



Weston & Sampson Engineers, Inc.
Five Centennial Drive
Peabody, Massachusetts 01960-7985
www.westonandsampson.com
Last saved by Mark P. Mitsch
Tel: (978)532-1900 Fax: (978)977-0100

Innovative Solutions since 1899

MEMORANDUM

TO: Washington Park Condominium Association
FROM: Weston & Sampson Engineers, Inc.
DATE: July 19, 2010
SUBJECT: Flood Mitigation Alternatives
c: file

In accordance with our proposal Weston & Sampson Engineers, Inc. (Weston & Sampson) has completed wetland flagging, conducted a site topographic survey and prepared a survey base plan for the Washington Park Condominium Association property, and identified flood mitigation alternatives for the Washington Park property in Andover, Massachusetts. This memorandum describes several potential flood mitigation alternatives, our opinions regarding the advantages and disadvantages of each, including environmental permitting implications, relative costs, and the ease of deployment and demobilization among other factors.

SITE SURVEY PLAN

The accompanying drawing C-1, "2010 Site Survey Plan," documents existing topographic conditions and site features at the Washington Park site. Elevations shown on the Plan are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29), which is Mean Sea Level of 1929. It is important to know the datum of elevation information on the drawing and to be sure other elevation information is converted to the same datum when comparing to the drawing, particularly where potential flooding is concerned. For instance, you have to add 0.797 ft. to an elevation that references the North American Vertical Datum of 1988 (NAVD88) to convert it to an elevation referencing NGVD29.

FLOOD MITIGATION OPTIONS

Flood mitigation measures at any Massachusetts locatoin fall under the jurisdiction of several agencies, including:

- the Federal Emergency Management Agency (FEMA) and U.S. Army Corps of Engineers (USACE) at the national level,
- the Massachusetts Departments of Environmental Protection (MADEP) and Conservation and Recreation (MADCR) at the state level, and
- the Andover Conservation Commission and local building codes at the local level.



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During personal communication, the State Hazard Management Officer, Richard Zingarelli, of the MADCR, revealed that mitigation measures within a floodplain are largely, though not entirely, overseen by local conservation commissions and building codes. Personal communication with Bob Douglas, Director of the Andover Conservation Commission, confirmed this, citing Washington Park's location within the 100-year flood zone, its location within the 100-foot buffer zone of the Shawsheen River and the presence of wetlands surrounding the property.

Potential flood mitigation alternatives would appear to fall under three broad categories: those designed to control flooding across the entire Washington Park property, those that shield individual buildings from floodwaters, and those that block individual doorways, windows, and other entry points. A summary table of these three categories appears below, followed by a brief discussion of each alternative.



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Alternative Analysis Summary Table

Scale	Alternative	Advantage	Disadvantage	Relative Cost
Property	Property floodwall or berm	No assembly or demobilization Maintains emergency access	Significant permitting issues Requires creation of floodplain off site	"Very expensive"
	Re-grade around building clusters	No assembly or demobilization	Significant permitting issues May require floodplain creation Emergency access impacted	"Expensive"
Building	Temporary flood barrier around individual buildings	Mild permitting issues Relatively inexpensive	Requires assembly and demobilization Limited emergency access Significant on-site storage of equipment Emergency access impacted	\$150,000-250,000
Entryways	Temporary flood barriers in individual doorways and windows	Minimal permitting issues Relatively Inexpensive Limited onsite storage required	Some assembly and demobilization Emergency access impacted Potential fire code issues	\$50,000-100,000

Property-scale Alternatives

Preliminary analysis suggests that flood mitigation alternatives designed to protect the entire Washington Park site, such as construction of a concrete floodwall or a reinforced earthen berm around the entire property would be relatively expensive and face significant permitting difficulties. Based on the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973, states and, in turn, municipalities, are required to limit new construction or significant improvements to existing structures in flood-prone areas that would raise the local base flood elevation. By constructing a permanent barrier around the Washington Park property, the Shawsheen River would be denied access to its floodplain in that area, causing flood elevations to rise upstream and downstream of the site. For this reason, permanent property-scale alternatives would be very difficult to permit.

One potential solution to the issue of removing the Shawsheen River's floodplain at Washington Park would be to create an equal or greater floodplain area elsewhere. Bob Douglas, well aware of the flooding issues face by Washington Park, acknowledged that some discussions had been held within the Conservation Commission about the possibility of extending the Shawsheen's floodplain within the Town-owned land across the River from Washington Park. However, any alteration of that Town-owned land to increase the Shawsheen's floodplain area would come at a significant cost.

However, large-scale alternatives are certainly not without their advantages, namely the safeguarding of emergency access routes from Main Street to the various Washington Park facilities during flood conditions as well as the permanent nature of such alternatives, requiring no assembly or demobilization.

A second large-scale flood mitigation alternative would be to re-grade the property in such a way that clusters of buildings were protected from flooding. For instance, the Jefferson, Groton, and Hamilton buildings are clustered closely together as are the Franklin, Exeter, and Dover buildings. By re-grading the area surrounding those building clusters, those buildings may be more permanently protected from flooding. However, according to Bob Douglas, such a mitigation alternative would likely still face significant permitting hurdles due to their "permanent" nature and large scale. In addition, such an alternative would not preserve emergency access routes and would be relatively expensive in comparison to other smaller-scale alternatives.

Building-scale Alternatives

Building-scale alternatives would consist of erecting a temporary flood barrier around each individual building during significant flooding events. Several such barriers are available, including the Water-Inflated Property Protector system offered by Hydro Response, Ltd. or Aqua Dams offered by Albion Water Structures, Ltd. among others. These systems broadly consist of water-filled bladders that act as temporary barriers to floodwaters. Such systems are sold in a

variety of sizes, ranging from 1-10 feet in diameter and in sections of 10 to 300 feet. Sections may be overlapped or otherwise coupled to create a barrier capable of protecting entire buildings. Based on conversations with the Andover Conservation Commission, such an alternative would avoid much of the permitting difficulty faced by the larger-scale alternatives due to its “temporary” and building-specific nature.

In addition, based on a very rough cost estimate, this alternative would likely be relatively inexpensive compared to property-scale flood mitigation measures. Weston & Sampson conducted that cost estimate based on spot elevations we collected of the lowest doorway or window in each residential building, measured building perimeters, and the highest 100-year base flood elevation listed for the entire Washington Park property with the Town offices, approximately 38.5 feet NGVD29.

Building Number	Building Name	Lowest Door or Window El. (ft NGVD29)	Lowest Floor Elevation (ft NGVD29)	Depth of Flooding (ft)	Depth to Floor (ft)	Building Perimeter (ft)
257	Concord	40.99	36.81	-2.49	1.69	346
247	Andover	40.17	37.09	-1.67	1.41	358
237	Bradford	38.51	35.39	-0.01	3.11	364
100	Plymouth	38.97	NA	-0.47	NA	301
90	Newton	38.94	NA	-0.44	NA	302
80	Hamilton	37.83	NA	0.67	NA	466
70	Franklin	37.90	NA	0.60	NA	470
60	Groton	37.83	NA	0.67	NA	466
50	Jefferson	37.51	NA	0.99	NA	513
40	Manchester	37.78	NA	0.72	NA	527
30	Lexington	38.14	NA	0.36	NA	582
20	Exeter	37.52	NA	0.98	NA	445
10	Dover	37.56	NA	0.94	NA	445

Building is expected to flood during a 100-year event.

Based on the values above, and providing for a small buffer between any temporary barrier and the nearest building wall, a temporary, building-specific alternative could be purchased for between \$150,000 and \$250,000. It should be noted that this cost estimate is highly simplified and fails to consider several potential sources of additional cost, including issues regarding the use of flood barriers on grass rather than concrete and the velocity of floodwaters through the area. Also not considered are the impact of flooding-induced saturation of the nearby soil and subsequent infiltration of the buildings through means other than doors or windows, particularly relevant to the Concord, Andover, and Bradford buildings due to the bottom floor lying below grade. This cost estimate also does not specifically include costs associated with deployment, maintenance, storage, and replacement. In addition, the flood depths used in the cost estimate are based on the existing 100-year base flood elevation. Several municipalities within Massachusetts currently face proposed changes to those elevations, though no such changes appear imminent for the Town of Andover at the time of writing. Despite these unknowns, this alternative would

appear to be less expensive than larger scale alternatives. However, building-specific flood barriers would not preserve emergency access routes, would require significant assembly and demobilization efforts, and would require significant on-site storage when not in use.

Entryway-scale Alternatives

A final set of alternatives are those that provide a flood barrier at individual doorways, windows, and any entryways through which floodwater might infiltrate the residential buildings of Washington Park. As with the building-scale alternatives, such entryway flood barriers bypass many of the permitting obstacles of the property-scale alternatives and could be implemented at a relatively low cost. These entryway barriers generally consist of a reinforced metal plate mounted to posts or joists that are securely anchored on either side of every at-risk doorway and window with a sill elevation below the 100-year base flood elevations. Many such door and window barriers exist, such as Door Dam offered by Presray Corporation and Flood Barrier offered by Zero International among others. Such entryway barrier panels are sold in a variety of sizes ranging from 10 to 36 inches in height and 28 to 50 inches in width. In addition, panels can also be readily connected to provide longer barriers or can be special ordered for irregular sizes.

As with the building-scale alternatives described above, these entryway-scale alternatives offer a “temporary” and “building-specific” solution that would likely avoid many of the difficult permitting issues associated with the large-scale alternatives. Alternatives such as the Door Dam or Flood Barrier systems are also relatively inexpensive. A rough cost estimate, based on the flood depths shown above and a count of at-risk doors and windows estimated with bird’s eye and street level photography available online, suggests that an entryway-scale alternative could be purchased for between \$50,000 and \$100,000.

Again, several unknowns are not factored into that cost estimate, including the potential for soil saturation-induced infiltration of water through openings other than doors or windows, as well as those costs associated with installation, deployment, maintenance, storage, and replacement of the barriers. In any case, these products would seem to offer the least expensive alternative, the shortest assembly and deployment times, the smallest storage requirements, and the fewest permitting obstacles. However, this alternative impacts emergency access in and out of individual buildings, would require installation of the anchoring/sealing posts, and might represent a fire code issue if low-lying windows were blocked by flood barriers.

In conclusion, Weston & Sampson evaluated several flood mitigation alternatives for the Washington Park site. That preliminary evaluation suggests that property-scale alternatives are cost-prohibitive and would face significant permitting issues. In contrast, building- and entryway-scale alternatives would avoid many of those permitting difficulties and would be significantly less expensive.