Alewife process, which imagines a more continuous urban street frontage.

Some limitations of the building code might also make it infeasible or impractical to apply this relief – for instance, even if the zoning definition of building height is altered, the building code would still impose limitations based on the measurement of height from grade.

Parking and Access

The petition proposes waiving requirements for parking and establishing maximum limits (Section 20.718), which is also the overall approach recommended in the Envision Alewife plan. The proposed maximum parking ratios of 0.5 space per unit for residential uses and one space per 1,500 square feet (or 0.66 space per 1,000 square feet) for non-residential uses are lower than the Envision Alewife recommendations of 0.75 space per unit and 0.5 to 1.5 spaces per 1,000 square feet (depending on the

exact use type), respectively. While there is consistency in the overall goal of lowering the amount of parking, a potential concern is that setting the limits too low in relation to market demand could make redevelopment economically undesirable, and incentivize property owners to retain their existing parking facilities rather than redevelop them.

The petition also prohibits development on “dead-end roads” and requires “direct and contiguous dry land access” to sites (Section 20.722). These requirements may be difficult to enforce, because they are not conditions that would be under the property owner’s control. The petition allows some relief if rescue can be provided by “wheeled vehicles” or shelter-in-place options are available for the duration of a flood event, but the intensity of such an event is not specified.

Flood protection/stormwater standards

Many of the proposed dimensional standards discussed in the prior section are intended to address flood risk. The petition also proposes some performance-based standards in addition to those applicable in the current Flood Plain Overlay District. A general issue with this approach is that the current requirements of the Flood Plain Overlay District – to provide compensatory flood storage and not to impede the flow of flood waters – might not be applicable or reasonable in areas where the main concern is flooding due to precipitation or storm surge.

The proposed standards requiring building sections below the 2070 1% flood elevation be designed to “recover” from a flood event, and requiring flood resistant design and construction measures for sections of buildings below that elevation (Section 20.715), are generally consistent with recommendations developed through the CCPR process.

Some requirements would add performance standards to the required open space and permeable components of a site, including a minimum depth of “structural soil” (Section 20.711) and the requirement that at least half of compensatory flood storage be provided within the open space, because “underground storage tanks have fixed volumes that cannot receive additional flood water in flood events larger than accommodated by the design and cannot adapt to increased flooding volumes caused by changes in climate” (Section [20].716). The petition would further require that “any fixed volume structure used for the remaining compensatory storage shall be 50% larger than the volume it is required to hold as required by Section 20.75(2),” along with other specific provisions whose practicality and effectiveness would need to be examined (Section [20].716). Dimensionally, these requirements would add to, and in some cases might impact the feasibility of, the proposed requirements for setbacks, open space, permeable area, and trees.

In addition, while open space, trees, and vegetation can provide benefits for water management and heat island mitigation, they do not necessarily provide greater capacity than other methods. “Green infrastructure” solutions may have distinct advantages, but they still have limited capacities, the same as other types of infrastructure. These capacities can be further constrained by high water tables and slow-percolating soils, which are characteristic of areas like Alewife. Furthermore, as noted previously, it is important not to conflate the issues of compensatory flood storage, stormwater management, and storm surge protection, which require different infrastructure solutions. These measures would not necessarily mitigate storm surge flooding.

The petition would require a special permit to install “permanent flood barriers, berms, levees, walls, gates, or other flood control structures,” due to potential adverse impacts on neighboring properties (Section 20.719). This provision could impact the City’s ability to install flood control measures that are in the public interest and might otherwise serve the objectives of the petition, such as protection of Fresh Pond or area-wide protective measures.

Heat mitigation standards

The aforementioned requirements for setbacks, open space, and tree canopy are also intended to provide mitigation from the urban heat island effect. While maximizing vegetation and minimizing pavement are noted as effective ways to lower temperatures, it is important to consider whether the total set of requirements can be met in a practical way, or if the requirements would discourage redevelopment that might improve the current condition of lots that contain surface parking or other large non-vegetated areas.

The petition provides for some non-vegetated cooling measures by requiring “cool roofs” (Section [20].717), which are recommended by the Envision Alewife and CCPR plans and have been required in other areas of the city. Other non-vegetated cooling measures, such as shading devices, are not referenced in the petition, but there are some current provisions in Article 22.000 of the Zoning Ordinance.

The most novel approach included in the petition is the proposed “Green Factor” calculation (Section 20.727 and Section 22.80, discussed further below), which addresses the objective of urban heat island mitigation by evaluating the amount and type of vegetation on a lot. However, because there are still many questions about the specific values and factors involved in the calculation, it is not clear what the effect of a “0.35 Green Factor Score” would mean in terms of practicality or effectiveness in meeting the city’s objectives.

Proposed New Section 22.80, Green Factor

Conceptually, the “Green Factor” section of the petition would be an innovative approach to quantifying various natural features that promote environmental sustainability on a developed lot. It proposes an accounting system that would evaluate green space (of varying soil depth), plantings, trees, green roofs, vegetated walls, native species, pervious paving, harvested rainwater irrigation, rain gardens and bio-retention areas, and urban agriculture.

As proposed, the “Green Factor Score” is essentially a weighted average combining the quantity and quality of vegetated areas and other natural features on a lot, and dividing by the total area of the lot. In some ways it is similar to the “open space ratio” calculation in zoning, except that instead of simply dividing total open space area by total lot area, it gives more “weight” to open space areas with more plantings, trees, water retention features, or other preferred characteristics. It also provides a way to account for green roofs and vegetated walls, which are not counted in current zoning definitions of open space.

This approach has been used in other communities. [Most notably, the City of Seattle’s web page contains helpful information about their Green Factor calculation and how it has been applied.](#) The City of Somerville, MA, is also proposing a Green Factor as part of its zoning ordinance overhaul. The specific provisions of the current petition appear to be modeled after the Somerville proposal, though there are some differences.

Potential Effects

The petition would insert the “Green Factor” section into Article 22.000 of the Zoning Ordinance, which also contains the Green Building Requirements and other sustainable design and development standards. The petition would require the calculation of a “Green Factor Score” for all development subject to the Project Review Special Permit requirements. However, except in the Flood Plain Overlay District (as noted above), no specific standard or “target” score is proposed.

Because the calculation combines many complex and varied components to arrive at a single value, the most challenging issue is to assess whether the different factors are calibrated to provide values that are meaningful and that produce desirable and practical outcomes. It would be helpful to learn more about the reasoning that led to the factors and values being proposed. Some other key questions to explore include the following:

- Do the proposed multipliers for various “green factors” align with the city’s environmental and resiliency objectives? For example, is it appropriate for vegetated walls to be given more weight than green roofs? Are there factors that aren’t included that should be accounted for?
- Can the proposed formulation be applied equally across all lots? For instance, if preservation of existing trees is given significant weight, does it become too onerous for a lot with no existing trees to meet the same standard?
- How would the Green Factor Score relate to other, prescriptive zoning requirements, such as open space and permeability ratios? Would the prescriptive requirements determine the majority of the Green Factor Score? If so, would this provide enough of an incentive to achieve better quality outcomes?

Additional study would also be needed to determine how to apply and administer these standards. For example, the City would need to develop landscape “eligibility and quality standards” for plantings and would need to provide a way to determine “tree canopy at maturity” for various different tree species.

Summary of Issues

While the subject matter of this zoning petition is related to the work of the City's Climate Change Preparedness & Resiliency (CCPR) planning effort, the specific proposal raises many potential concerns that deserve careful consideration, including the following:

- Expanding the Flood Plain Overlay District in the manner proposed would greatly increase the number of parcels that are partly or wholly within the district, from about 261 to 6,000 or more (around 46% of all parcels in the city), making many more properties subject to new requirements and lengthy permitting procedures for nearly all types of construction activity, including new construction, alterations, and earthwork, at both large and small scales.
- Because the proposed district boundaries are based on estimated projections, rather than precise reference lines, there could be uncertainty as to what exact areas are included in the district and how changes to those projections might affect zoning requirements in the future.
- The new development standards proposed for the expanded Flood Plain Overlay District would impose many new requirements for land and buildings that are more restrictive than current zoning and the development guidelines developed through the CCPR process thus far. These standards could result in many non-conforming conditions for existing buildings and lots.
- For new buildings and uses, the proposed standards could be prohibitive for uses that are otherwise allowed in the base districts and might not be feasible for many types of new construction. The uncertainty of the petition's impacts might stop or delay projects that are currently in process, even small-scale construction or alterations. The proposed standards would also diverge from some of the city's general urban design objectives, such as encouraging active ground floors.
- The proposed standards may conflict with the land use and urban design objectives being developed through the "Envision Alewife" process, which include a more urbanistic "streetwall" design for new buildings and the retention of industrial uses in portions of the area. The CCPR and Envision Alewife processes are being closely coordinated so that climate change impacts and urban design can be addressed in an integrated way.
- The "Green Factor" provision is an innovative idea that has some potential benefits, but further study and testing is needed to determine whether the calculations are calibrated to achieve practical results that are aligned with the City's objectives.