January 19, 2021

BY ELECTRONIC MAIL ONLY

Belmont Zoning Board of Appeals
Belmont Town Hall
455 Concord Avenue
Belmont, MA 02478

Re: Application for Comprehensive Permit – 91 Beatrice Circle, Belmont

BUILD WISE BELMONT POSITION STATEMENT
IN REBUTTAL TO ATTORNEY HALL'S ANALYSIS

Dear Members of the Board:

On January 13, 2021, a group of neighbors organized under the name Build Wise Belmont ("BWB") submitted a Position Statement articulating the grounds for the Zoning Board to invoke the "general land area minimum" ("GLAM") safe harbor under Chapter 40B in response to the Project. Attached to the Position Statement was an Excel spreadsheet containing the calculations that supported the position that subsidized housing exists on sites comprising 1.5% of more of the developable land area in Belmont. Section 20 of Chapter 40B states that where a municipality surpasses this GLAM threshold, any decision made a board of appeals on a comprehensive permit application will be deemed "consistent with local needs" and upheld as a matter of law.

In the Position Statement, BWB acknowledged that the state Department of Housing and Community Development ("DHCD") has guidelines to enforce the GLAM provision of the statute and its counterpart in the Chapter 40B regulations, and that these Guidelines restrict a town's tallying of the numerator and denominator in this calculation in several material ways. BWB further explained that certain provisions of the GLAM Guidelines are susceptible to legal challenge, where they seem to limit a town's ability to achieve this safe harbor in ways that are inconsistent with the primary source of law, the statute. Regardless, our calculations made *within* the dubious framework of the GLAM Guidelines established that the Town had a good faith argument to at least invoke the safe harbor before next week's deadline set by DHCD in its Chapter 40B regulations.

Yesterday afternoon BWB received an 8-page opinion letter from Town Counsel George Hall, disagreeing with BWB's GLAM conclusion and challenging several assumptions made in BWB's Excel spreadsheet. Attorney Hall is relying on adjustments to BWB's figures made by the Town's Community Development department. BWB has reviewed each of the issues Attorney Hall has raised, and BWB respectfully disagree with his position.

I. NUMERATOR REBUTTALS

A. All 13.2 Acres of the Royal Belmont Project Should Count

First, Attorney Hall's position as to how much acreage could be assigned to the Royal Belmont apartment project off of Acorn Park Drive aligns with the comprehensive permit applicant, 91 Beatrice Circle, LLC (the "Applicant"). He states on page 4 of his letter that the eligible area to be counted under the GLAM Guidelines, in consideration of the "directly associated" provisions, is only "6.5 – 7.2 acres, not the 13+ acres used by BWB." Attorney Hall's reasoning is that "portions of the site consist of wetlands and wooded areas that are not actively maintained for the use of benefit of residents of the development," and therefore must be excluded from the numerator. With respect to both, the analyses by Attorney Hall and the Applicant are incorrect.

The Royal Belmont, formerly known as the "Belmont Uplands" project, was permitted under Chapter 40B by the ZBA in 2007. A copy of the ZBA's comprehensive permit is attached as Exhibit A for your reference. As the ZBA observed in its decision, the Belmont Uplands site was originally re-zoned for commercial use in 2002 at the request of the 40B developer, and as part of that re-zoning, the developer had agreed to restrict a significant amount of land "to mitigate the expected consequences of development of the Property." The ZBA approved the comprehensive permit in 2007 on the express condition that the open space on the project site be permanently restricted, but perpetually maintained in accordance with an Open Space Maintenance Plan that was prepared by the developer.

The Open Space Maintenance Plan, which is attached as Exhibit B, requires the property owner to perform regular maintenance on all of the 7.91 acres of open space (some of which is in Cambridge), which include (1) evaluation and control of invasive species, (2) installation and maintenance of various habitat enhancements, (3) forest management per Massachusetts Forestry Best Management Practices Manual, and (4) trash collection and periodic clean-up – the site collects litter being one of the few undeveloped areas adjacent to Route 2 and other densely developed urban property.

Contrary to Attorney Hall's opinion, the GLAM Guidelines do not mandate the exclusion of the Royal Belmont's open space from the numerator, and in fact the Guidelines, in the definition of "directly associated area," specifically contemplate that "actively maintained wooded and vegetated areas" associated with a project *would* be included in the eligible land area. Attorney Hall did not explain in his opinion why the Royal Belmont open space, which must be actively maintained as a requirement of a permit issued by this Board, cannot be counted in the numerator. BWB strongly asserts that this open space is a directly associated area and should be counted in the numerator.

B. **59 Pearson Road Should be Included in the Numerator**

Attorney Hall believes that the .71-acre lot at 59 Pearson Road should be excluded from the numerator. This lot apparently contains the office for the Belmont Housing Authority, and is part of the Housing Authority's Belmont Village complex containing 100 affordable housing units. The Belmont Village complex appears on the Town's assessor's database as 50 separate land parcels, but it is, functionally, one large development. Notably, DHCD's Subsidized Housing Inventory (Exhibit C attached), lists Belmont Village as one project, with an address of 59 Pearson Road. It is therefore confusing why the Town is taking the position that the lot with an address of 59 Pearson Road is not properly included. Common areas and community facilities that are components of affordable housing projects are expressly included within the definition of "directly associated area" under the GLAM Guidelines. **Excluding this land from the numerator is simply unjustified and inconsistent with the GLAM Guidelines.**

C. **The Group Home Acreage From Belmont GIS Should be Counted in Full**

All of the land area statistics used in the Excel spreadsheet developed by Max Colice come from the state's or town's Geographic Information System sources, as required by the GLAM Guidelines. The Guidelines require towns to submit their supporting documentation to DHCD in a GIS format, not assessor's maps. For the group home units on the Town's SHI, the acreage (1.479 ac) was determined through Belmont's GIS system, not from the assessment records. Yet, the Community Development ("CD") department apparently tallies the land area of the group homes using assessment records, to come up with 1.38 acres. Curiously, The CD department identified 8 separate properties, while we identified 7. Regardless, the Town must not use assessment records where the Guidelines call for GIS records, and the Town must not shortchange itself.

II. DENOMINATOR REBUTTALS

A. **Total Land Area, Public Rights of Way, and Water Bodies**

Similar to I(C) above, the Town and CD have erroneously utilized the Belmont assessor's database to calculate Total Land Area, Public Properties, Public Rights of Way ("ROW"), and Water Bodies – and in so doing, they have shortchanged the Public ROW by almost 60 acres. This is erroneous.

BWB, on the other hand, has utilized the Massachusetts Department of Transportation ("MassDOT") GIS database, which the Guidelines mandate must be used. **BWB respectfully submits that the Town and CD must use the MassDOT GIS data, which is more accurate and is in conformity with the Guidelines.**

B. **McLean Hospital**

The Town and CD included two subdistricts from the McLean Hospital Property (totaling over 57 acres) in their denominator. BWB respectfully asserts that this is done in error.

BWB excluded these two subdistricts in its denominator because these subdistricts are not zoned for commercial, industrial, or residential use. In his Memorandum, Town Counsel points out that, apparently, there is no case law indicating that non-profit research and development or a non-

profit psychiatric teaching hospital would not be treated as a commercial use. However, BWB is not aware of any HAC guidance indicating that these uses could be considered commercial. Furthermore, BWB's reading of the Town's zoning bylaws indicates that any commercial, industrial, or residential use of these subdistricts would require a variance. **Therefore, a more reasonable interpretation is that the 57 acres on the McLean Hospital should be excluded from the denominator.**

C. **Private Land Subject to Conservation Restrictions**

Town Counsel points out that excluding privately owned land that is subject to statutory conservation restrictions would be "an aggressive interpretation of the *regulations*." BWB respectfully disagrees. The *regulations* do not address privately owned land that is subject to statutory conservation restrictions. The technical instructions to the Guidelines, which do not have the force of law, address this point. As Town Counsel points out, the HAC has rejected similar arguments in the recent Arlington and Braintree decisions. But these decisions are not final decisions—they have not been adjudicated by any court yet. And state law prohibits development of this area, regardless of local zoning bylaws.

BWB respectfully asserts that the Town should strive to exclude privately-owned Conservation Restriction land - aggressively – until a Court of law determines conclusively that it should not be excluded.

In closing, Town Counsel suggests that the financial cost to the Town could be great by invoking Safe Harbor and enduring resultant litigation. BWB would advise the Town not to be penny-wise and pound foolish. It is just as likely that the legal fees the Town may incur will be dwarfed by other costs to the Town resulting from this project, such as upgrading the water and sewer lines to the project, trash and recycling, and others.

Respectfully submitted,

/s/ Build Wise Belmont

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EXHIBIT A

DECISION

TOWN OF BELMONT, MASSACHUSETTS
ZONING BOARD OF APPEALS

DECISION UPON APPLICATION OF
AP CAMBRIDGE PARTNERS II, LLC
FOR A COMPREHENSIVE PERMIT

FEBRUARY 16, 2007

PROCEDURAL HISTORY

1. On or about December 16, 2005, AP Cambridge Partners II, LLC (the "Applicant"), applied for a Comprehensive Permit, pursuant to Massachusetts General Laws Chapter 40B ("Chapter 40B" or the "Act"), to construct 299 units of rental housing on the west side of Acorn Park Drive in Belmont, Massachusetts (the "Project"). The Project site is within a larger parcel of land containing approximately 12.9 acres in Belmont (the "Property") and an additional 2.7 acres of land in Cambridge, Massachusetts (the "Cambridge Area"). The Property is known as Map 40, Block 1, of the Belmont Assessing Department Records. The Project is identified as "The Residences at Acorn Park" located on the south side of Frontage Road and the west side of Acorn Park Drive in Belmont, Massachusetts.

2. The Zoning Board of Appeals (the "Board"), opened a duly advertised public hearing on January 11, 2006 and continued the public hearing to the following dates:

February 15, 2006	September 5, 2006
March 22, 2006	October 4, 2006
May 4, 2006	November 1, 2006
May 31, 2006	December 6, 2006
June 28, 2006	January 3, 2007
July 26, 2006	

3. On January 3, 2007 the Board closed the Public Hearing and entered into deliberations.

4. On January 17, 2007, January 24, 2007, January 30, 2007, February 6, 2007, February 7, 2007, and February 12, 2007 the Board conducted public meetings to deliberate on this application for a Comprehensive Permit (the "Application"). The Applicant granted the Board an extension of time up to 5 P.M. on February 16, 2007 to file a written decision on the Application. On February 16, 2007, the Board voted to grant the Comprehensive Permit subject to the conditions listed below.

5. A list of the letters, reports, plans and emails received by the Board and made a part of the record is attached as Attachment B.

6. The Board retained the following consultants to assist in the review of the Application:

Civil Engineering Review: Fay, Spofford & Thorndike
Burlington, MA

Environmental Review: (sub-contractor to FST)	Wetlands & Wildlife, Inc. Ashburnham, MA
MHP Fund: (Ch. 40B Advisor)	Michael Jacobs MHJ Associates Brookline, MA
Transportation Review:	BSC Group Boston, MA

7. In addition to having copies of the complete application available for public review at the Belmont Public Library, 336 Concord Avenue and at the Office of Community Development, 19 Moore Street, consistent with the provisions of Chapter 40B, Section 21, the Board notified the following boards, committees, and commissions of the filing of the Application by sending a copy thereof to such local boards for their recommendations, all of which have been made a part of the record of these proceedings and have been taken into consideration by the Board in rendering its decision.

Board of Selectmen
Board of Health
Planning Board
Conservation Commission
Historic District Commission
Fire Department
Police Department
Department of Public Works
Housing Trust
Building Commissioner
Uplands Advisory Committee

FINDINGS - GENERAL

1. The Applicant is qualified pursuant to 760 Code of Massachusetts Regulations ("CMR") 31.10 in that the Applicant:

a) is or will become a "limited dividend organization" as that term is used in Chapter 40B, Section 21 and 760 CMR 31.01 in that prior to the issuance of a Building Permit it will execute a Regulatory Agreement that shall require the limiting of its profits on this Project to an annual return on equity no greater than 10%.

b) has a determination of Project Eligibility (Site Approval) dated February 11, 2005 from MassDevelopment regarding use of the MassDevelopment Tax-Exempt Bond Program for Rental Housing establishing fundability by a subsidizing agency in compliance with 760 CMR 31.01(1)(b).

c) has control of the site as that term is used in 760 CMR 31.01 in that a copy of the deed has been provided showing transfer of ownership from Arthur D. Little Real Estate Corporation to the Applicant, dated June 24, 1999, and recorded in Middlesex South District Registry of Deeds at Book 30386, pages 240 - 243.

2. Based on the evidence presented by the Applicant, local boards and officials, various consultants, and interested parties at the Public Hearing, the Board finds as follows:

a) The Town of Belmont (the "Town") has not met the statutory minimum set forth in Chapter 40B, Section 20 or 760 CMR 31.04 in that (i) it does not have 10% of its total housing units available to low and moderate income households, (ii) affordable housing is not located on sites comprising 1 ½% or more of the total land area zoned for residential, commercial or industrial use, and (iii) the development of affordable homes consistent with the Application will not result in the commencement of construction of such housing on sites comprising more that 0.3% of such land area or ten (10) acres, whichever is larger, in any one calendar year.

b) If the Applicant complies with the conditions set forth in this Decision, and only if it complies with those conditions, the Project will adequately provide for traffic circulation, storm water drainage, sewage disposal, water, open space and the environment without an undue burden on, or a threat to the public health and safety of, the Project's occupants, the surrounding neighborhood, the Town or the Town of Arlington.

c) The Project is supported by the evidence and, as conditioned below, (i) would represent a reasonable accommodation of the regional need for low and moderate income housing, and (ii) would be consistent with local needs within the meaning of Chapter 40B, Section 20.

FINDINGS - SITE SPECIFIC

3. The Property was rezoned in 2002 at the Applicant's request from a General Residence Zoning District (two-family residential) to the Belmont Uplands District, a Zoning District that was designed specifically for the Property and consists solely of the Property. In the Belmont Uplands District, only non-residential uses are allowed, particularly, office, research and development, open space, and accessory uses. At the time of the rezoning, the Applicant indicated the intent to construct at the Property a four-story office/lab building with an accessory parking structure.

4. As a result of this rezoning, Section 6B was added to the Zoning By-Law of the Town (the "By-Law"). The dimensional regulations of Section 6B were based upon the particular features and conditions of the Property and the Cambridge Area and reflect valid health, safety, environmental, and other local concerns as to the development capacity of the Property and the Cambridge Area.

5. In connection with such rezoning, the Applicant and the Town entered into a certain Memorandum of Agreement dated May 28, 2002, and recorded with the Middlesex South District Registry of Deeds in Book 35716, Page 594 (the "MOA"). In consideration of the rezoning, the Applicant agreed in the MOA to a number of conditions, each designed to mitigate the expected consequences of development of the Property. According to the MOA, the obligations of the Applicant under the MOA shall run with the land.

6. The Applicant agreed in the MOA to preserve certain portions of the Property and the adjacent land in Cambridge as open space pursuant to a Conservation Restriction and Easement.

Although a metes and bounds legal description of the land subject to such Conservation Restriction may not have been completed, the boundaries of the restricted land were sufficiently established so that the Applicant's engineer could plot them on a plan included in the record of this Application and determine the area of the restricted land.

7. The Project encroaches in the southern and western directions into the land shown as restricted under the MOA, which encroachments, given the environmental sensitivity of such land and its proximity to resource areas, the Board finds material. Absent a release by the Town of the land subject to such encroachments, the Board raised the question of the authority of the Applicant to make any use of such land in a manner inconsistent with the Conservation Restriction, such as for any building, parking, or services areas of the Project.

8. The dimensional regulations of Section 6B and the conditions of the MOA were an integral part of the rezoning. The Applicant relies upon the rezoning in determining the acquisition value of the Property in its financial projections submitted by the Applicant to the Board.

FINDINGS - WASTEWATER

9. One of the gravest issues presented by the Project is the sewage it will generate in light of the existing sewage problems in the area during storm events. This issue was the subject of a great deal of discussion at the hearings with testimony from the public, the Applicant's consultant, Mr. Sullivan of Rizzo Associates ("Rizzo"), and the peer reviewer, Mr. Gould of Fay, Spofford & Thorndike ("FST"), who is also the Town's consultant on wastewater issues. Rizzo and FST also presented a number of written analyses. As discussed below, the Town sewer system in the adjacent area has adequate capacity to accept the additional flow during ordinary conditions. However, the nearby areas suffer "sewage discharge events" – backups – in severe storms. Numerous residents, particularly from Oliver Road and Frost Road, testified to backups over the past few years from personal experience. While the Applicant is not responsible for these existing problems, any worsening of the problem due to the Project would increase the exposure of the residents in nearby areas to raw sewage in their homes and pose a severe public health problem.

10. The projected average daily flow from the proposed 463-bedroom Project is estimated at approximately 51,000 gallons per day under Title 5 (which assumes 110 gallons per day per bedroom), but both Rizzo and FST agreed that the projected actual average daily flow is approximately half of the Title 5 number, or 25,500 gallons per day. The MOA regarding the rezoning of the Property contemplated a Title 5 average daily flow of 18,375 gallons, so it appears that the Project will generate slightly less than three times the amount of wastewater projected for the Office/R&D project contemplated by Section 6B of the By-Law.

11. The Applicant proposes to provide sewer service by the construction of a pump station and a force main along Acorn Park Drive, Frontage Road, Lake Street and Garrison Road. The force main will connect to the Town of Belmont gravity sewer at the intersection of Garrison Road and Gilmore Road. This 8" gravity sewer flows from Gilmore Road to Oliver Road and into a 15" gravity sewer in Brighton Street before discharging into the 36-inch MWRA Belmont Branch Sewer at the intersection of Brighton Street and Flanders Road. Approximately 80% (60 miles) of Belmont's sewer system is tributary to the Flanders Road connection. The 15" connection on Brighton Street is located at the furthest downstream point in the system.

12. FST constructed a computer model of the existing gravity sewer sub-system tributary to the Brighton Street connection. Based on flow-monitoring and MWRA data, FST modeled the peak flow during normal conditions with the addition of the proposed flow from the Project. FST concluded (6/23/06 letter and attachments) that during normal conditions the existing gravity sewer has sufficient capacity to accept the additional flow. However, during a storm event, the existing sewer experiences surcharge conditions (that is, exceeds capacity and backs up) without the Project and lacks capacity to accept the additional flow. In sum, without mitigation, the addition of the Project wastewater will make the existing problems worse in storm conditions.

13. Three principal ways of addressing the Project's wastewater were discussed during the hearings.[1] First, there was possibility of avoiding any Belmont connection by running the sewer from the Project to the Discovery Park pump station just south of Acorn Park Drive in Cambridge. The wastewater from that station flows through an 18" sewer which connects to the 30" branch of the MWRA Belmont Branch sewer in Cambridge approximately 2,800 feet downstream from Brighton Street. Both Rizzo and FST agreed (Rizzo 12/5/06 letter and 12/6/06 hearing; FST at the 1/3/07 hearing) that with such a connection the Project would have a "virtually negligible" impact on Belmont. Mr. Gould stated that this alternative would avoid the impact of the Project on Belmont, although it would not improve the existing situation. However, the City of Cambridge has not indicated any willingness to agree to such a connection. Since neither the Board nor the Applicant has the ability to require Cambridge to agree to such a connection, this potential solution – while preferable – is hypothetical. The Board decided to encourage the Applicant to pursue this approach by condition, but it cannot rely on it.

14. Second, the Applicant proposed and FST recommended negotiation of a payment to the Town to fund an infiltration/inflow ("I/I") removal program to help offset the proposed peak flows. FST estimated the Town's present actual cost of removing I/I to be $1.50 per gallon and stated that on projects it had been involved in the removal ratio ranged from 4:1 to 10:1. The McLean project provided I/I mitigation at a 5:1 ratio, while the MOA provided for I/I mitigation based on the Title V number, a 5:1 removal ratio and a removal cost of $1.26 per gallon. Municipal policy for I/I included a 5:1 ratio in 2004 (OCD letter 5/20/04). According to FST (7/26/06 hearing), the I/I ratio is greater than 1:1 because inflow accumulates faster than sewage. Based on the comments on the draft conditions, the Applicant is willing to accept an I/I mitigation based on Title V flows, a 5:1 ratio, and a $1.50 per gallon cost. While there were discussions of other formulas for I/I, FST stated there was no precedent for them. The Board decided to require by condition an I/I payment based on Title V numbers, a 5:1 removal ratio and the present $1.50/gallon removal cost. The Applicant's I/I payment will be $382,500, except as provide in condition 28.

15. While an I/I mitigation payment would potentially remove infiltration and inflow from the Town's sewers and help offset the new wastewater from the Project, it is not in itself a solution. The additional sewage from the Project would still add to the overload on the sewers during storm events, when the existing system is at capacity and inflow is fastest, and the I/I payment is not targeted to these

[1] At the hearings, there was also discussion of installation of a pump in the Winn Brook area to alleviate backup problems, but FST (6/28/06 and 7/26/06 hearings) stated that this would merely move the problem from one part of the system to another. There was also discussion of the size of the 8" sewer from Gilmore to Oliver Road, but FST said that this sewer has adequate capacity: the problem is the wet weather flows from Belmont and other towns as it reaches the MWRA connector. The location of the Project is not the problem, and bypassing Oliver Road would not change the situation. A similar addition to wastewater elsewhere in Town would have the same effect.

events. In sum, this proposed mitigation, while helpful, does not directly address the critical issue of avoiding additional wastewater impact on the Town sewer system during storm events.

16. Third, the Applicant proposed to provide a holding tank to hold wastewater when the Belmont sewers approach surcharge condition. As outlined by Rizzo (11/1/06 and 12/6/06 hearings), the holding tank would have a 25,000-gallon capacity to hold one day's worth of wastewater from the Project. This approximately 10' by 45' concrete tank would be located under the parking lot to north side of the site in an area outside of the 100 year floodplain. There would be a sensor at Brighton Street that would be triggered when the flow in the 36" pipe reaches a 30" level, before the pipe reaches capacity and creates surcharge conditions. FST confirmed at the 1/3/07 hearing that when the sewer level is at 30" it is within capacity so that there would be no surcharge. When the meter is triggered, the wastewater flow from the pump station at the Project would be diverted into the holding tank. When the level in the sewer fell below the trigger level, the wastewater would be redirected to the Belmont sewer, and the holding tank would gradually empty into the sewer. If the wastewater is diverted into the holding tank for long enough to approach capacity, the holding tank would be pumped out by a septage hauler. The Applicant proposed to include this on-call service as part of its contract with a trucking company.

17. Rizzo supported this approach with an analysis of the length of surcharge events over the past five years from MWRA flow metering data (11/27/06 email). Based on data from 10/1/01 to 10/1/06, Rizzo identified eight periods when the flow in the 36" interceptor pipe flow exceeded 35", one of which (5/13-14/06) lasted over 24 hours. Using the more conservative 30" surcharge trigger level, Rizzo identified 15 surcharge periods, two of which (5/13-15/06 and 4/1-2/04) lasted more than 24 hours (26:15 and 43:30, respectively). Based on that analysis, Rizzo contended that a holding tank capacity at the 24 hour flow amount was reasonable. Rizzo stated that this was not a new technology, and the septage hauler would be placed "on alert" when a sensor in the holding tank showed that the holding tank had reached a percentage of capacity. Rizzo added that avoiding overflow would be a top priority since backup due to a full holding tank would be onsite.

18. FST reviewed and agreed that the analysis and recommended tank size were reasonable (12/1/06 email), although it noted that (a) the Applicant would need to have a septage hauler available to pump out the tank as necessary if the capacity of the holding tank is exceeded by an event lasting more than 24 hours, and (b) operating protocols and "SCADA" systems/instrumentation will be needed to activate the system. FST stated (1/3/07 hearing) that it was satisfied that the tank is large enough, and that the Title V numbers are based on private residential flows that contain an "inherent multiplier" so that half of the Title V average daily flow is an appropriate size. Review of the 100 year floodplain (at 8.2') shows that the holding tank can be located in the parking lot and that access from Frontage Road and Acorn Park Drive will not require going into the 100 year floodplain.

19. In light of FST's agreement with Rizzo's analysis, the Board was inclined to adopt a condition requiring a 25,000-gallon capacity holding tank and the septage hauler contract as proposed. However, the Board was informed by staff that the MWRA requires septage haulers to dispose of pumped septage in the municipality where the septage originated. This raised a significant concern because 80% of the Belmont system flows to the Flanders Road connector. Disposal of septage pumped from the Project's holding tank into the Belmont system during surcharge conditions would merely replicate the surcharge problem the holding tank/septage hauler contract was intended to mitigate. In these circumstances, the septage hauler trucks would have to hold the septage until the end of the

surcharge event: they would thus function as ancillary holding tanks, not an alternative method of disposing of the septage. Given that there will be periods when the capacity of the 25,000- gallon capacity tank is exceeded (as shown by the Rizzo analysis of the 2001-2006 period), the Board concluded that the 25,000 gallon capacity tank is too small. Having trucks filled with septage parked at the Project (or elsewhere in Belmont) until the surcharge event ended might be acceptable during rare events, but it is not a reasonable solution where it would have been required twice in the past five years. The Board, accordingly, concluded that the holding tank(s) should have a capacity of at least 50,000 gallons (two days of Project wastewater) so that surcharge events like those during the 2001-2006 analysis period would not require use of the septage hauler trucks as ancillary holding tanks.

20. As the I/I payment and the holding tank(s) are mitigation measures that to some extent overlap, the Board determined that a limited deduction from the I/I payment to reflect at least part of the capital costs of the holding tank(s) is appropriate.

21. The other main wastewater issue concerned the size of the force main and the pump station. FST reviewed the pump station wastewater flow calculation and design, including the peaking factor used to account for peak flows in the mornings or Super Bowl half-time. FST expressed concern over the size of the force main and the pump. Based on Technical Report #16, Guides for the Design of Wastewater Treatment Works ("TR-16"), by the New England Interstate Water Pollution Control Commissioner, an accepted industry standard for the design of wastewater systems, FST recommended (5/17/06) that the minimum force main diameter be 4" and that the pump be capable of passing a minimum 3"-diameter sphere. Rizzo contended that TR-16 permits use of smaller sizes for small residential systems and asserts that based on the 25,500 gallons per day estimated flow a 3" force main and a pump capable of passing a 2 ½" diameter sphere are sufficient. FST responded (7/25/06 letter and 7/26/06 hearing) that not adhering to the guidelines will likely result in the need for increased maintenance and will reduce reliability. In response to concerns expressed at the hearings, FST also noted (7/25/06) that the pumping station will have two pumps (one for operation and one for backup, although they will exchange roles) and further recommended that the pumping station have emergency power to avoid overflow risk in the event of a power outage. The Applicant agreed (7/26/06 hearing) that there will be two pumps and backup power.

22. The proposed pumping station itself will only store a few hundred gallons of sewage (FST 7/25/06), so that reliability of the pump station is critical. While the redundant pump and backup power address this issue to some extent, FST is of the view that the larger force main and pump will improve reliability by minimizing the potential for clogging and recommends them under the TR-16 industry standard. The Applicant (7/26/06 hearing) advised that the additional cost of the larger pump would be less than $50,000. The reliability is of concern even though the Applicant will be responsible for maintenance of the privately owned force main and pump. The Board accordingly determined to require the larger pipe and pump, as recommended by FST, by condition.

FINDINGS - ENVIRONMENT

23. The Application proposes five buildings (A-E) and a total of 337,884 s.f. of gross floor area ("GFA"). The western half of the Project would be surrounded by a fire road constructed using a pervious paving system. At a point, the proposed fire road behind Building B would abut the Wetlands Protection Act's 200' riverfront buffer zone of the Little River. Building B would be approximately

300' long on the side facing the River. At its closest point, Building B would be only 220 feet from the River.

24. The Project would be located squarely in the middle of the forest and surrounding ecosystems. See Epsilon's Open Space Maintenance Plan (2002) (Figure 4) and Rizzo Associates' Conservation Restriction Limits Comparison (sheet CR-1) (6/5/06). It would severely fragment that environment and habitat.

25. In the Public Hearing, the Belmont Conservation Commission submitted comments to the Board expressing serious concerns about the impacts of the Project on the surrounding environment. It noted that:

> the site ... provides a vital link to the urban greenway which connects the Little River, Alewife Brook, Aberjona River, and the Mystic River to the Charles River Basin. The area is already heavily developed except for this Greenway and segmenting the green space diminishes its value to wildlife and pollution mitigation.

The Commission also noted that Little River/Alewife Brook is an impaired water body requiring a Total Maximum Daily Load Limit because of a variety of pollutants. It expressed concern that the runoff from the parking lots, via swales, detention and/or retention basins, would further degrade the water quality.

26. The Belmont Planning Board recommended that, in view of the Town's Open Space Plan of 2001, the Project be required to meet the dimensional regulations in Section 6B of the By-Law. Those regulations are a minimum open space of 65%, maximum lot coverage of 20%, maximum impervious surface of 35% and maximum GFA of 245,000 s.f.

27. The Belmont Board of Selectmen submitted comments supporting the "smallest possible development", in part because of the sensitivity of the site.

28. Other participants in the Public Hearing also objected to the impacts the Project would have on the surrounding environment. For example, the Mystic River Watershed Association echoed the characterization of the site as part of a significant greenway and habitat corridor. It also noted that "uplands abutting wetlands provide a greater range of habitat than wetlands alone, by allowing some animals who need uplands, or both wetlands and uplands, to live there" (citing its publication *An Alewife Area Ecology Guide* (Cambridge; Arthur D. Little, Inc., 1994). MyRWA also submitted its observations of water quality in the Little River and surrounding water bodies, as well as data on the pollutants in typical run-off. It noted that, for example, under DEP's Stormwater Policy, roof water is considered clean and can be infiltrated directly but often contains elevated levels of nutrients and heavy metals.

29. Most comprehensively, the non-profit organization Friends of the Uplands submitted extensive materials describing and documenting the habitat, pollution filtration and other ecological values of the Uplands, and the impacts of fragmentation and other intrusion. The Board received into the record of this Application all of these materials and finds them to be significant evidence of the environmental sensitivity of the site.

30. Based on all the evidence, including that submitted by the Applicant's consultant Epsilon, the Board finds that the silver maple forest on and adjacent to the site is remarkably intact for this region

and constitutes a rare monoculture; it is an important food source; the mixed hardwood forest and the adjacency of the two forest types is rare (perhaps unique) in the Boston area; and the wildlife includes such diverse and ecologically valuable species as otter, mink and fox; and that wildlife depends on the uplands as well as wetlands parts of the site and surrounding area. The Board walked the site and observed the condition of the forest. Based on all the evidence, the Board finds that the site constitutes an important component of contiguous regional open space and wildlife corridor, and the silver maple forest and other ecosystems on the site provide valuable wildlife habitat (both uplands and wetlands) and long-term filtering of pollutants.

31. The Board also finds that the Project would, even beyond its footprint, inevitably impair those functions and degrade the quality of the ecosystems on the site. Its impacts would be most acute between Building B and the Little River. Because of the size, orientation and proximity of that building, it will present a four-story wall of windows and noise to the riverfront area. Added to that would be significant light and noise from its parking garage, recreation on and off the fire road, and other spillover impacts. Some of the degradation might be gradual and long-term, but it would be inevitable.

32. The Board acknowledges the Conservation Restriction (the "CR") proposed by the Applicant, a small part of which would cover the area between the Project and the Little River. However, the CR would not prevent, or even mitigate, the impacts from Building B and the fire road, described above. Moreover, it would not prevent impacts to the environment from permitted uses of the CR area itself, which are likely to lead to trampling, littering and noise within and beyond the CR area.

33. The Board also acknowledges Epsilon's Open Space Maintenance Plan prepared for the R&D project in 2002. However, the Board believes that such Plan, parts of which are inapplicable to the Property and the Project, would not effectively protect these resources by itself.

34. Finally, the Board understands that the Project would not actually encroach into the riverfront area or violate any state or local regulations regarding wetlands or uplands. Nevertheless, it would blink reality to believe that the Project, and Building B in particular, would not degrade the nominally-protected ecosystems on and next to the site. The Board does not believe that such wishful thinking is required by Chapter 40B, and it unanimously finds that the Project is larger and more dense than appropriate for the site.

35. The Chapter 40B regulations, 760 CMR 31.07(2)(b), state that:

> If a town ... attempts to rebut the presumption that there is a substantial regional housing need which outweighs local concerns, . . .
> (b) the weight of the local concern will be commensurate with ... the degree to which the natural environment is endangered ... and the degree to which the local requirements and regulations bear a direct and substantial relationship to the protection of such local concerns....

36. The Board unanimously concludes that, in order to be consistent with local needs, several conditions are required to protect the surrounding open space and habitat, particularly in the direction of the Little River. It is requiring the Applicant to prevent or minimize the impacts of the Project in that direction by including the conditions set out in this Decision regarding pets, lighting, fencing, a trail/kiosk/parking area and other issues.

37. The Board considered requiring that the Project, and specifically Building B, be moved farther from the Little River and the riverfront area. Such a condition would address those resources most directly. However, the Board is unable to determine how much farther would be necessary to protect those resources more fully or what level of protection is significant for their healthy functioning. In those circumstances, the Board felt constrained that it lacks the authority under decisions of the Housing Appeals Committee ("HAC") to require that the Project be reduced or moved significantly.

38. The Applicant recently recalculated the Project's open space and impervious surface coverage by including the Cambridge Area, pursuant to Section 6B of the By-Law. Based on that recalculation, the Project would comply with the By-Law minimum of 65% open space. It still would slightly exceed the 35% maximum impervious surface coverage regulation (35.23%), but the Applicant withdrew its request for a waiver of that regulation. The Board also considered the rear setback and GFA regulations in Section 6B of the By-Law. It again felt constrained that conditions based on those regulations would be difficult to defend under HAC decisions, even though they would help preserve not only the off-site resources threatened by the Project but also part of the silver maple forest on the site.

DECISION

Pursuant to Chapter 40B, the Board, after Public Hearing and findings of fact, grants a Comprehensive Permit to the Applicant for the construction of no more than 299 rental units, with associated infrastructure improvements, subject to the conditions listed below.

CONDITIONS

1. (A) Except as more particularly provided for in this decision, including these conditions ("Decision"), the Project shall be constructed in conformance with the following plans of record ("Project Plans"):

   a. Residences at Acorn Park, prepared by Rizzo Associates, dated December 6, 2005, revised June 26, 2006 (except as noted below) submitted as part of the Comprehensive Permit Application. Said plans include:
      - Sheet C-1: Existing Conditions Plan
      - Sheet C-2: Layout and Materials Plan (dated September 5, 2006, with revised Zoning Summary Table submitted to the Board on February 12, 2007)
      - Sheet C-3: Grading and Drainage Plan
      - Sheet C-4: Erosion Control Plan
      - Sheet C-5: Utility Plan (as marked July 26, 2006 to reflect discussions with Fire Department)
      - Sheet C-6: Landscape Plan
      - Sheet C-7: Lighting Plan
      - Sheet C-8 through C-10: Construction Details
      - Sheet C-11: Water and Sewer Extension Plan (as marked July 26, 2006 to show redundant water mains)
      - Sheet C-12: Surface Parking Cross Sections
      - Sheet C-13: Fire Truck Turning Plan
      - Sheet A-1: Architectural Site Plan, prepared by ADD, Inc (dated 5 December 2005)

- Sheet A-2: Typical Building Plans, Building E (A Similar), prepared by ADD, Inc (dated 5 December 2005)
- Sheet A-3: Typical Building Plans, Building B (D Similar), prepared by ADD, Inc (dated 5 December 2005)
- Sheet A-4: Typical Building Plans, Building C, prepared by ADD, Inc (dated 5 December 2005)
- Sheet A-5: Typical Building Sections, prepared by ADD, Inc (dated 5 December 2005)
- Sheet A-6: Typical Building Elevations, prepared by ADD, Inc (dated 5 December 2005)
- Sheet CR-1: Conservation Restriction Limits Comparison (dated June 5, 2006)

b. Open Space Maintenance Plan. Belmont Uplands Site. Acorn Park Drive and Frontage Road, Belmont/Cambridge, MA, prepared by Epsilon Associates, Inc., dated September 5, 2001, revised May 17, 2002.

c. Stormwater Management Systems narrative prepared by Rizzo Associates, dated December 9, 2005, revised June 26, 2006. Including emails and memos dated July 18, 2006 and July 19, 2006.

(B) For the Project to be consistent with local needs, the following dimensional regulations of Section 6B shall be complied with: (i) minimum open space of 65% in accordance with Section 6B.2(h); and (ii) maximum impervious surface coverage of 35% in accordance with Section 6B.2(k). The Project zoning summary, as recently revised, indicates compliance with said minimum open space requirement. At the February 12, 2007 meeting, the Applicant withdrew its request for an exception to said minimum impervious surface coverage requirement.

2. Prior to the issuance of a Building Permit, the Applicant (which for the purposes of these conditions shall include its successors and assigns) shall submit the following final engineered plans and supporting documentation ("Final Plans"), which plans shall be consistent with the Project Plans as modified to reflect this Decision and shall be subject to review and approval by the Board or its designee:

a. Site Plan (including location of snow removal and/or storage, bicycle racks, and dumpster location and screening). A property line should be shown on plan, stamped by a Professional Land Surveyor.
b. Landscaping, screening and planting plan to include opaque barrier to the south of Parking Lot A to prevent lighting of Conservation Restriction Area south of Building A caused by vehicle headlights.
c. Lighting plan.
d. Grading plan.
e. Architectural plans (including floor plans, exterior materials and elevations of all facades).
f. Erosion Control plans.
g. Utilities plan including Stormwater/drainage plan.
h. Final Stormwater management calculations and supporting material (including soils information) demonstrating compliance with Massachusetts Department of Environmental Protection ("DEP") Stormwater Management Policy provisions.
i. Signage plan.
j. Road and sidewalk design with profiles.

3. During construction, the Applicant shall conform to all local, state, and federal laws regarding noise, vibration, dust, and blocking of any roads. The Applicant shall at all times use all reasonable means to minimize inconveniences to residents in the general area. Construction shall not commence on any day before 7:00 A.M. on weekdays, and 8:00 A.M. on Saturday, and shall not continue beyond 6:00 P.M. There shall be no construction on any Sunday or state or federal legal holiday.

4. Prior to commencing construction, the Applicant shall prepare and present to the Board or its designee, for its approval, a construction mitigation plan that shall include, but not be limited to, a phasing plan, a description of staging and storage areas, measures to control erosion and sedimentation, limitations on hours of work, a description of proposed earth removal, types and numbers of vehicles and vehicle trips involved with construction, a construction parking plan, tree and brush clearing and grading and general site mitigation measures. Construction vehicles approaching or leaving the site shall use, in the Town of Belmont, only Route 2, Route 60 (Pleasant Street), Acorn Park Drive, Frontage Road, Lake Street, Trapelo Road, and Belmont Street.

5. The Applicant shall submit draft Regulatory and Monitoring Agreements used by MassDevelopment to the Board for its review and approval. Such documents shall include the Town as a party to the Agreements with the right to enforce and impose sanctions and shall contain, at a minimum, the following terms:

   a. no less than twenty percent (20%) of the units within the Project shall be affordable in perpetuity to households earning not more than 50 percent of Area Median Income (the "Affordable Units").
   b. to the extent allowed by law, preference in the rental of the Affordable Units shall be given to Belmont residents. A Belmont resident shall be as determined in Section 6.10.2 (5) of the By-Law.
   c. the Applicant shall select, with the prior approval of the Board, a Lottery Agent for the selection of the renters of the Affordable Units. Prior to conducting the Lottery, the Lottery Agent shall submit a final Lottery Plan to the Board for its review and approval.
   d. the Monitoring Agent for the Project shall be Mass Development. In the event that Mass Development ceases to act as Monitoring Agent, the Town shall designate the Monitoring Agent. The fees of such Monitoring Agent shall be paid by the Applicant.
   e. the Applicant shall donate to the Town profits from the Project that are in excess of those allowed by Chapter 40B as demonstrated by audit. Any excess profits shall be in an Affordable Housing Development Fund used for affordable housing purposes only.

   The Applicant shall submit fully executed Regulatory and Monitoring Agreements to the Board before the issuance of a Building Permit.

6. This Project is subject to Massachusetts Environmental Policy Act ("MEPA") review, and this Decision shall not be implemented until the MEPA review has been completed. If, during the course of MEPA review, changes to the Project Plans as modified to reflect this Decision are necessitated, the Applicant shall return to the Board for a review of those changes in accordance with 760 CMR 31.03(3).

7. Prior to the issuance of the first Certificate of Occupancy, the Applicant shall provide a

performance guarantee (which may include a covenant, bond, surety, or tripartite agreement) to the Board or its designee for completion of on-site and off-site improvements (excluding buildings), in a form acceptable to the Board. The Board shall approve both the type and amount of the performance guarantee. The amount of the performance guarantee shall be based on the costs of any improvements, as determined by the Project Engineer plus a ten percent (10%) contingency. Any such security instrument shall provide for reduction in the secured amount as the work is satisfactorily completed as indicated by Building Inspector certificates.

8. a. If the Applicant must revise any of the Final Plans to comply with any other local or state or federal approvals or permits, it shall present the revised plans to the Board or its Agent for a review of those changes in accordance with 760 CMR 31.03(3).

b. Before the issuance of a Building Permit and before commencement of any site work (including site clearing activities), the Applicant shall certify to the Board or its designee that all local, state and federal approvals and permits required to obtain a Building Permit or commence site work have been obtained. Notice of construction activity, test borings or other such activity shall be provided to the Town's Office of Community Development at least three days prior to the commencement of such activity.

9. As set forth in 760 CMR 31.08(5), this Comprehensive Permit is granted solely to AP Cambridge Partners II, LLC, and shall not be transferred to any other person or entity without the written approval of the Board. In the event AP Cambridge Partners II, LLC sells, transfers, or assigns any of its interest in the Project, this Comprehensive Permit shall be binding upon the purchaser, transferee, or assignee. The provisions and limitations of the Limited Dividend Organization shall apply to the Project regardless of sale, transfer or assignment.

10. Annually, and immediately upon its receipt, the Applicant shall submit to the Board a copy of the audit conducted by the Monitoring Agent. The Board reserves the right to conduct an initial audit pursuant to Massachusetts Housing Partnership guidelines with the reasonable cost thereof paid by the Applicant and any other audit. The Applicant shall provide a copy of its cost certification to the Town not later than sixty (60) days after the issuance of the final Certificate of Occupancy and in no event later than the time it provides the cost certification to the Monitoring Agent.

11. The Applicant shall submit to the Board a Final As-Built site plan showing the Property line and the location of all buildings and other improvements on the Property. Said As-Built plan shall be stamped by a Professional Land Surveyor or Registered Land Surveyor and shall be submitted within 90 days of the final Certificate of Occupancy.

12. The Applicant shall pay within thirty days of receiving notice all reasonable inspection, peer review and/or legal fees for Town consultants or counsel as may be required to ensure compliance with the conditions listed herein.

13. The Applicant has requested, and the Board hereby authorizes those exceptions from the requirements of the By-Law and other local laws, rules and regulations, as listed in Attachment A, as long as the Project is constructed in accordance with the Project Plans and this Decision (including these Conditions). To the extent that the Project Plans show additional exceptions or waivers not expressly set forth in Attachment A, such exceptions or waivers were not requested

and, in any event, are denied. Minor deviations from otherwise applicable local rules may be authorized by the Board in the subsequent review and approval of Final Plans. Except as permitted by this Decision (including Attachment A), the Applicant shall be required to comply with all other applicable local bylaws, rules and regulations, as well as all applicable laws and regulations of the Commonwealth of Massachusetts and the United States of America.

Site Specific

14. The Applicant shall provide a shuttle service designed to meet the needs of employees and residents of the Project to travel from the Project to (and from) the Alewife MBTA Station and Belmont Center. The Applicant shall provide a proposed shuttle schedule and fees, if any, for non-residents to the Board for its review and comment prior to the initial Certificate of Occupancy. The proposed schedule shall address shuttle service (a) during initial occupancy and (b) when occupancy reaches 90%. Six months after the Project reaches 90% occupancy, the Applicant shall submit a report regarding the shuttle bus service which shall include, at a minimum, hourly ridership numbers during relevant periods (weekday, rush hour, evening, Saturday and Sunday/holiday), together with any proposals for modifications (increases and/or decreases) in service to reasonably reflect ridership levels during typical periods, for the Board's review and comment. Thereafter, the Applicant shall at least annually submit to the Board such a report for its review and comment.

15. a. The Applicant shall provide four bicycle racks, each holding 8 bicycles, in each of Buildings A, B, D, and E. Racks shall be located in the underground parking facilities. In addition, Applicant shall provide two bicycle racks, each holding 8 bicycles, in Building C, which shall be located in the underground parking facility of that building.

b. The Project shall conform to either (1) or (2) herein below with appropriate signage and geometric design, but in either event shall be subject to (3) herein below:

(1) There shall be three driveways as follows: a central driveway for ingress to the Project only and north and south driveways for egress from the Project only, or

(2) There shall be only two driveways. The central driveway currently shown on the Project Plans shall be closed in a manner acceptable for emergency access by the Fire Department.

(3) The driveways shall be as narrow as safe driveway design and turning radius requirements will allow and any resulting reduction in paving shall be converted to pervious surfaces to the maximum extent possible.

16. Prior to receipt of a Building Permit for any buildings on the Property, the Applicant shall provide the Fire Department final plans showing the details demonstrating compliance with the following:

a. As requested by the Fire Department the Project shall include around the rear of Buildings B and D a fire access lane, as shown on the plans, constructed out of a pervious paving system and constructed so as to support the weight of an operating fire apparatus.

b. As requested by the Fire Department the Project shall be serviced by a redundant water supply connected to the Belmont water system. The redundant water lines may be

located within the same utility trench, provided that they are separated within such trench and that the two water lines tie into the Belmont water system at different locations.

c. Final plans shall be submitted to the Fire Department to demonstrate that the "trash rooms" will be constructed as agreed to by Applicant and the Fire Department.

Housing

17. The Project shall not exceed 299 rental units in 5 buildings consisting of 20 studio units, 156 one-bedroom units, 107 two-bedroom units, and 16 three-bedroom units. Twenty percent of each unit type shall be Affordable Units. In the event the number of units is reduced as a result of this Decision, or for any other reason, the Affordable Units shall consist of studio, one-bedroom, two-bedroom, and three-bedroom units in the same proportion as provided by the Applicant were the Project to contain 299 units.

18. The Affordable Units and the market rate units shall be distributed proportionately within the buildings of the Project and among bedroom types. The Affordable Units shall be comparable to the market-rate units in terms of location, quality, character, room size, number of rooms, amenities and external appearance. The interior finishes of and appliances in the Affordable Units shall be comparable to the interior finishes and appliances in the market-rate units. The Affordable Units shall be constructed simultaneously with the construction of the market-rate units and occupancy permits shall be issued at a proportional rate for affordable as for market rate units.

19. The affordability restrictions shall be enforceable against all subsequent owners and shall be effective in perpetuity. The calculation of affordability for the allowable monthly rent to be charged the occupants of the Affordable Units shall include all mandatory fees and standard allowances for tenant paid utilities.

Transportation

20. The Applicant shall complete the following traffic mitigation measures in accordance with the description set forth in the Traffic Impact and Access Study by Vanasse and Associates, Inc., dated January 23, 2006, as refined in the Vanasse and Associates April 28, 2006 response to comments (together, the "Vanasse Study"), and they shall be constructed prior to the issuance of the first Certificate of Occupancy for the Project.

    a. Cross Street and Brighton Street Intersection - Design and implement an optimal traffic signal timing and phasing plan to include re-striping, shared turn-lane, and an upgrade of the existing traffic signal which will accommodate pedestrian and bicycle travel in a safe and efficient manner. Prepare an evaluation of, and design, an emergency preemption system and, if feasible and approved by the Town, install said system.

    b. Lake Street and Cross Street Intersection - Re-stripe the northbound approach to provide separate left and right-turn lanes as an interim improvement measure. The Applicant shall undertake a supplemental analysis of operating conditions and safety at the intersection of Lake Street at Cross Street within one year of the issuance of the first Certificate of Occupancy for the Project. This study will consist of the collection of weekday morning (7 to 9 AM) and evening (4 to 6 PM) manual turning movement counts

at the intersection; a review of motor vehicle crash information for the most recent continuous three-year period; the completion of a detailed traffic operations analysis (LOS, delay and vehicle queuing); and the development of a conceptual improvement plan to address any safety or operational deficiencies that are identified as a result of the supplemental analysis. This information will be summarized in a report provided to the Board for planning purposes and to obtain funding to complete the identified improvements by others.

c. Acorn Park Drive and Frontage Road Intersection - Upgrade the existing traffic signal equipment, timing and phasing as necessary to accommodate pedestrian and bicycle access to Project site. Include upgraded signs and pavement markings at intersection.

d. Concord Avenue and Blanchard Road Intersection - Design and implement an optimal traffic signal timing and phasing plan.

e. Concord Avenue at Alewife Brook Parkway - Undertake a detailed safety analysis of the rotary based on motor vehicle crash data provided by the City of Cambridge Police Department including a motor vehicle collision diagram, in order to identify any safety deficiencies that may exist at the rotary that are subject to correction, Subject to the approval of the DCR and the City of Cambridge, the Applicant will review and upgrade the signs and pavement markings at the rotary including providing advance directional signs on all approaches. Copies of the safety study will be provided to the DCR, MassHighway, the City of Cambridge, and the Town of Belmont.

f. Massachusetts Avenue/Lake Street and Massachusetts Avenue/Alewife Brook Parkway – Design and, subject to approval of the Town of Arlington, implement an optimal traffic signal timing and phasing plan.

g. All other intersection mitigation measures presented in the Vanasse Study.

21. The Applicant shall construct a sidewalk made of pervious material along the Project frontage on Acorn Park Drive that will link the Project to the existing sidewalk located along Frontage Road. The sidewalk design and construction shall meet MAAB & ADA requirements. Further, subject to being given an easement (at no acquisition charge to the Applicant) and all applicable approvals, the Applicant agrees to construct the missing segment of sidewalk between the Property and the existing sidewalk on Acorn Park Drive toward Cambridge Discovery Park. The Applicant shall submit to the Board copies of requests for easements and all applicable approvals by third parties, where necessary, prior to issuance of the first Certificate of Occupancy.

22. The Applicant will provide a weather protected waiting area for the shuttle bus within the Project which will be designed to be consistent with the architectural character and design of the buildings in the Project.

23. The Applicant's traffic mitigation measures described above in condition 20 assume that the improvements due to be made by the developer of Cambridge Discovery Park (as set forth at pages 5-6 of the Vanasse Study) will be in place when the Applicant commences implementation of its mitigation measures. If such mitigation measures of the developer of Cambridge Discovery Park are not completed when the Applicant proposes to implement its traffic mitigation measures, the Applicant will complete any or all improvements that should have been done by the developer of Cambridge Discovery Park that are not in place when the Applicant

commences work on its mitigation. The Applicant shall complete these measures before issuance of the first Certificate of Occupancy.

24. The Applicant shall be prohibited from granting easements over portions of the Property on the easterly side of Acorn Park Drive and onto the privately owned portion of Acorn Park Drive. The Applicant shall ensure access to the Project over Acorn Park Drive for school buses, police, fire and other municipal services. The Applicant shall be responsible for safe road maintenance (including but not limited to snow plowing, sanding, paving, and pothole repair) of Acorn Park Drive and shall annually file a plan for meeting this responsibility with the Town's Department of Public Works and Office of Community Development.

Infrastructure

25. The following portions of the Project shall be and shall remain forever private, and the Town shall not have, now or ever, any legal responsibility for their operation or maintenance:

    a. stormwater management system
    b. all driveways and parking areas and Acorn Park Drive
    c. wastewater system to the connection on Garrison Road, including the pump station
    d. on-site lighting
    e. recreation and all other common areas, excluding the area subject to the Conservation Restriction (to the extent provided in the Conservation Restriction).

26. All utilities within the Property (including electric, telephone, cable, and other such lines and equipment) shall be underground.

27. a. Wastewater flows from the Project will be discharged into the Belmont wastewater collection system ("Belmont System") starting on Garrison Road. The Applicant shall install on the Property a holding tank or tanks with a total capacity of at least 50,000 gallons to detain wastewater during surcharge events in the Belmont System. The holding tank(s) shall be under the parking area and not within the 100 year floodplain. In addition, the Applicant shall establish operating protocols which are to be supported by SCADA systems/instrumentation to activate the storage system during surcharge events (i.e., when the flow level in the 36" sewer at Brighton Street exceeds 30"). As part of those operating protocols, the Applicant shall have in place and shall perpetually maintain a septage hauler contract to pump out the holding tank(s) as frequently as necessary until surcharging in the Belmont System ceases. Such septage hauler shall not dispose of septage into the Belmont System until the surcharge event is over. The Applicant shall file a current copy of the septage hauler contract with the Town's Office of Community Development before issuance of an initial Certificate of Occupancy and shall maintain a current copy on file thereafter. The design of the holding tank(s) (including the operating protocols and the SCADA systems/instrumentation) shall be subject to the approval of the Board after review by the Town's sewer consultant, currently Fay Spofford & Thorndike. The cost of the holding tank(s) will be deducted from the Inflow/Infiltration (I/I) payment made pursuant to condition 28 to the extent allowed therein. The Applicant shall file a cost certification, with supporting detail, of the cost of the holding tank(s) with the Board before issuance of the first Certificate of

Occupancy.

b. Prior to the issuance of the Building Permit, the Applicant shall make a good faith application to the City of Cambridge for a connection to the Cambridge municipal wastewater system ("Cambridge System") in Acorn Park Drive. If such application is approved (and no appeals are filed or any such appeals are resolved successfully) and the cost and timing of such connection to the Cambridge System is no greater than the cost and timing to connect to the Belmont System (e.g. the cost to construct the sewer line from the Property to Garrison Road and the costs to comply with conditions 27.a. and 28), then the Applicant shall connect into the Cambridge System instead of connecting to the Belmont System and installing a holding tank(s).

c. The Applicant may, with the approval of the Board, substitute another method that achieves the same result as condition 27.a.

28. The Applicant shall make an I/I payment of $382,500.00 (less the cost of the holding tank(s) described in condition 27.a. or the alternative described in condition 27.c., but in any event not less than $300,000) to the Town of Belmont prior to the issuance of a Building Permit, provided however, in the event the Applicant is allowed to connect to the Cambridge System, then such I/I payment will not be required.

29. The Applicant shall provide an Operations and Maintenance Plan (O&M Plan) for the Stormwater Drainage System to the Board prior to the issuance of the first Certificate of Occupancy. The O&M Plan shall include: monthly inspections and quarterly cleanings of catch basins, area drains, and drop inlets, and monitoring the depth of water in the infiltration /detention systems as part of the semi-annual maintenance program (and, during the first year of full occupancy, after each storm event defined as more than ½ inch of rain in a 24 hour period). The O&M Plan shall include a provision requiring the use of sand for de-icing of the travel surfaces of the Project.

30. The catch basins on grade shall be designed to capture fully the 100-year storm event (6.6 inches of rainfall in a 24 hour period). Manholes for maintenance will be constructed as part of each chamber and underground detention basin. A clean out shall be installed at the location where grit chambers connect to the system.

31. The Belmont Water Department shall inspect the water main installation during construction. Approval of installation by the Water Department is required prior to issuance of the first Certificate of Occupancy.

32. As recommended by FST, the wastewater pump and force main to be constructed for the Project shall have a minimum diameter of 4 inches, and the pump shall be capable of passing a 3" diameter sphere. There shall be redundant pumps and an emergency power source for the pumps. Specifications for the pump and force main shall be submitted to the Board for review and approval prior to the issuance of a Building Permit.

Environmental

33. The Applicant shall provide to the Board a detailed site preparation plan, planting/landscaping

plan, and monitoring/maintenance plan for each flood storage area to be created, including at a minimum the detail called for in Epsilon's letter of May 24, 2006 and attachments, prior to the issuance of a Building Permit. Floodplain compensation volumes shall be at a ratio of at least 1.6:1 calculated using the current FEMA 100 year flood elevation of 8.2'.

34. The Applicant shall submit to the Board a management plan for the open space surrounding the Project prior to the issuance of the first Certificate of Occupancy. Any Open Space Maintenance Plan for the Project shall be in a form substantially similar to and as a minimum implement habitat enhancement measures as referenced in the previous Open Space Maintenance Plan dated May 17, 2002 prepared for the R&D Office Building. In addition the Applicant shall provide the Board with a plan showing the location of all tenant recreational areas prior to the issuance of a Building Permit.

35. The Applicant shall provide a tree cutting plan to the Board prior to commencing site work. The Applicant shall use all reasonable efforts to preserve trees. The Applicant shall, after consultation with the Tree Warden, identify all trees that are healthy and greater than 9" dbh in or within 10 feet of the work area and determine whether slight modifications in the site plan are practicable to preserve those trees. If the Applicant determines that slight site plan modifications cannot be practicably accomplished, the Board may request that additional trees (including but not limited to silver maples) be planted outside the Project area, but on the Property.

36. The Applicant shall work with the Green Roundtable to incorporate, to the greatest extent economically feasible, low impact and sustainable development principles for the construction and maintenance of the Project including, but not limited to, use of pervious pavement, and drought-resistant plants and collection of rooftop runoff for the irrigation system. Prior to the issuance of the first Certificate of Occupancy, the Applicant shall submit to the Board the final report of the Green Round Table which will detail how the Project satisfies this condition.

37. The Applicant shall finalize, execute and record the Conservation Restriction (CR) in substantially the same form as the draft submitted to the Board on June 9, 2006. The CR will restrict approximately 7.91 acres of the 15.65 acre parcel owned by the Applicant, as generally shown on a plan entitled "Conservation Restriction Limits Comparison" drawn by Rizzo Associates, dated June 5, 2006 (CR-1). In the event the Project site shifts to the north and east as a result of this Decision, or for any other reason, then the boundaries of the CR shall shift accordingly. The Applicant shall perform all of the actions required in the CR, except that no trail, kiosk or parking area shall be constructed. The CR shall be recorded prior to the issuance of the first Certificate of Occupancy but shall be executed and delivered, subject to an escrow arrangement approved by the Board prior to the issuance of any Building Permit for the Project.

38. Prior to the first Certificate of Occupancy Applicant shall provide the Board with a snow removal plan. The Applicant's snow removal plan shall be consistent with DEP Snow Disposal Guidelines (BRPG01-01, March 8, 2001), in that landscaped areas designated on the plans as snow storage areas will be used as much as possible. Any damage occurring to such landscaped area due to snow storage shall be replaced/repaired as necessary by the Applicant consistent with BRPG01-01.

    Any paved areas used for snow storage shall be graded to drain away from any wetlands and towards the site drainage system as required by BRPG01-01.

Legal

39. No dogs or cats, except seeing-eye dogs and hearing-ear dogs, shall be allowed on the Property.

40. The Board shall retain jurisdiction over the Project to ensure compliance with the terms and conditions of this Decision.

41. Subsequent to the expiration of all applicable appeal periods and, in any event, prior to the issuance of any Building Permit for the Project, the Applicant shall record this Decision in the Middlesex County South District Registry of Deeds and shall provide the Office of Community Development and the Building Inspector with a copy of this Decision endorsed with the applicable recording information.

42. This Comprehensive Permit shall expire, if the Applicant has not, for whatever cause, obtained a Building Permit for the units within three years of the date this Decision becomes final, or if the Applicant has not completed construction of the Project within five years of the date this Decision becomes final unless extended by the Board. The Decision is deemed to have become final upon the date the Decision is filed with the Town Clerk and no appeal is filed, or on the date the last appeal is decided or otherwise disposed of.

RECORD OF VOTE

The following members of the Board attended all public hearing sessions on this Case: William D. Chin, Chairman, Arthur P. Kreiger, Rebecca Vose, Eric A. Smith, and Anthony L. Leccese.

The following members of the Board vote to grant a comprehensive permit subject to the terms of this Decision:

William D. Chin, Chairman

Arthur P. Kreiger

Rebecca Vose

Eric A. Smith

The following member of the Board votes to grant a comprehensive permit subject to the terms of this Decision except to the extent that it permits the Applicant to construct a total of 337,884 square feet of gross floor area and to encroach into the land shown as restricted under the MOA, which he would not permit:

Anthony L. Leccese

Wherefore a Comprehensive Permit, consistent with the conditions of this Decision is granted to the Applicant.

Filed with the Town Clerk on Feb 16, 2007.

Dolores Keefe, Town Clerk

LIST OF ATTACHMENTS

Attachment A	List of Exceptions From Local By-Laws and Ordinances
Attachment B	List of Documents

ATTACHMENT A

REQUIRED EXCEPTIONS FROM LOCAL BYLAWS AND ORDINANCES
RESIDENCES AT ACORN PARK
"BELMONT UPLANDS"
ACORN PARK DRIVE
BELMONT, MASSACHUSETTS

I. ZONING BY-LAWS

A. Belmont Uplands District: Note: The Property is in the Belmont Uplands District and §6B.9 of the By-Law pre-empts and supersedes other provisions of the By-Law. The exceptions from the Uplands District for the Project are set forth below in this section "A" and those exceptions from the other applicable sections of the By-Law (not pre-empted or superseded by §6B.9) are set forth below in section "B".

1. Use: Exception from the prohibition of residential uses set forth in §6B.1.

2. Dimensional: Exception from the following dimensional regulations of §6B.2

   a.) Exception from §6B.2(c), minimum front set back
   Required: 65' Provided: 18.5' (Building A only);
   20.3' (Building E only)

   b.) Exception from §6B.2(e), minimum rear set back
   Required: 40' Provided: 27.1' (Building D only)

   c.) Exception from §6B.2(g), maximum gross floor area
   Required: 245,000 sf Provided: 337,884 sf

3. Parking: Exception from §6B.3.3, limitation on number of outdoor parking spaces, the outdoor spaces of the Project exceed the permitted 110 outdoor spaces. Outdoor parking is not to exceed 210 spaces.

4. Lighting: Exception from §6B.5., to increase the maximum of 175 watts to 400 watts, the light poles have been maintained at a lower height (15') in order to provide proper safe lighting. Proposed lighting is confined primarily to the interior of the building layout, and parking lot lighting is 175' or more from Frontage Road.

5. Design and Site Plan Review: Exception from design and site plan review under §6B.6, permit approval procedure is governed by Chapter 40B.

6. Site Plan Review Procedures: Exception from site plan review under §6.B.8, permit approval procedure is governed by Chapter 40B.

B. General Zoning By-Laws NOT Superseded By Belmont Uplands District:

1. Parking:

   a.) Exception from §5.1.3(e) in accordance with note on §5.4.3(b), below

   b.) Exception from §5.1.3(g), egress location, exception from the limit of 2 driveway openings onto a street from a parking area serving more than 20 parking spaces where all driveways are not separated by 150'.

2. Landscaping:

   a.) Exception from §5.3.5, existing vegetation, exception from the retention of trees exceeding 6" dbh within 25' of the street.

3. Lighting:

   a.) Exception from §5.4.3(b), provided that spillover off the Project site will be avoided or minimized, still consistent with pedestrian and vehicle safety, and the lighting plan shall be subject to the approval of the Board.

4. Cluster Development Special Permit

   a.) Exception from cluster development special permit under §6.5, permit approval procedure is governed by Chapter 40B.

5. Floodplain District

   a.) Exception from §6.6.7, special permits, permit approval procedure is governed by Chapter 40B.

6. Design and Site Plan Review

   a.) Exception from design and site plan review under §7.3, permit approval procedure is governed by Chapter 40B.

7. Special Permits

   a.) Exception from §7.4, special permits, permit approval procedure is governed by Chapter 40B.

8. Development Impact Report

   a.) Exception from development and impact report under §7.5, permit approval procedure is governed by Chapter 40B.

II. OTHER NON-ZONING BYLAWS AND REGULATIONS

A. Water Department Regulations. Exception to the extent Section C (paragraphs 1 through 3) of the regulations for water main pipe extension require Applicant to

increase the size of proposed water pipes to accommodate future non-Project extensions.

ATTACHMENT B: LIST OF DOCUMENTS RECEIVED

APPLICANT'S SUBMITTALS

Application and Plans
Epsilon Associates response to Conservation Commission (12/9/03)
Revised Plans (6/8/06)
Financials including Pro Forma, Market Rent Study (9/30/03) and Appraisal (9/29/06)
Financial Pro Forma (12/4/06)
Traffic Impacts and Assessment Study
Requested Zoning Waivers
Unit Mix (12/1/06)
List of Requested Exemptions

COMMENTS

TOWN BOARDS/COMMITTEES

Uplands Advisory Committee (9 comment letters)
Board of Health
Housing Trust
Historic Commission
Fire Department (4)
School Department (2)
Board of Selectmen
Community Development
Conservation Commission
Planning Board
Police Department (3/15/06)
Police Department email (12/7/06)
Police Department email (12/28/06)
Public Works Dept. (3/15/06)
Response to Fire Dept - Rizzo (7/26/06)

OTHER PUBLIC COMMENTS

Sustainable Belmont
Mystic Rvr Wtrshd Assc
Kirwan
Bishop
Brownsberger Email (3/28/06)
Ltr from Clancy (5/11/06)
Ltr from Moore (12/19/06)
Cohen Comments (8/14/06 & 10/11/06)
Sewer System, Sumner Brown, (7/10/06)
Comments to Brown - FS&T (7/25/06)
Developer Responses (8/24/06)
Working Group Notes (10/16,10/23&10/31)

APPLICANT'S RESPONSE

SEB – Bob Engler (Affordable Housing Concerns) (2/9/06)
RIZZO ASSOCIATES (Site Design and Civil Engineering) (2/28/06)
ADD INC (Architecture) (2/23/06)
VANASSE & ASSOC. (Traffic) (2/27/06)
EPSILON ASSOCIATES (Draft and Final Response)- Environment (2/20 & 4/24/06)
NUTTER McCLENNEN & FISH (40B Process and Legal) (3/22/06)

PEER REVIEWS

Traffic – BSC Group (3/16/06)
Traffic – BSC Group Review of Response (5/4/06)
Traffic – BSC Group, Final Letter (7/26/06)
Site, Stormwater & Wastewater - Fay, Spofford & Thorndike (4/27/06)

Wastewater - Fay, Spofford & Thorndike (5/17/06), not posted
Site & Stormwater - FS&T Review of Response (6/22/06)
Wastewater - Fay, Spofford & Thorndike (6/23/06)
Site Supplemental - Fay, Spofford & Thorndike (7/20/06)
Wastewater, Pumping Station - Fay, Spofford & Thorndike (7/25/06)
Environmental - FST, Wetlands & Wildlife, (4/24/06)
Environmental - FST, Wetlands & Wildlife Review of Response (5/31/06)
Environmental - FST, Wetlands & Wildlife Review of Response (6/23/06)
Environmental - FST, Wetlands & Wildlife Review of Site Change (11/27/06)
Financial - Jacobs (12/4/06)
Traffic (review of narrowing Acorn Park– BSC Group, (12/7/06)
Review of Driveway Alternative - BSC Group (2/7/07 email)

RESPONSES TO REVIEWS

Traffic/BSC Group – Vanasse & Associates (4/28/06)
Site Traffic/BSC Group – Rizzo Associates (5/3/06)
Site & Stormwater/FS&T - Rizzo Associates (5/4/06)
Wastewater/FS&T - Rizzo Associates (5/30/06)
Environmental/Fay, Spofford & Thorndike – Epsilon Associates (5/24/06)
Final Site & Stormwater/FS&T - Rizzo Associates (6/8/06), long, not posted
Stormwater - Rizzo Associates (6/26/06)
Driveway Entrance - Rizzo/Vanasse Associates (6/29/06)
Stormwater, 8.2' FEMA - Rizzo Associates (7/6/06)
Technical Calculations - Rizzo Associates (7/18/06), not posted
Semi-annual inspection reports - Rizzo Associates (7/19/06), not posted
Re: widening Acorn Park Dr - Vanasse Associates (11/22/06)
Environmental Review of Revised Site Plan – Epsilon Associates (12/4/06)
Wastewater (Cambridge vs Tank) - Rizzo Associates (12/5/06)
Wastewater (MWRA 5 year data)- Rizzo Associates (12/6/06)
Revised Dimensional Setbacks - Rizzo Associates (2/7/07)

OTHER REVIEWS

Wastewater - Citizens Forum, Norfolk Ram Group

COMMUNICATIONS

Alcorn
Haller
Flynn (2)
First Parish Church of Cambridge
Brownsberger email re: S. 1909
Cambridge Conservation Commission
Email from Gallant
Velie/Stadler
Town of Arlington (2)
Dohanian
Passero & Kirwan
Cunningham
Marinell
Duffy, D.
Goldberg
Frankel (email)
Nuscher
Hickey
Hanely
Sodini
McGurl
Caputo et al

Duffy/Paulsen
Baram (email)
Mass (2)
Passero (2)
Canavan
Sorkin
Connolly (2)
Hartman
Fuller
Bass
Sciascia
Lambert
Brown (2)
Petition, High School Environmental Club
Katragadda email
Belmont Board of Selectmen (1/10/07)

MISCELLANEOUS

Friends of Alewife Reservation (Large Packet
Mass (email, 3/20/06)
Nutter McClennan & Fish (4/18/06)
Nutter McClennan & Fish (5/19/06)
Uplands Alternative Group
Statement by Kit Drier
City of Cambridge Resolution, Unofficial copy
S. 1909, Unofficial Copy of Act
BSC response re: S. 1909
Rizzo Associates, re: test pit locations
Unofficial FEMA Maps submitted by Rizzo Assoc
Nutter McClennan & Fish re: comparison of CR lands
Mystic River Watershed Assoc - Water Quality Data
Petition re: MEPA Review
Kaiser - Model for Establishing Mitigation Ratio
Sewer - memo from OCD and DPW example of license
Arlington Redevelopment Board
Presentation - Katuska, Brown, etc. (12/6)
Uplands Alternative Group (10/16/06)
Board of Selectmen (10/23/06)
Email comment from Applicant (10/10/06)
Board of Selectment Motion
Applicant submittal - HAC Decisions re: schools
Memo to Soloman (9/18/06)
Bass Testimony (12/6/06)
Cmbrdge Sewer Connection 2003 - Mass
Town of Arlington
Belmont Selectmen Letter (1/10/07)

EXHIBIT B

Open Space Maintenance Plan

Belmont Uplands Site

Acorn Park Drive and Frontage Road
Belmont/Cambridge, Massachusetts

Prepared for:
AP Cambridge Partners II, LLC
700 South Henderson Road
King of Prussia, PA, 19406

Prepared by:
Epsilon Associates, Inc.
3 Clock Tower Place, Suite 250
Maynard, MA 01754

September 2, 2010

Epsilon
ASSOCIATES INC
ENGINEERS ENVIRONMENTAL CONSULTANTS

Open Space Maintenance Plan

The Residences at Acorn Park

(Belmont Uplands Site)

Prepared for:

AP Cambridge Partners, LLC
700 South Henderson Road
King of Prussia, PA 19406

Prepared by:

Epsilon Associates, Inc.
3 Clock Tower Place Suite 250
Maynard, Massachusetts 01754-0700

September 5, 2001
Revised May 17, 2002
Revised June 12, 2007
Revised September 2, 2010

Table of Contents

List of Figures

Appendices

1.0 Introduction

This Open Space Maintenance Plan ("the Plan") has been prepared for the 15.6 acre "Belmont Uplands" Site ("the Site"), located along Acorn Park Drive and Frontage Road, in Belmont and Cambridge, Massachusetts (see Figure 1 – Site Locus). The Site is being developed by AP Cambridge Partners II, LLC (herein after "Owner/Grantor"), who has proposed a five building, rental, residential development on an approximately 7.1 acre portion of the Site, coupled with a Conservation Restriction to preserve and enhance 7.95 acres of upland and wetland communities (see Figure 1A – Conceptual Conservation Restriction Plan and Figure 1B- Conservation Restriction Area plan prepared by Tetra Tech Rizzo).

Previous drafts of the Open Space Maintenance Plan have been reviewed and approved by the town of Belmont. The former plan included design components for a trail system, information kiosk and public parking area, which have since been eliminated as a result of the Comprehensive Permit decision issued by the Zoning Board of Appeals on February 16, 2007, prohibiting such construction.

The purpose of the Conservation Restriction is to protect and preserve the undeveloped portions of the property including approximately 33,736 square foot (s.f.) of combined compensatory flood storage areas, wildlife habitat replication areas and Buffer Zone enhancement areas associated with the site development. The undeveloped portions include approximately 3.3 acres of upland and 4.6 acres of wetland areas adjacent to the Alewife Reservation land managed by the Department of Conservation and Recreation ("DCR"). The approximately 7.95 acre parcel of land to be managed under the Conservation Restriction will be referred to in this document as "the CR Parcel" [Note: all area calculations may be subject to confirmation/change]. The portion of the DCR Alewife Reservation abutting the CR Parcel includes Little Pond and Little River, which connects downstream with Alewife Brook in Cambridge.

This Open Space Maintenance Plan provides background information on the existing Site resources and habitat features, and presents recommendations for enhancing the parcel's value for wildlife habitat, restoration and maintenance of impaired wetlands and uplands (primarily degraded by invasive species), and overall enhancement of functions and values to the community.

The main element of the Open Space Maintenance Plan includes: 1) a Habitat Enhancement (Upland & Wetland) Plan. The Habitat Enhancement Plan includes measures to further evaluate the presence and control of invasive species (both upland and wetland), which are pervasive on the Site, as well as physical and biological measures to enhance the Site use for various wildlife species, in conjunction with standard forest management practices used to enhance biodiversity.

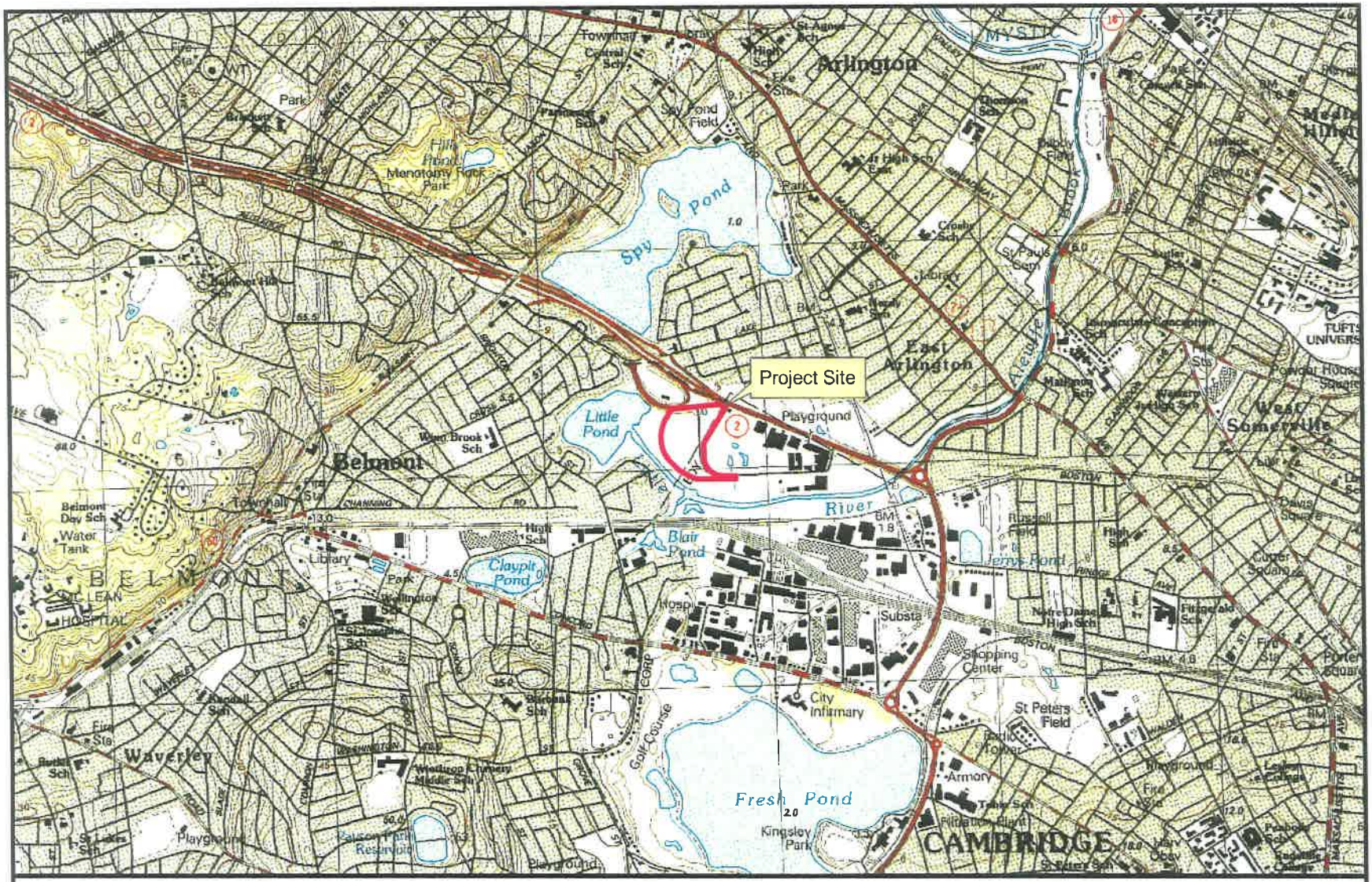

Figure 1
USGS Locus
Belmont Uplands Open Space Maintenance Plan Site
Belmont/Cambridge, Massachusetts

Basemap: 1985 USGS Quadrangles, MassGIS

Epsilon Associates Inc

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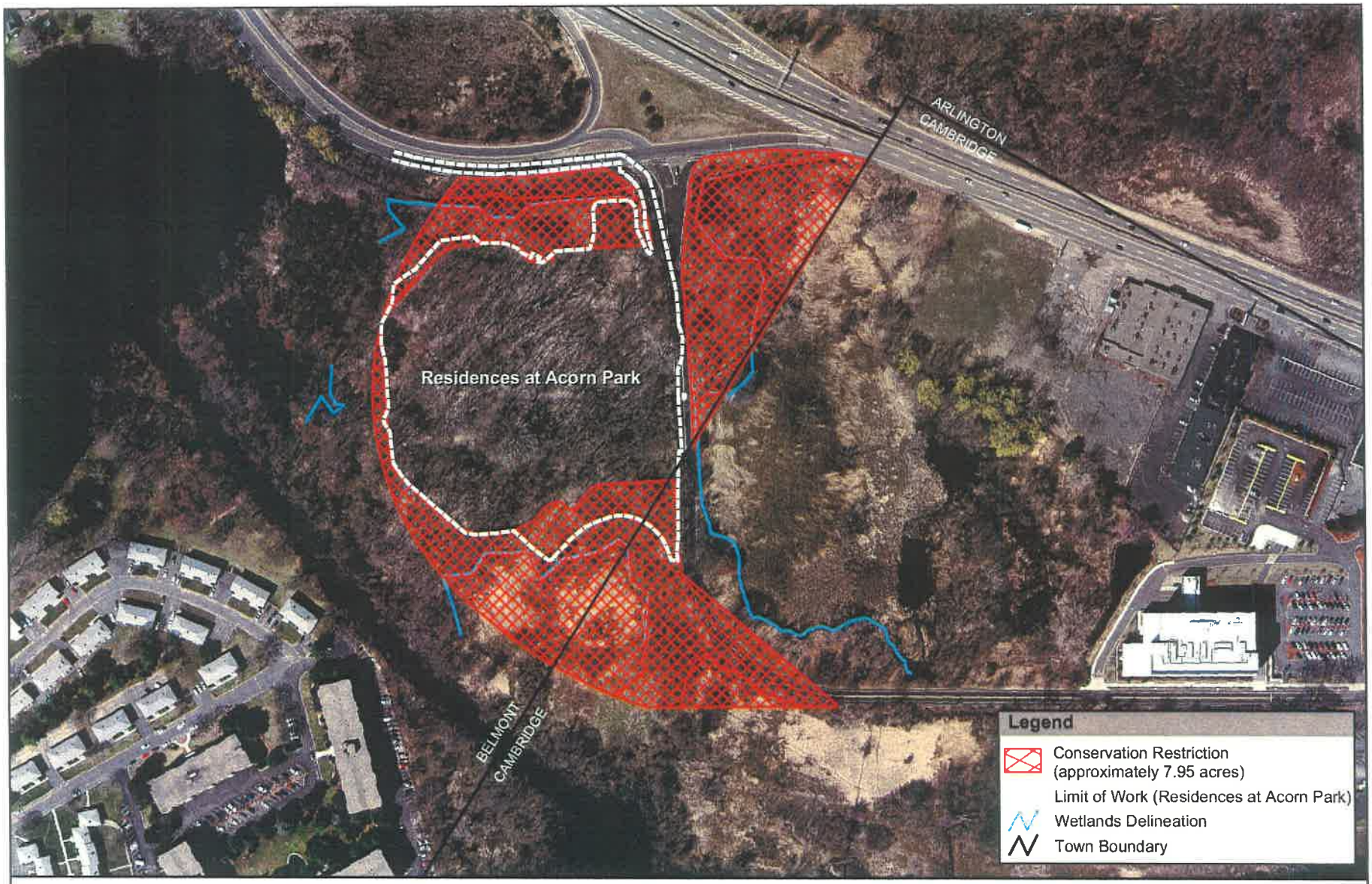

Scale 1:3,000
1 inch = 250 feet

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Feet

Figure 1A
Conceptual Conservation Restriction Plan (02/09)

Belmont Uplands Open Space Maintenance Plan Site
Belmont/Cambridge, Massachusetts

Basemap: 2008 Orthophotography, MassGIS

Epsilon Associates Inc.

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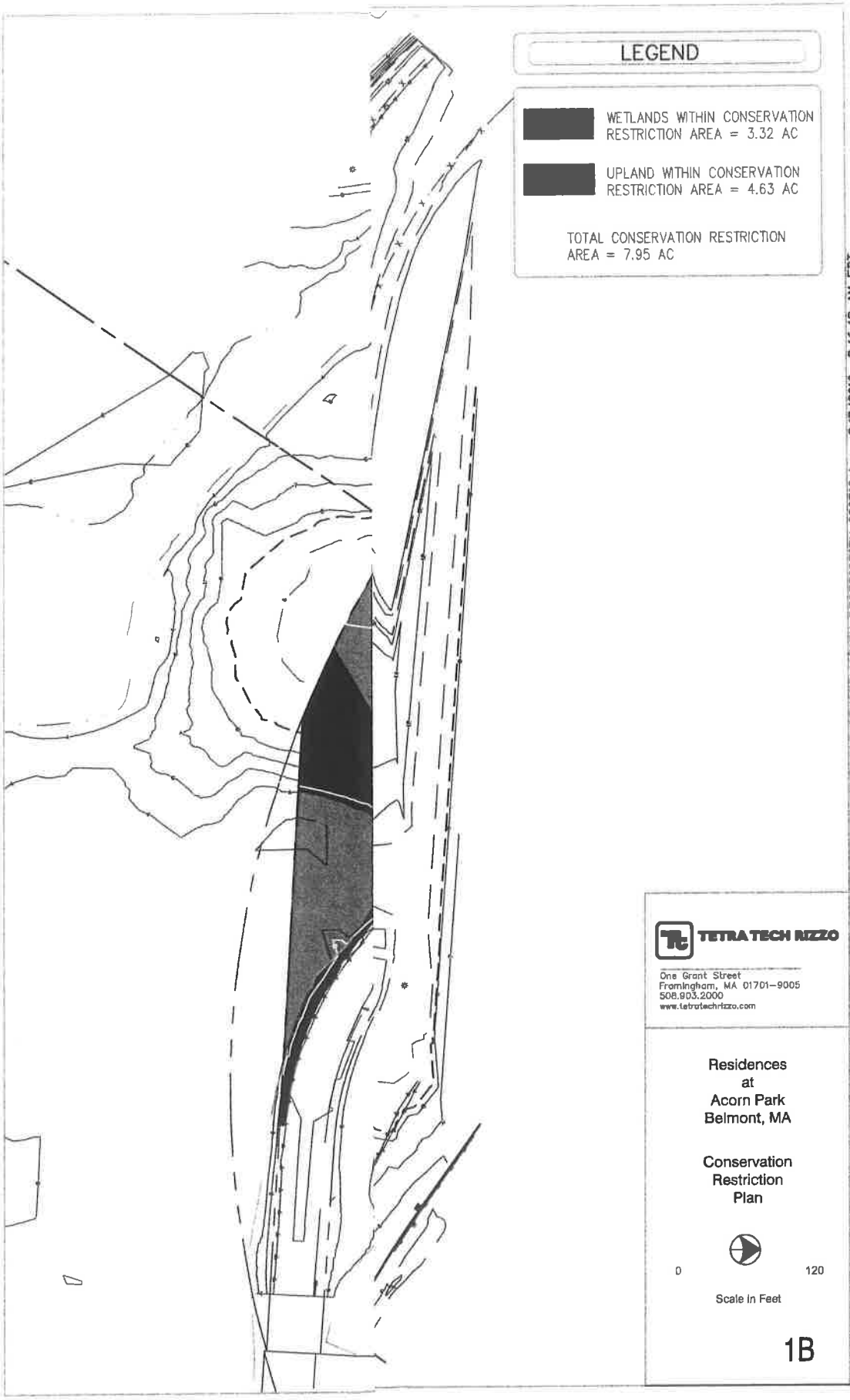

TETRA TECH NIZZO
One Grant Street
Framingham, MA 01701-9005
508.903.2000
www.tetratechnizzo.com

Residences
at
Acorn Park
Belmont, MA

Conservation
Restriction
Plan

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Scale in Feet

1B

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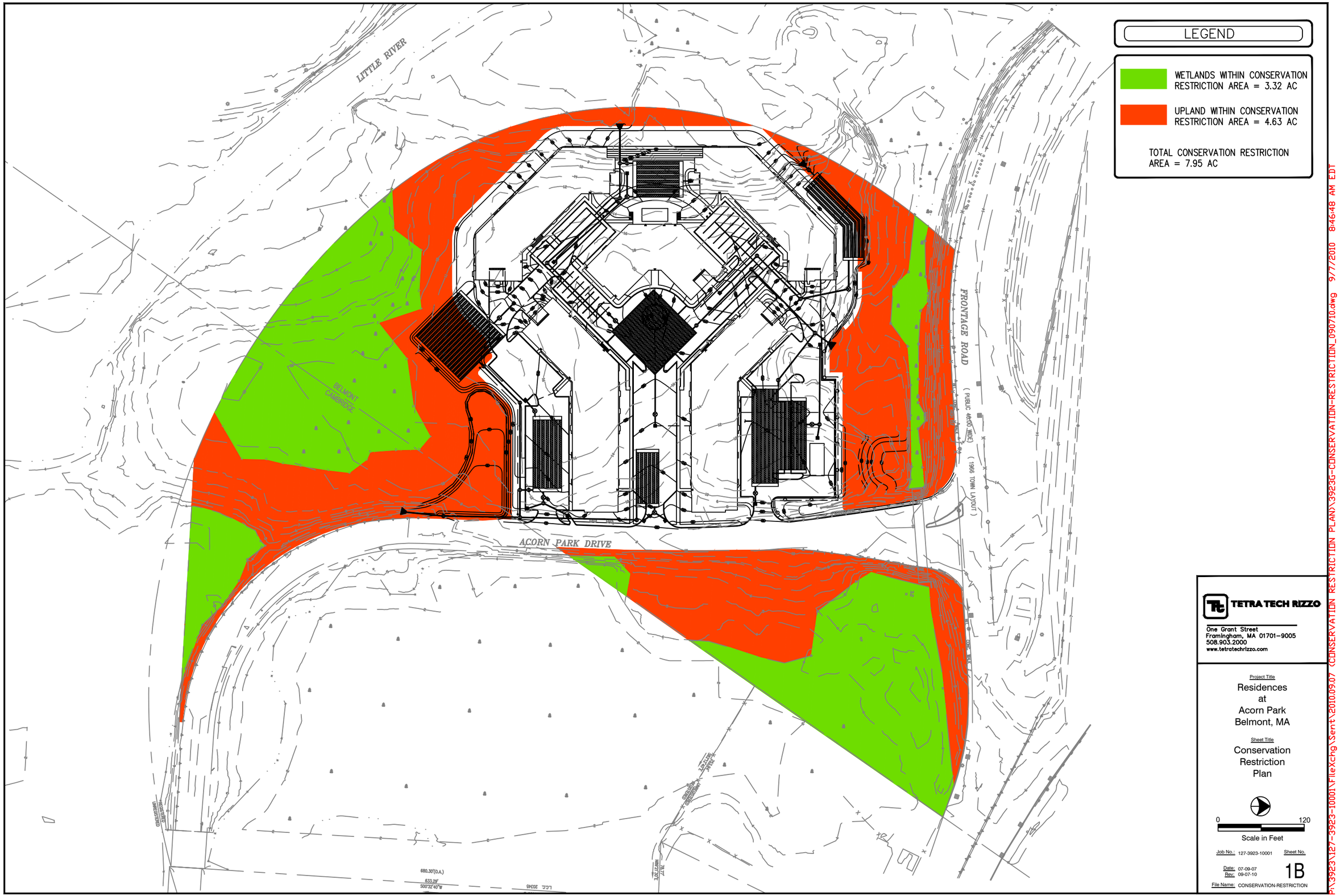

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Project Title
Residences
at
Acorn Park
Belmont, MA

Sheet Title
Conservation
Restriction
Plan

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Scale in Feet

Job No.: 127-3923-10001 Sheet No.
Date: 07-09-07
Rev: 09-07-10 1B
File Name: CONSERVATION-RESTRICTION

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2.0 Habitat Enhancement Plan

2.1 Existing Site Conditions

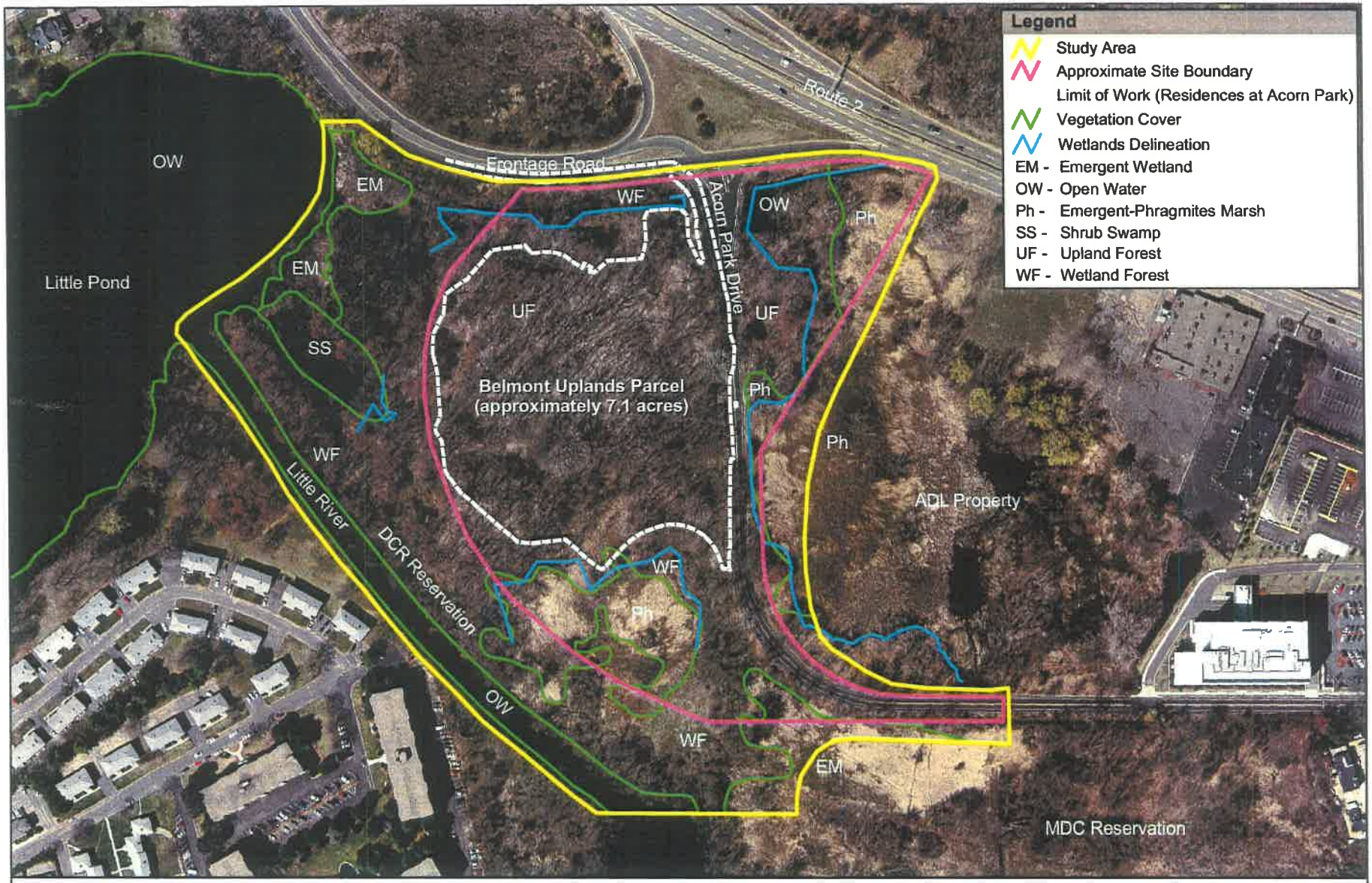
2.1.1 Methodology

On November 9, 2000 and August 8, 2001, two field scientists from Epsilon Associates visited the Belmont Uplands Site and a portion of the adjacent DCR Alewife Reservation to evaluate the Site's natural features and wildlife potential. Additionally, wildlife habitat evaluations were conducted by Epsilon Scientists on April 19, 2007 and February 18, 2009 to facilitate preparation of the Notice of Intent filing and to supplement Superseding Order of Condition proceedings for the residential development. During the site visits, detailed information was collected including vegetative species, vegetative cover types, hydrologic conditions (surface and subsurface), water bodies (i.e., Little Pond and Little River), soils, wildlife habitat indicators (burrows, snags, tracks, etc.), and actual wildlife sightings or calls. For the August 8, 2001 site visit, specific observation points and transects were laid out prior to the inspection on an orthophoto map of the Site with latitudinal/ longitudinal gridlines. Transects to each point were walked with the aid of a hand-held Global Positioning System (GPS) unit. Site data (listed above) were then collected along each transect and at each observation point. From these observations, a map of general vegetative cover/habitat types was prepared (Figure 2, Existing Site Habitats) along with a list of observed vegetative and wildlife species (Appendix A) and representative Site photos (Appendix B).

2.1.2 Existing Site Conditions

The Site is located immediately south of Interchange 60 off Route 2 and east of Little Pond. Two areas of land separated by Acorn Park Drive comprise the Site consisting of the approximately 13.2 acre main Site area west of Acorn Park Road and the approximately 2.4 acre "triangular" area east of the same road (Figure 2). Two major vegetative community types occupy these areas: upland forest and mixed wetland. Upland forest includes primarily deciduous tree cover with a mosaic of shrub & sapling undergrowth that varies in density from thin to thick. The mixed wetland community includes forested, scrub-shrub wetland, and emergent marsh (Phragmites-dominated). A list of common plant species found on both upland and wetland areas of the Site including habitat preferences are provided in Appendix A.

Upland portions of the Site may be characterized as regenerated forest dominated by silver maple (*Acer saccharinum*) (see also Site photos 1 & 2, Appendix B). Other plant species common in the upland area of the Site include red maple (*Acer rubrum*), black cherry (*Prunus serotina*), quaking aspen (*Populus tremula*), box elder (*Acer negundo*), Norway maple (*Acer platanoides*), multiflora rose (*Rosa multiflora*), European buckthorn (*Frangula alnus*), and blackberries (*Rubus sp*). Owing to the urban nature of the surrounding area, a significant number of the plant species found in upland areas are either invasive exotic



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1 inch = 250 feet

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Figure 2
Existing Site Habitats
Belmont Uplands Open Space Maintenance Plan Site
Belmont/Cambridge, Massachusetts

Basemap: 2008 Orthophotography, MassGIS

Epsilon Associates Inc.

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species or escaped from cultivation. Plant species that can be found on the Site are currently regarded as invasive by the Massachusetts Biodiversity Initiative include multiflora rose, Norway maple (*Acer platanoides*), oriental bittersweet (*Celastrus orbiculata*), European buckthorn, common buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*), Japanese knotweed (*Polygonum cuspidatum*) and tree of heaven (*Ailanthus altissima*). Other species of note found on the Site that have escaped from cultivation include amur corktree (*Phellodendron amurense*) and a crab apple variety (*Malus spp.*).

Mixed wetland communities on the project Site include two distinct types. These include those vegetated by emergent and forested wetland cover types.

Emergent wetland is located in two areas. One area is located at the southern point of the Site west of Acorn Park Drive. The other area is located on the easternmost side of the Site located east of the same road. Emergent wetland is dominated almost entirely by common reed (*Phragmites australis*).

Forested wetland generally borders the northeast side of Little Pond and Little River along the western boundary of the property. This wetland is principally forested, but it also contains small inclusions of emergent wetland along the northeast edge of Little Pond and two areas of shrub swamp in the same general area (see Site photos 3, 4 & 6). The forested wetland is dominated by silver and red maple. Other common species found here include pin oak (*Quercus palustris*), American elm (*Ulmus americana*), cottonwood (*Populus deltoides*), spotted jewelweed (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*) and European buckthorn. The small emergent wetland is vegetated primarily by purple loosestrife (*Lythrum salicaria*), goldenrods (*Solidgo spp.*), cattails (*Typha angustifolia*), speckled alder (*Alnus rugosa*), and European buckthorn. The two areas of shrub swamp are dominated by buttonbush (*Cephalanthus occidentalis*).

Little Pond and Little River did not exhibit either submerged or floating macrophytic vegetation at the time of Epsilon's Site visits (Site photos 7, 8, 11 &12). The water in these two water bodies was slightly turbid on November 9, 2000 and heavily turbid on August 8, 2001. The substrate in both water bodies consists primarily of gravel that is lightly covered with a combination of fine silt and algae.

2.1.3 Wildlife Habitats

The proposed Site, along with similar undeveloped parcels immediately to the east, exist as relatively isolated natural habitats in an urban setting. As such, it provides potential refuge to resident wildlife tolerant of urban conditions, some neotropical birds passing through the area while on annual migrations, feral cats, rats and possibly remnant populations of wildlife that may have been more abundant in the area prior to development. Direct observations of wildlife actually using the Site and immediate area are limited to a few species present at the time of Epsilon's Site visits. Bird species seen at the Site included American robin (*Turdus migratorius*), gray cat bird (*Dumetella* carolinensis), black-capped

chickadee (*Parus carolinensis*), American crow (*Corvus brachyrhynchos*), American goldfinch (*Carduelis* tristis), hairy woodpecker (*Picoides villosus*), cedar waxwing (*Bombycilla cedrorum*), great blue heron (*Ardea herodias)* (observed as a fly-over) and double-crested cormarant (*Phalacrocorax auritus*) (observed within the pond). Also seen at the Site were eastern chipmunks (*Tamias striates*) and woodchuck *(Marmota monax*). Indirect observations of wildlife include the occurrence of burrows in both upland and wetland areas. In upland areas, the burrows could possibly be attributed to woodchuck, skunk (*Mephitis mephitis),* or raccoon (*Prycon lotor*). In wetland areas, burrows are limited to the bank of Little Pond and may be attributed to muskrat (*Ondatra zibethica*). Other indirect signs of wild include cavities in large trees [possibly gray squirrel (*Sciurus carolinensis*) or raccoon], clipped twigs at ground level [cottontail rabbit (*Sylvilagus floridanus*)] and scratched depressions in leaf litter (gray squirrel).

Observations of aquatic life using Little Pond and Little River are limited. During Epsilon's Site visit, some unidentified fish were seen leaping and swimming in Little Pond and the river. No reptiles or amphibians were seen. It is anticipated that common varieties of amphibians such as green frog (*Rana clamitans*) or bullfrog (*Rana catesbeiana*) could potentially be found here.

Of detriment to the overall value of the project Site to wildlife, is the high number of exotic and invasive plant species present here. Of the 46 vegetative species identified on the Site, approximately 25% are considered invasive according to the Massachusetts Biodiversity Initiative (see Appendix A). These invasive plant species act to reduce the diversity of native species on the Site. Invasive species generally thrive in disturbed habitats. A review of historic USGS maps from 1903 through 1950 indicates that the project Site has been extensively altered during the last century and has probably influenced the Site's present degraded vegetated condition.

2.2 Assumptions and Principles for Habitat Enhancement

In developing a management strategy for the enhancement of natural habitats at the Site, several assumptions have been made regarding the current use of the Site and area by wildlife and the degree one could expect to either restore or enhance the Site to improve its value to wildlife. These assumptions are based on observations of the existing nature of the Site, the surrounding area and current use by wildlife. The need to state these assumptions is to focus management on realistic goals that can be attained. The current development proposal by the Owner/Grantor to construct a residential development on only a 7.1 acre portion of the 15.6 acre project Site provides a unique opportunity to apply management and enhancement practices on the remaining land to be set-aside for the CR Parcel.

The assumptions that have been made regarding the Site and its management are as follows:

- As a part of a relatively large tract of undeveloped land located in a heavily developed area, the Site essentially exists as a "Forest Island". Such areas are valuable to migrating neotropical birds as stop-over habitats that they frequently use for resting during their migration to other areas. In the context of the greater metropolitan area, relatively few such areas exist protected from future development (Figure 3, Regional Open Space Lands). Important features of such areas that make them valuable include large size and the presence of adequate vegetation that provides escape and nesting cover.

- The Site, being a part of an urban landscape, suffers from the effects of such a setting. One of the most noticeable effects is the prevalence of vegetation that is non-native and invasive. To the detriment of wildlife, such vegetation adversely acts to reduce the diversity on native plant species that wildlife generally require. Because invasive species, once established, are difficult and expensive to eradicate, it is unrealistic at this time to assume that all the invasive species on the Site and in the immediate area can be permanently eradicated. It is safe to assume that control can be exerted if the areas to be managed are relatively small and that management can be applied on a regular basis.

- Invasive species may also be managed if proper environmental situations can be perpetuated that preclude the establishment and growth of these species. This approach can be applied on both small and large scales. At the large scale, the approach must focus on a "holistic" approach that considers causative factors as well as long-term solutions. Such an approach would include a cooperative effort of all land managers and property owners.

- As a relatively isolated upland area of finite size, only a limited amount of wildlife in terms of both types and numbers can occur here. Based on this assumption, management and enhancement should focus on strategies that favor wildlife species known to frequent urban areas and that are not known to harm the public health or create a public nuisance.

In addition to consideration of these principles, a consultation with Mr. Stewart Sanders, a member of the Town of Belmont Alewife Study Committee and local wildlife observer, was conducted to gain additional input on local priorities for wildlife habitat enhancement. These priorities are discussed on the following page.

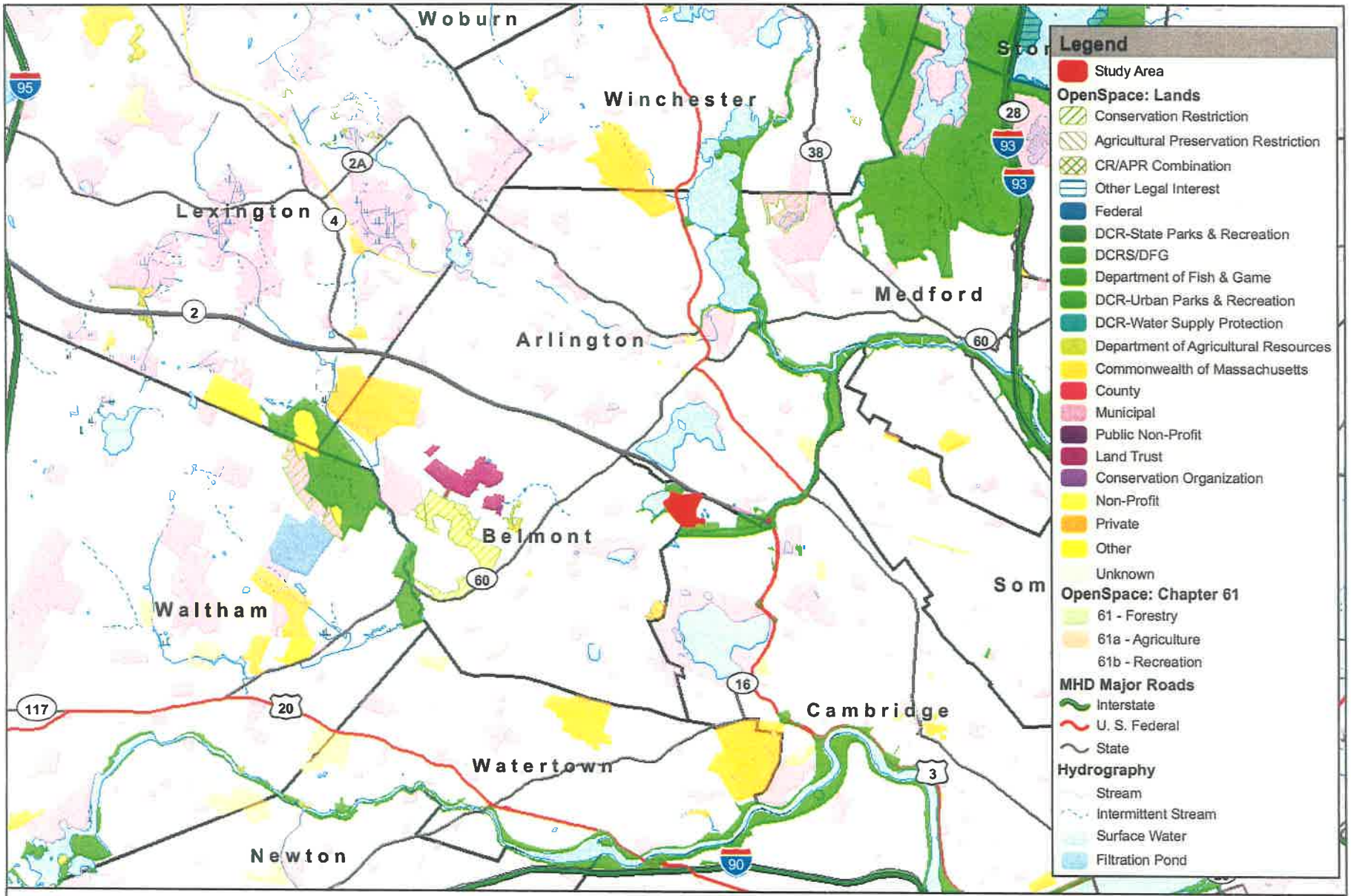

Figure 3
Regional Open Space Lands
Belmont Uplands Open Space Maintenance Plan Site
Belmont/Cambridge, Massachusetts

Epsilon Associates Inc.

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2.3 *Upland Habitat Enhancement*

Wildlife Habitat Enhancement Components

Some of the basic elements of wildlife habitat include features that provide cover and food to wildlife. To enhance the Site with regard to these features, management goals are as follows:

1. Promote the development of snags (dead trees) by girdling select trees in remote locations. Snags over time serve to encourage the presence of a variety of insects that vertebrate animals such as birds and mammals feed on. Snags also provide a substrate that animals can use to create cavities for nesting and roosting. Bats are also known to frequent areas beneath the loose bark of dead trees.

2. Promote a situation that helps to retain fallen trees and large branches on the ground surface. The presence of large pieces of dead wood in contact with the ground provides suitable nesting and feeding habitat for certain reptiles, amphibians, and small mammals.

3. Provide escape cover for some birds and mammals by creating brush piles in scattered locations throughout the Site.

4. Augment nesting habitat for birds and squirrels by providing a variety of nesting structures and boxes throughout the Site.

5. Promote and or augment the growth of native and non-invasive plant species that provide valuable sources of food, such as pin oak (*Quercus palustris*), shagbark or pignut hickory (*Carya ovata* or *C. glabra*), American hazelnut (*Corylus americana*), hawthorn (*Crataegus* sp.), highbush blueberry (*Vaccinium corymbosum*), highbush cranberry (*Vaccinium trilobum*), northern arrowwood, and gray stemmed dogwood (*Cornus racemosa*). These species provide primarily nut and berry food sources as well as cover for nesting and escape, and are generally tolerant of a variety of soil conditions and previous disturbance.

6. Manage open field/grassland to promote more specialized habitat for bird species such as woodcock (*Scolopax minor*), song sparrow (*Melospiza melodia*), red-tailed hawk (*Buteo jamaicensis*), and American kestrel (*Falco sparverius*). An area of open field which can serve this purpose is proposed on the CR Parcel within the southern compensatory flood storage area.

These measures will be applied to areas indicated on the CR Parcel and DCR Reservation as shown on Figure 4, Habitat Enhancement Plan. With an adaptive management approach in mind, enhancement effectiveness should be reviewed on an annual basis. Based on this review, application of additional enhancement measures or maintenance of existing measures may be warranted.

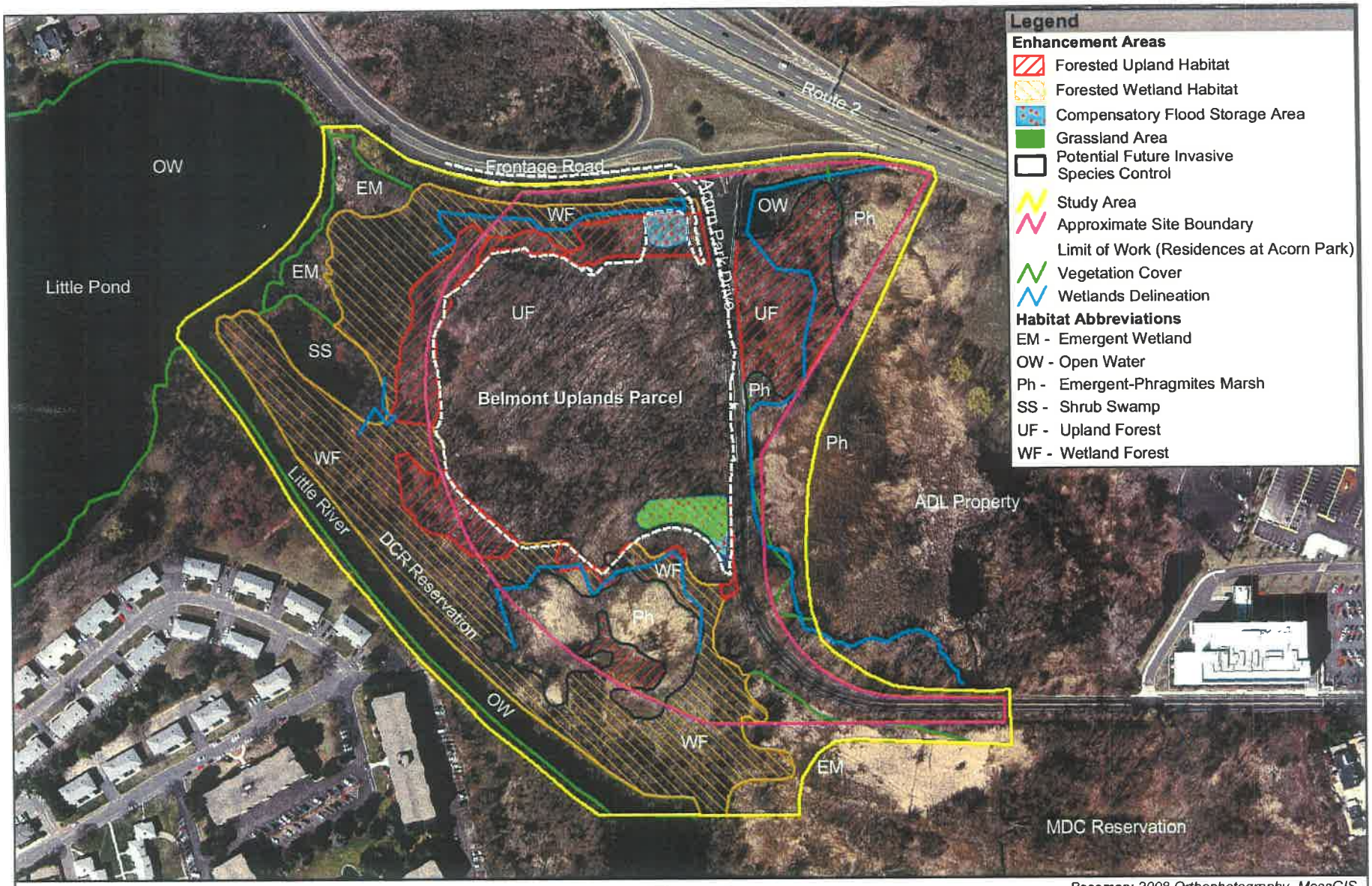
It is anticipated the habitat management and enhancement measures within the CR Parcel described in this section will be performed by the Owner/Grantor.

Standard Forest Management Practices

The overall management goal is to maintain the Site primarily as forest. In doing so, the preferred approach is to manage the forest in a manner that simulates natural disturbance. In such a situation, active management will promote the creation of small open patches in the forest canopy. This management approach will help to create diversity in forest structures and composition. The creation of patches may also include development of snags and large pieces of dead wood left to remain in contact with the ground surface. In the direct application of forest management techniques to achieve the goal of creating small open patches, best management practices (BMP's) will be applied as identified in the "Massachusetts Forestry Best Management Practices Manual" provided in Appendix C. The application of BMP's will insure that forest management activities will be completed in a manner conducive to sound environmental practices.

Specialized Habitats

The creation of an open field area provides opportunities to promote a habitat type which is not common within the local area. Managed open field with a low and tall shrub edge provides mating and nesting habitat for woodcock, song sparrow and other edge-thriving species. Such an area also promotes use by small rodents (e.g., field mice and voles [*Microtus pennsylvanicus*], which in turn provides open hunting grounds for raptors such as red-tailed hawk and American Kestrel (or "sparrow hawk"). This habitat will be promoted with the creation of grassland area within the southern compensatory flood storage area (CFSA) south of the proposed residential development area (see Figure 1B and Figure 4). Final grading and topsoil additions to the area will include organic-rich humus (e.g., compost from a local composting facility) to promote earthworms as a food source. A mix of wetland and upland grass species and forbs will be planted in the field to provide seed food sources. The perimeter of the grassed CFSA will be planted with a variety of tree and shrub species to further create wildlife habitat. Bird boxes and nest piles will be constructed within the grassed areas to enhance wildlife habitat.



Scale 1:3,000
1 inch = 250 feet

125 0 125 250 Feet

Figure 4
Habitat Enhancement Plan
Belmont Uplands Open Space Maintenance Plan Site
Belmont/Cambridge, Massachusetts

Basemap: 2008 Orthophotography, MassGIS

Epsilon Associates Inc

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2.3.1 Upland Invasive Species Control

Management of invasive species will be limited to controlling small isolated patches of such species that may occur within the upland forest. To control these patches, BMP's developed specifically for the control of invasive species will be employed. Examples of BMP's that may be employed includes those found in the "Weed Control Methods Hand Book: Tools and Techniques for Use in Natural Areas" by Mary Tu, Callie Hurd and John Randal. The manual can be obtained online at http://www.invasive.org/gist/handbook.html. Additionally, please refer to Appendix D for information on invasive species.

Practices that may be applied to control invasive species on the Site include manual cutting and application of herbicides. The goal in applying these practices is to promote the growth of native species that may have been out competed by the invasive species growing in the area. The general approach to managing invasive species in upland areas of the Site must be adaptive in nature. In application, the Site should be inspected at least once a year to identify locations where invasive species are proliferating. Based on such an inspection, target areas for invasive species eradication should be identified and action plans for removal can be developed. In accordance with the approved "Wildlife Habitat Replication/Enhancement Plan" (See Appendix F), Enhancement Area 2, located in the southwestern section of the site, has been identified for upland invasive species control. Non-native shrubs (including buckthorn and honeysuckle) will be removed by hand and replaced with native species including red maple, red oak (*Quercus rubra*), American hazelnut (*Corylus Americana*), grey dogwood (*Cornus racemosa*) and northern arrowwood (*Viburnum dentatum*).

2.4 Wetland Habitat Enhancement

Wetland Invasive Species Control

Control and management of invasive species in wetland areas will be limited to small isolated patches that may develop from time to time. Because of the ever pervasive nature of invasive species in the area, it is only realistic to manage such species in an ongoing and adaptive manner. The approach that will be taken to manage invasive species in upland areas will similarly be applied to wetlands. Invasive species will be particularly managed in the newly created compensatory storage and wildlife habitat replication areas.

Wildlife Habitat Enhancement Components

Wildlife enhancement components identified for upland areas in general may be applied to wetland areas. In doing so extra measures must be taken to insure that such measures are being applied in locations that will not act to degrade the resource or adjacent areas. Wetland areas that may warrant special attention include areas of soft saturated soil. In these locations improper actions may act to destabilize soil resulting in erosion, destroy

valuable vegetation and/or act to encourage the proliferation of invasive species in locations where they have not been seen before.

As with the upland management areas, enhancement activities will be performed by the Owner/Grantor during the initial construction phase of the development project. Many of the above referenced habitat enhancement measures have been approved under the Final Superseding Order of Conditions issued by the Department of Environmental Protection on May 13, 2010. Habitat enhancement measures above and beyond those activities described in the NOI filing may require additional permitting or review with the local Conservation Commission, through either a Notice of Intent (NOI) or a Request for a Determination of Applicability (RDA) filing.

3.0 Conservation Restriction

As stated above, 7.95 acres of the 15.6 acre site will be deeded to the Town of Belmont to ensure the property is preserved and protected in perpetuity (See draft Conservation Restriction in Appendix E) to allow for natural and scenic preservation, passive recreation, habitat protection, and watershed protection.

APPENDIX A: List of Site Vegetative and Wildlife Species

Belmont Uplands – List of Observed Vegetative and Wildlife Species

Vegetative Species[1]	
Common Name	Latin Name
Boxelder	*Acer negundo*
Norway maple	*Acer platanoides*
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Tree-of-heaven	*Ailanthus altissima*
Speckled alder	*Alnus rugosa*
Japanese barberry	*Berberis thunbergii*
White birch	*Betula pendula*
Gray birch	*Betula populifolia*
Sedges	*Carex spp.*
Oriental bittersweet	*Celastrus orbiculata*
Buttonbush	*Cephalanthus occidentalis*
Enchanter's nightshade	*Circaea spp.*
Black ash	*Fraxinus nigra*
Jewelweed	*Impatiens capensis*
Honeysuckle	*Lonicera tatarica*
Purple loosestrife	*Lythrum salicaria*
Crabapple	*Malus spp.*
Sensitive fern	*Onoclea sensibilis*
Virginia creeper	*Parthenocissus spp.*
Amur Corktree	*Phellodendron amurense*
Common reed	*Phragmites australis*
False Solomon's seal	*Polygonatum biflorum*
Japanese knotweed	*Polygonum cuspidatum*
Smartweed	*Polygonum spp*
Cottonwood	*Populus spp.*
Black cherry	*Prunus serotina*
Pin Oak	*Quercus palustris*
Common buckthorn	*Rhamnus cathartica*
European buckthorn	*Frangula alnus*
Smooth sumac	*Rhus glabra*
Poison ivy	*Rhus radicans*
Staghorn sumac	*Rhus typhina*
Multiflora rose	*Rosa multiflora*
Common dewberry	*Rubus flagellaris*
Black raspberry	*Rubus occidentalis*

[1] Bold indicates plant is listed as an invasive species in "A Guide to Invasive Plants in Massachusetts" by Pamela B. Weatherbee, Paul Somers and Tim Simmons, The Massachusetts Biodiversity Initiative, MA Division of Fisheries and Wildlife. 1998.

Highbush blackberry	*Rubus sp.*
Weeping willow	*Salix babylonica*
Elderberry	*Sambucus canandensis*
Bittersweet nightshade	*Solanum dulcamara*
Goldenrod	*Solidago spp.*
Skunk cabbage	*Symplocarpus foetidus*
Tall Meadow Rue	*Thalictrum pubescens*
Narrow-leaved cattail	*Typha angustifolia*
American elm	*Ulmus americana*
Northern arrowwood	*Viburnum dentatum*
Wildlife Species [2]	
Great Blue Heron	*Ardea herodias*
Cedar Waxwing	*Bombycilla cedrorum*
American Goldfinch	*Carduelis tristis*
American Crow	*Corvus brachyrhynchos*
Gray Catbird	*Dumetella carolinensis*
Gray Tree Frog	*Hyla versicolor*
Skunk	*Mephitis mephitis*
Muskrat	*Ondatra zibethica*
Black-capped Chickadee	*Parus carolinensis*
Double-crested Cormorant	*Phalacrocorax auritus*
Hairy Woodpecker	*Picoides villosus*
Raccoon	*Prycon lotor*
Green Frog	*Rana clamitans*
Bullfrog	*Rana catesbeiana*
Wood Frog	*Rana sylvatica*
Gray Squirrel	*Sciurus carolinensis*
Cottontail Rabbit	*Sylvialgus floridanus*
Chipmunk	*Tamias striates*
American Robin	*Turdus migratorius*

[2] Includes indirect observations and signs (calls, burrows, branch browse, tracks, scat, etc.)

APPENDIX B – Site Photographs

Photo 1: Typical upland forest community.

Photo 2: Forested upland community with dense understory.

Photo 3: Forested wetland community.

Photo 4: Typical wetland forest/shrub community.

Photo 5: Large multi-stem Silver Maple tree on CR parcel.

Photo 6: Emergent marsh wetland community, southern section of the site.

Photo 7: Little River near mouth of Little Pond.

Photo 8: View of Little River.

Photo 9: Small Pond east of Acorn Park Drive.

Photo 10: Emergent marsh community east of Acorn Park Drive.

Photo 11: View across Little Pond (facing west).

Photo 12: View facing downstream of Little River (facing east).

Photo 13: Dense scrub-shrub wetland vegetation adjacent to Little Pond.

Photo 14: Wetland drainage swale along Frontage Road (northern section of property).

Photo 15: Invasive species control (easterly edge of Acorn Park Drive).

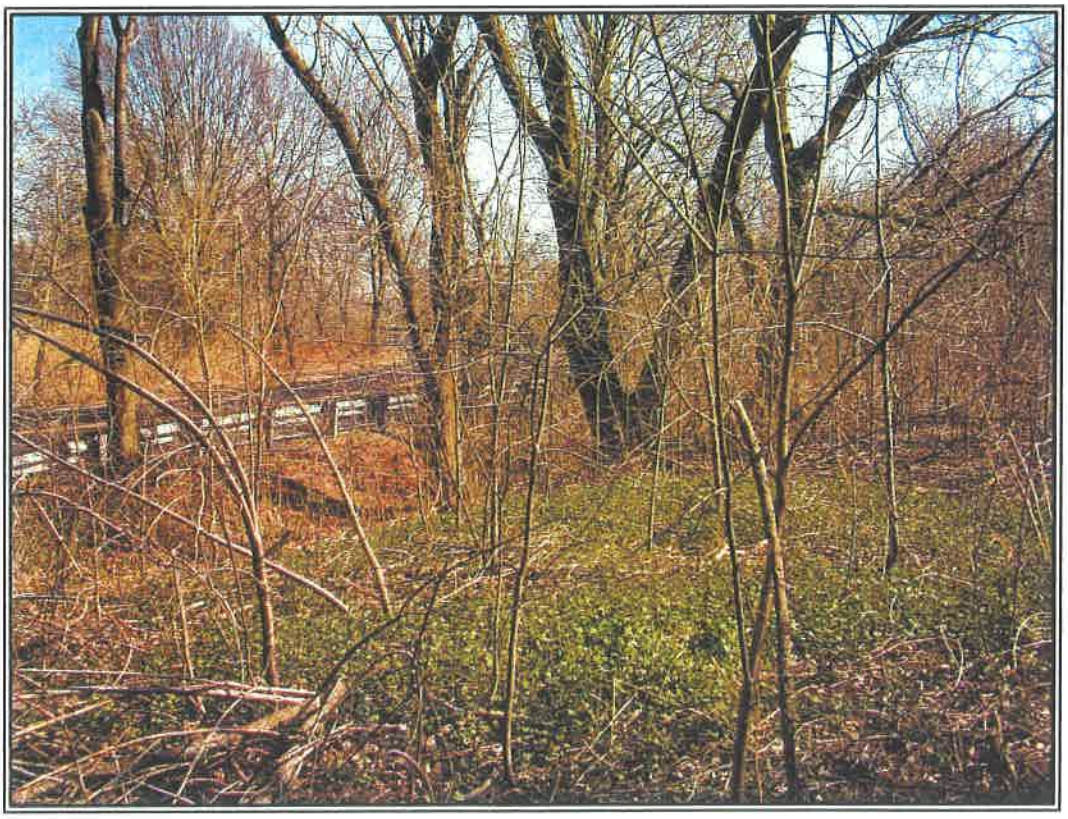
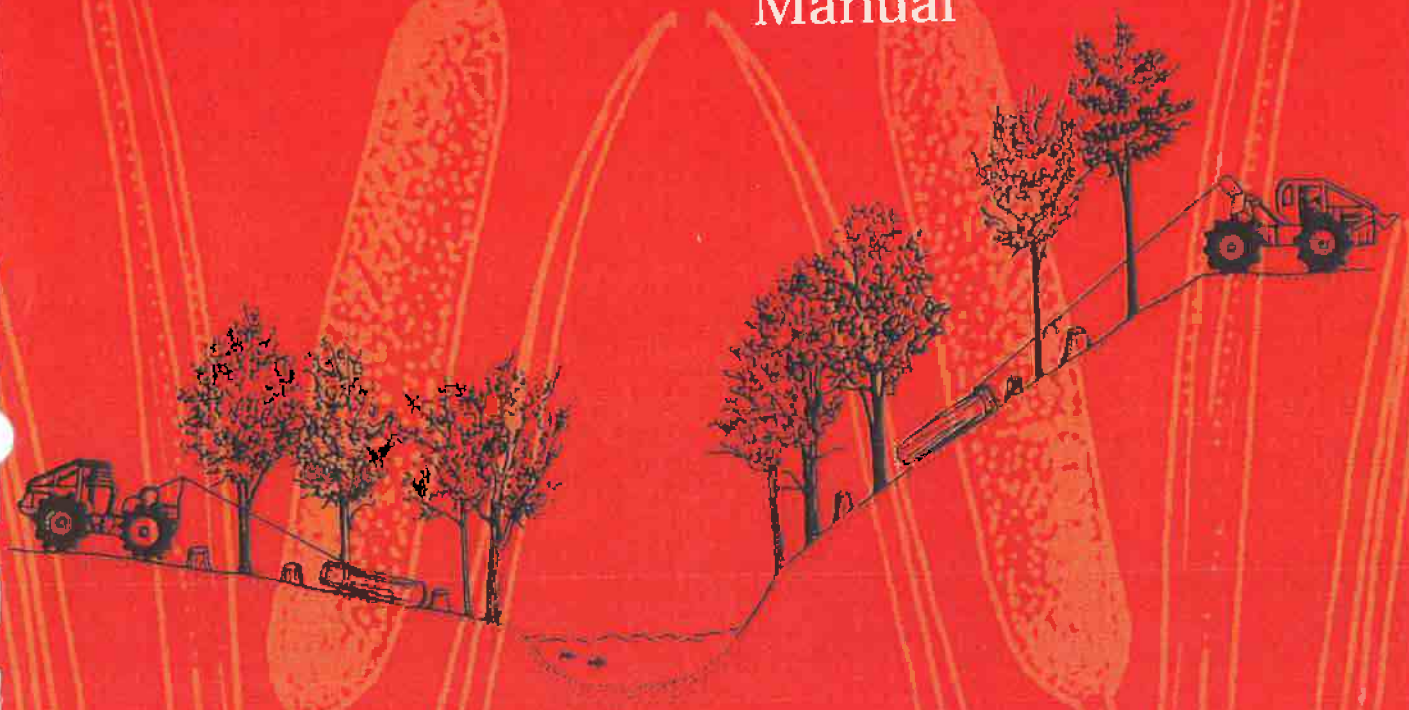


Photo 16: Southern compensatory flood storage area. Area to be planted with native species to enhance wildlife habitat.

APPENDIX C – Massachusetts Forestry Best Management Practices

Massachusetts Forestry Best Management Practices Manual



Prepared for:

Massachusetts Department of Environmental Protection
Office of Watershed Management

and

U.S. Environmental Protection Agency
Region I, Water Division, Water Quality Section

Massachusetts Forestry Best Management Practices Manual

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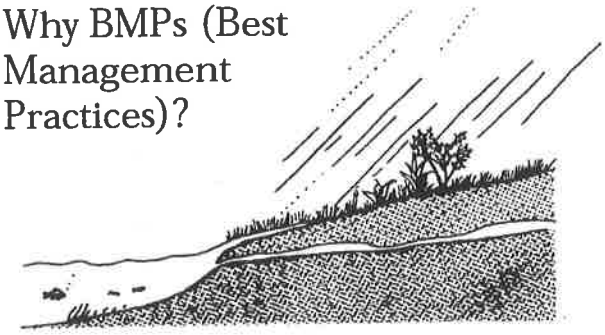
Table of Contents

1
Why BMPs (Best Management Practices)?



When forest products are harvested using heavy equipment that can disturb soil, runoff carrying sediment may occur. This sediment-laden runoff is called non-point source pollution if it gets into rivers, streams, lakes, ponds, or wetlands. Other types of non-point source pollution include lubricant leaks, and fertilizer/pesticide applications.

The basic principle behind BMPs is to minimize the overland speed and volume of water carrying sediment and nutrients that:

- **impact wetlands and water bodies,**
- **impact drinking water supplies, and**
- **impact fish/amphibian/reptile habitat**

BMPs are required to prevent or minimize non-point source water pollution by MGL Chapter 132, sections 40-46 - the Massachusetts Forest Cutting Practices Act, and the latest (1995) revision of its regulations.

The US Environmental Protection Agency (EPA) and National Oceanic and Atmospheric Administration (NOAA)administer several federal laws that require state agencies to address non-point source pollution from forest harvesting:

Section 6217 Federal Coastal Zone Act of 1990 requires the MA Coastal Zone Management office to assess non-point source pollution problems caused by harvesting, publish specific man-

Figure 1 (above) – The path of water over and through soil towards a water body.

agement recommendations, and coordinate the implementation of these recommendations in areas affecting coastal regions of the state. Harvesting activities throughout the entire state are considered to possibly have an effect on the coastal zone.

Section 319 of the Federal Clean Water Act of 1987 requires MA Department of Environmental Protection to assess nonpoint source forestry problems statewide as they affect water quality standards, identify best management practices needed to reduce levels of pollution, and coordinate the implementation of these BMPs.

Section 404 of the Clean Water act of 1977 requires the US Army Corps of Engineers to provide jurisdiction over activities that result in discharges of dredged or fill material in waters of the United States. Recently the Corps of Engineers and the states have been cooperating to transfer the jurisdiction to the appropriate state agency for easier administration.

Massachusetts General Laws Chapter 131 The Wetland Protection Act and Chapter 132 the Forest Cutting Practices Act require BMPs to control non-point source pollution from harvesting operations. Under the wetland regulation, BMPs are required in order to meet the conditions for the exemption from the Wetlands Protection Act. There is a Memorandum of Understanding (MOU) between the Department of Environmental Management, responsible for administering Chapter 132, and the Department of Environmental Protection, responsible for administering Chapter 131, that provides Service Forester oversight of wetland protection during harvesting, and thereby exempts harvesting from Chapter 131 procedures so long as it is in compliance with Chapter 132.

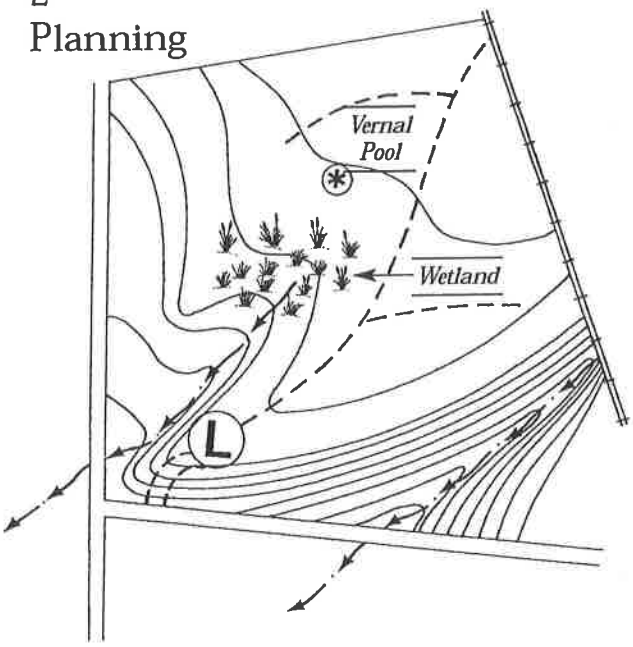
Finally, BMPs prevent rutting and will preserve access for future activities. They will also improve the looks of a timber harvest, which is important to landowners and the public in general.

This manual contains BMPs required by Chapter 132, as well as BMPs that are not required but highly recommended to protect water supplies, terrestrial and aquatic wildlife habitat, and the forest environment.

R **BMPs required by Chapter 132 are indicated by a red R.**

G Recommended activities or guidelines are indicated by a gold G.

2
Planning



Planning is one of the **most important BMPs, and the first to consider.** Planning ahead can save time in the future once the job begins, and insure prompt approval of the Forest Cutting Plan by the DEM Service Forester. It can also result in the most efficient use of machinery, and reduced wear and down-time.

Locate landings, access roads, and skid roads carefully to avoid steep slopes, wetlands, vernal pools, and stream crossings. It may be more cost-effective and efficient to layout longer skid trails to avoid these situations. Avoiding them will also mean less possibility of erosion. Consider alternatives such as obtaining permission to access the timber sale from a neighboring property to avoid such situations.

Planning not only means **how** you will access the timber sale, but also **when** the timber will be cut. **Timing** is one of the most important BMPs. Operating when the ground is dry, frozen, or snow-covered is an excellent way to reduce erosion.

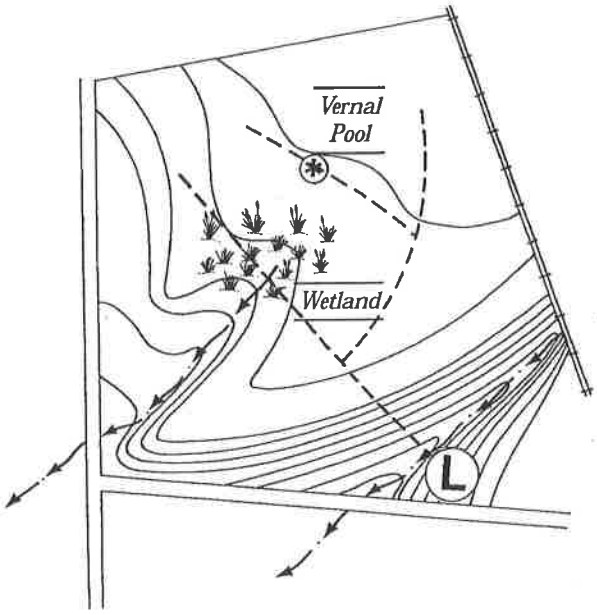


Figure 2 – Topograpic map of the same timber sale. Left, a well-planned operation, avoiding sensitive areas. Right, skid trails in conflict with such areas.

Forest Cutting Plan must include a description of the erosion control measures to be used. The Forest Cutting Plan map must show the proposed location of all truck roads, principal skid roads, stream and wetland crossings, as well as the general location of appropriate erosion control measures such as filter strips.

Operating on sustained slopes of 30% or more for a slope distance of 200 feet or greater requires the indication of these Steep Slope areas on the Forest Cutting Plan map. Special care must be taken to prevent erosion from roads, skid roads, and trails by closely following erosion control practices such as water bars to stabilize these areas during and

after the operation. Specific measures to be used to control erosion in these areas must be detailed in the Plan.

R No logging equipment may operate in a filter strip except:

- to reduce environmental damage shown to be necessary in a statement in an approved Forest Cutting Plan,
- at an approved stream crossing,
- on a pre-existing logging road, or
- in filter strips greater than 50 feet in width, beyond 50 feet from the water body. In this case, equipment can operate beyond 50 feet of the waterbody, as long as no principal skid road is located there, disturbance of the forest floor is minimized, and any disturbed soil is promptly stabilized.

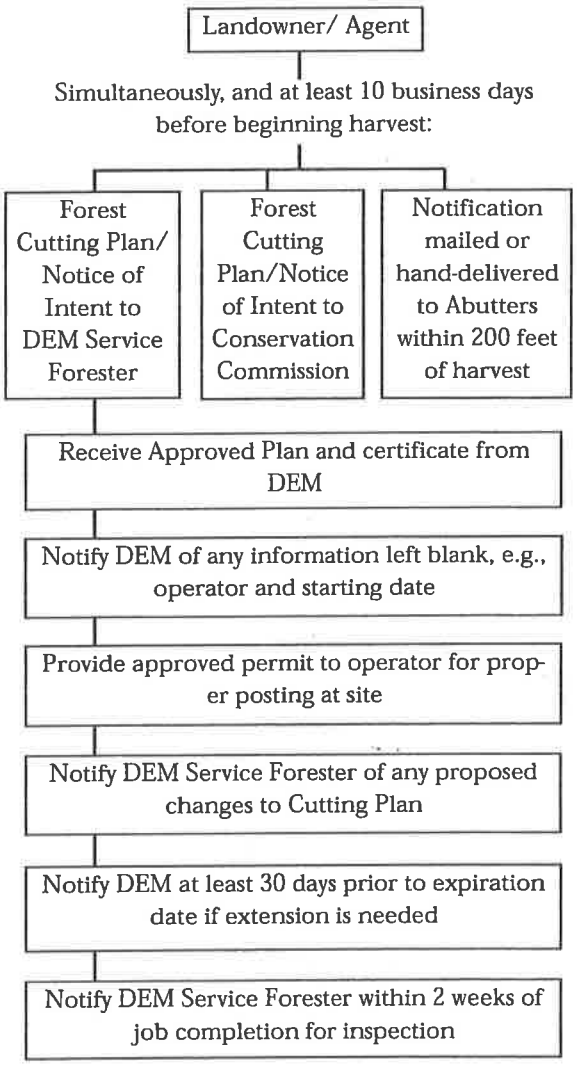
R MA Slash Law requirements pertain, and should be considered in the planning phase before the sale begins. See the section on slash for more details.

R Upon approval of the submitted Forest Cutting Plan, post the certificate at the landing of the job.

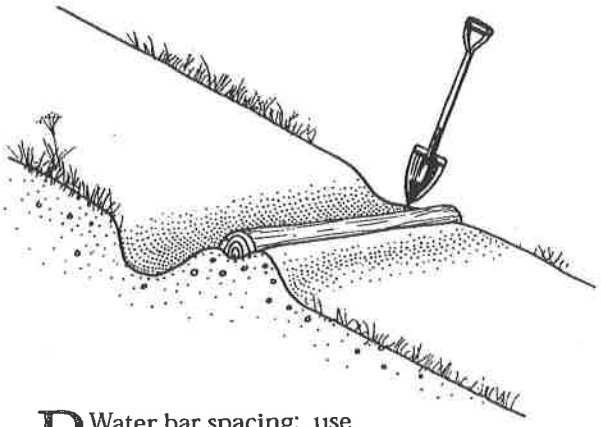
R Operators are required to have a copy of the approved Forest Cutting Plan on the job site.

R An approved Forest Cutting Plan is valid for up to two years from the date of receipt at the DEM regional office. Two one-year extensions may be granted for adequate reasons, at the discretion of the Director or the Director's agent, when requested in writing by the landowner or the landowner's Agent at least 30 days before the expiration date of the Plan. All logging, engineering, and stabilization requirements of the Plan must be fulfilled by the completion of the operation or by the expiration date, whichever is sooner.

Figure 3 – Steps in filing a Forest Cutting Plan/ Notice of Intent including threshold for Chapter 132



3
Skid Trails



R Water bar spacing: use common sense in the location of water bars. Local terrain often prevents them from being located exactly where the guidelines below specify, however these guidelines are a requirement of Chapter 132.

road grade (%)	*approximate distance needed between water bars(feet)*
1	400
2	245
5	125
10	78
15	58
20	47
25	40
30	35
35	32
40	29

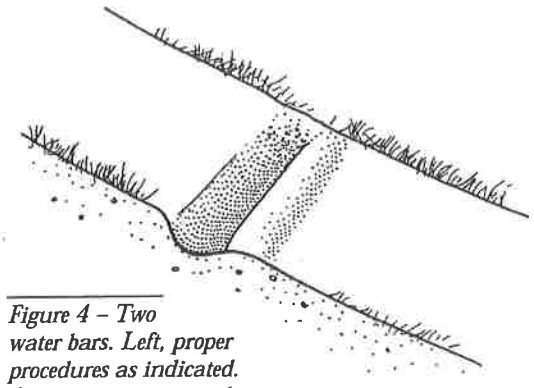


Figure 4 – Two water bars. Left, proper procedures as indicated. Above, incorrect procedures.
1. Angle to the center line of the road of roughly 30 degrees (i.e., not perpendicular)
2. Height of the berm (8-12"), depth of the ditch
3. Outflow for water from the ditch is open, and extends beyond the edge of the skid road; use of a shovel
4. Reinforce berm with a log
5. Make them deep to insure that they last a long time, and serve as a possible deterrent to ORV traffic, which can be a significant source of erosion
6. Mulching or seeding the berm will reduce scouring or erosion of the berm and make it last longer

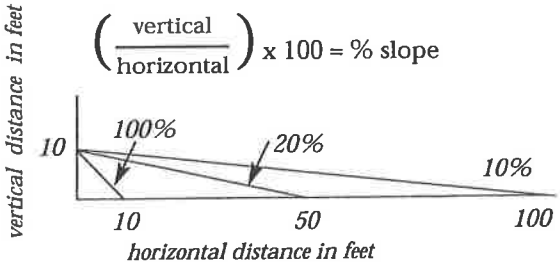


Figure 5 – How slope is determined

R Do not operate skidders on slopes greater than 60%, unless special permission is given by the Service Forester in the approved Forest Cutting Plan. In these cases, the applicant must show that soils are stable and that measures will be used to minimize erosion during and following the operation.

R Do not operate a machine in a wetland unless the ground is dry, frozen, or otherwise stable enough to support it. Identify the location of wetland and stream crossings on the ground with flagging or paint, as well as on the map with the Forest Cutting Plan. See the section on Wetland Protection (page 35) for further information.

R No machinery is allowed to operate in a certified vernal pool at any time of the year. A 50-foot filter strip must surround each certified vernal pool. See the sections on filter strips (page 21) and vernal pools (page 40) for more information.

R No logging equipment may operate in the filter strip except:

- to reduce environmental damage shown to be necessary in a statement in an approved Forest Cutting Plan,
- at an approved stream crossing,
- on a pre-existing logging road, or
- in filter strips greater than 50 feet in width, beyond 50 feet from the water body. In this case, equipment can operate beyond 50 feet of the waterbody, as long as no principal skid road is located there, disturbance of the forest floor is minimized, and any disturbed soil is promptly stabilized.

R All principal skid roads will be stabilized whenever they are left inactive for one month or more, or whenever the Service Forester determines such work is necessary. All necessary and required erosion control work will be performed by the completion of the operation.

G Watch the weather forecast and plan ahead for severe storms. Most sediment enters a stream following a severe storm. Hay bales and reinforced water bars are the best way to keep water from entering streams at crossings.

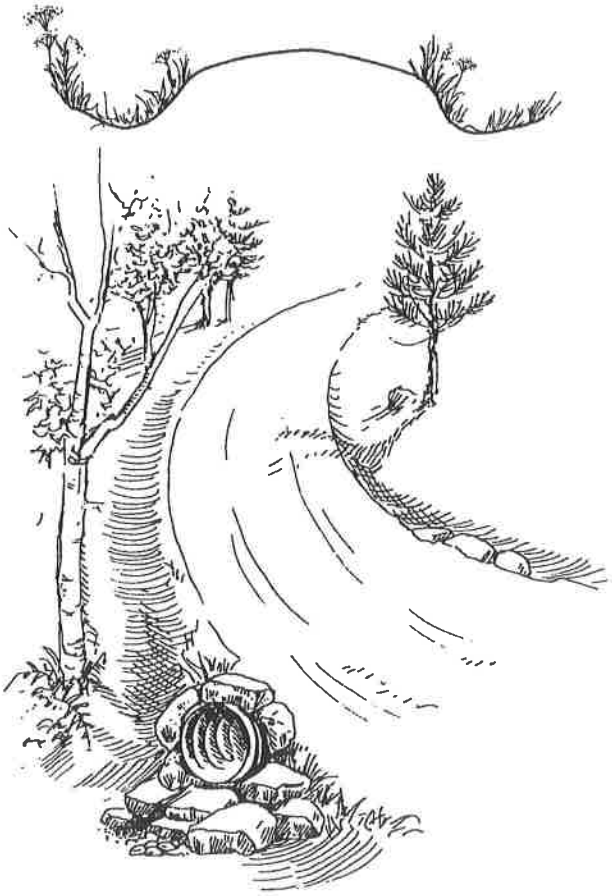
G Consider topography in the location of skid roads. Avoid steep slopes.

G Minimize debarking and other damage to residual trees.

G Choose skid roads partially on the basis of which trees are the "best" to damage. Every reasonable effort should be made to preserve advanced regeneration.

G Woods roads and skid trails should be smoothed and repaired after logging, and left in a stable condition to resist erosion.

4
Truck Roads



R Adequate drainage ditches, culverts, and water bars will be provided, and runoff will be led into filter strips or haybale impoundments to remove sediment.

R Access roads from a landing to a highway must be graveled or mulched to prevent mud from tracking onto the highway. Alternatively, they must not be used during wet weather, or mud must be removed immediately from the public

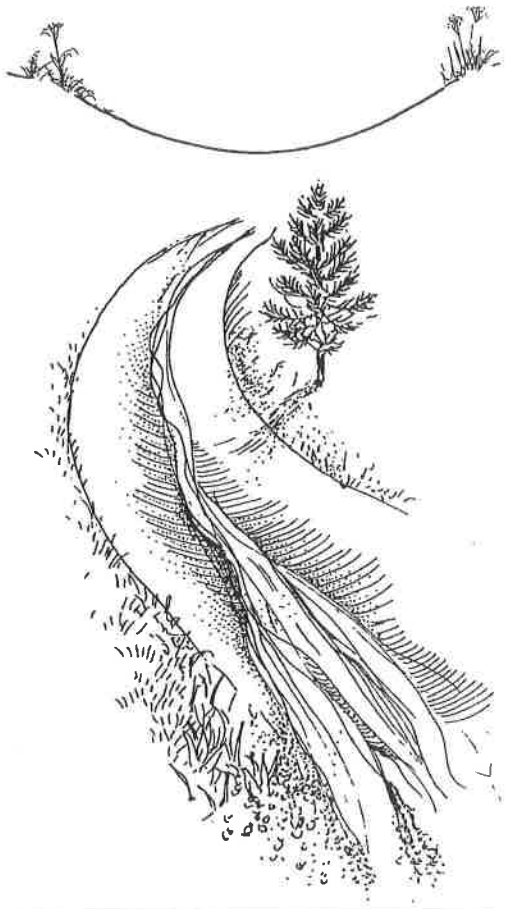


Figure 6 – Left, woods road with proper crown and ditches in place, and occasional broad-based dips, open-topped culverts, and culverts in use. Above, woods road with no crown, no ditches, water running down the center, spewing mud on the highway.

highway. At the end of the operation, the soil must be stabilized, and if necessary, seeded with grass. Refer to the section on seeding for specifics (p. 46).

R No logging equipment may operate in the filter strip except:

- to reduce environmental damage shown to be necessary in a statement in an approved Forest Cutting Plan,

- at an approved stream crossing,
- on a pre-existing logging road, or
- in filter strips greater than 50 feet in width, beyond 50 feet from the water body. In the last case above, equipment can operate beyond 50 feet of the waterbody, as long as no principal skid road is located there, disturbance of the forest floor is minimized, and any disturbed soil is promptly stabilized.

When a culvert is used, the Forest Cutting Plan must state its diameter, based on the culvert sizing table below:

Area above pipe (acres)	*pipe diameter (")* *Type I*	*Type II*
1	8	8
5	12	12
10	15	18
15	18	24
20	24	24
25	24	24
30	24	30
35	30	30
40	30	30
45	30	30
50	30	36
75	36	36
100	48	48
150	48	48
200	60	60
250	60	60

Type I terrain is forested and rolling, with slopes between 5 and 10%. Type II terrain is forested and hilly, with slopes between 10 and 30%. Culvert diameters are based on the 25-year storm.

Broad-based dips can be installed by a bulldozer, and are easier to maintain than culverts, since they do not have to be cleaned out. They also can not be broken down by Off-Road Vehicles (ORVs). They are effective at moving surface water off the road and into adjacent ditches or the forest floor. Recommended spacing is:

road grade (%)	*approx distance between dips (ft)*
1	500
2	300
5	180
10	140

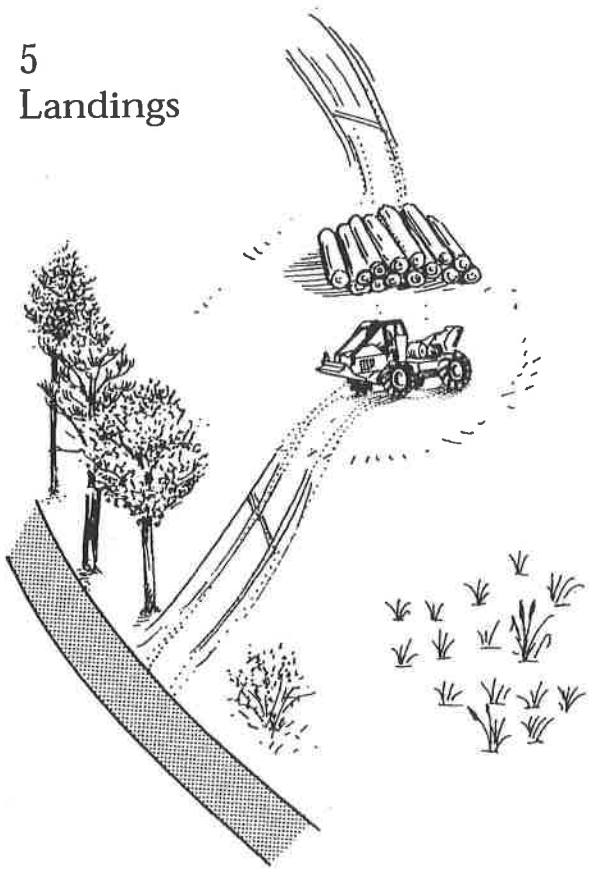
Open-topped culverts can also be used to move water off of the road surface. recommended spacing is:

road grade (%)	*approx distance between culverts (ft)*
1	400
2	245
5	125
10	78
15	58
20	47

If possible, avoid grades of more than 5%.

Good road management practices during and after the harvesting operation include: maintain and clear culverts, maintain and periodically reinforce broad-based dips and water bars, and close roads to unauthorized use.

5
Landings



R All unnatural debris such as cans, papers, discarded tires, metal parts, and other junk must be removed. Woody debris will be placed neatly to improve appearance and promote rapid decay.

R Soil will be stabilized and if necessary seeded to grass at the end of the operation (see p. 46).

G Locate the landing on gently sloping or level ground with good drainage, to avoid ponding of water. Whenever possible, place the landing out of sight of public ways. Curve the access road to break the line-of-sight from the public way.

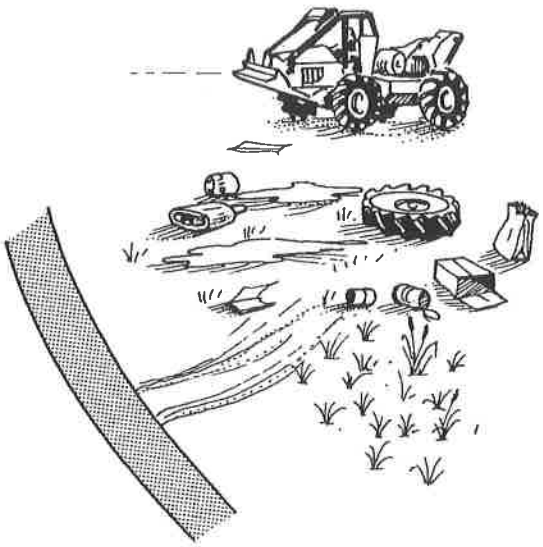


Figure 7 – Left, a good landing, as described in this section. Above, an improper landing.

G Set the landing at least 100 feet from water bodies and wetlands.

G If the landing must be closer than 100 feet to a water body or wetland, use hay bales or silt fence to check erosion.

G Locate diversions such as water bars or broad-based dips on skid trails leading into the landing, to prevent water from flowing into the landing and ponding, due to soil compaction from the machinery.

G Locate diversions such as water bars and broad-based dips on the truck road leading out of the landing, to prevent the flow of accumulated water and sediment from the landing out onto the public way.

G Check hoses and fittings regularly to prevent leaks of lubricants and hydraulic oil from machinery.

G Have oil-absorbent mats on the landing in case fuel, lubricant, or hydraulic fluid spills or leaks. In the event of slow leaks while the machine is parked overnight or for an extended period, place an oil-absorbent mat to catch the leak.

6
Hay Bale and Silt Fence Installation

Hay bales can be used as temporary means to intercept runoff and trap sediment. They can be used downslope of disturbed areas such as landings or on a skid trail upslope from a stream crossing, to keep water carrying sediment from entering the stream while the job is inactive (e.g., overnight, on weekends or during down times).

Proper installation includes:

- Hold the bales in place with stakes.
- To prevent being undercut, dig a foundation for the bales several inches deep. Compact soil up against the bales on the upslope side.
- Overlap hay bales to increase their effectiveness and insure that they will remain in place.

Wire or nylon-bound bales are more durable than those bound with twine.

Hay bales will only last 2-6 months, and will need to be replaced when saturated with sediment.

Silt fence is intended to temporarily retain sediment from small disturbed areas by reducing the speed of overland flow.

The rule of thumb for placement downgradient of disturbed areas such as landings generally is to use 100 feet of silt fence for every 1/4 acre of disturbed area.

Proper installation of silt fence involves:

- Drive in posts spaced 4-6 feet apart.
- Fence height should be at least 2.5 feet.

- Attach a continuous length of fabric to the posts. Attach the posts downgradient from the fabric, so water and sediment do not pull the fabric from the posts.
- Bury several inches of the fabric in the ground to anchor it and prevent flow beneath it.
- Backfill the base of the fabric with compacted soil or crushed stone.

Consider reinforcement of silt fence by stringing wire mesh fencing between the posts.

Beware of undercutting of silt fence due to improper burying of the fabric.

Do not install silt fence across streams, ditches, or waterways.

Inspect fence periodically and after each rainfall.

Replace worn fabric immediately.

Remove accumulated sediment deposits immediately.

Remove all fence materials and unstable sediment after the drainage area is stabilized.

The design life of silt fence is 6 months or less. Do not leave the silt fence in place as a permanent erosion control structure. It may serve as a barrier to amphibian and reptile travel.

7
Filter Strips

It is the purpose of filter strips to:

- slow the movement of overland flow of water, thus enabling transported sediment to be left behind,
- provide an opportunity for vegetation to take up nutrients that may otherwise flow into the water body,
- provide shade to the adjacent water body, to prevent warming of the water, and thus injury to aquatic and riparian wildlife habitat, and
- protect bank stability and prevent erosion.

It is important not to disturb the forest floor of filter strips, to permit the filtration of overland flow through ground vegetation and forest floor debris. It is likewise important to retain at least 50% of the overstory basal area, to provide the important shade function to the adjacent water body.

Filter strips are required along all water bodies and certified vernal pools. No more than 50% of the basal area may be cut at any one time, and a waiting period or five years must elapse before another cut is made. The residual stand will be composed of healthy growing trees well distributed over the area. Exceptions to this standard may be made by the Service Forester if it is shown in the Forest Cutting Plan that a heavier cut is necessary to protect the stream, bank, or water quality.

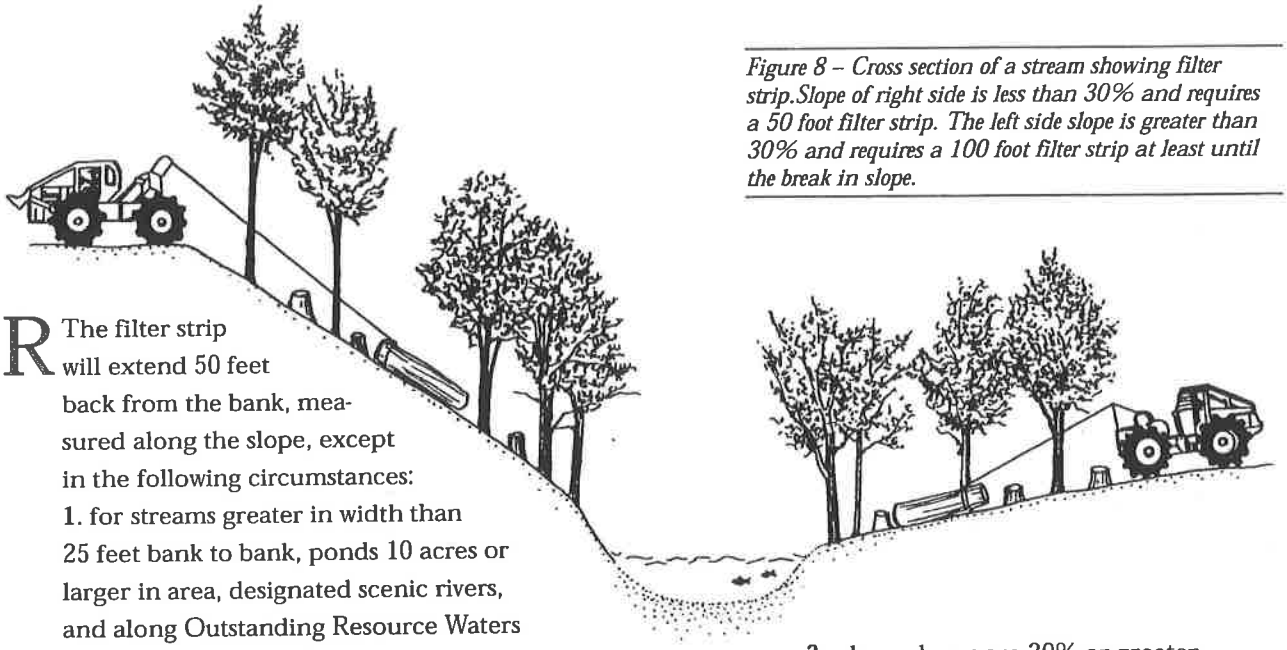


Figure 8 – Cross section of a stream showing filter strip. Slope of right side is less than 30% and requires a 50 foot filter strip. The left side slope is greater than 30% and requires a 100 foot filter strip at least until the break in slope.

R The filter strip will extend 50 feet back from the bank, measured along the slope, except in the following circumstances:

1. for streams greater in width than 25 feet bank to bank, ponds 10 acres or larger in area, designated scenic rivers, and along Outstanding Resource Waters and their tributaries (excluding vernal pools), filter strips will be of variable width, depending on slope, as described in the following table:

slope %	*filter strip width (feet)*
0	50
10	90
20	130
30	17
40	210
50	250
60	290
70	330
80	370
90	410
100	450

Variable-width filter strips may be advisable to use in other circumstances, as well.

2. where slopes are 30% or greater, the filter strip will extend 100 feet back from the bank, or to the point between 50 and 100 feet from the bank, where a break in the topography reduces the slope to less than 30%.

R No logging equipment may operate in the filter strip except:

- to reduce environmental damage shown to be necessary in a statement in an approved Forest Cutting Plan,
- at an approved stream crossing,
- on a pre-existing logging road, or
- in filter strips greater than 50 feet in width, beyond 50 feet from the water body. In the last case above, equipment can operate beyond 50 feet of the waterbody, as long as no principal skid road is located there, disturbance of the forest floor is minimized, and any disturbed soil is promptly stabilized.

R Cut trees will be winched out of the filter strip and slash will be disposed of according to the Slash Law. No slash can remain within 25 feet of any continually flowing brook, stream, river, or any lake, pond, or water supply.

G The following guidelines may be used to provide additional protection to sensitive streams (tributaries to water supply reservoirs, high-quality trout streams, and rare species habitat) and wildlife habitat in riparian corridors:

- 15-foot no-cut buffer
- avoid soil compaction and rutting within 200 feet of a stream
- maintain areas within 200 feet of the stream in a forested condition
- preserve important habitat characteristics within 200 feet of a stream, such as trees with cavities, downed logs, stone walls and rock jumbles
- use variable-width filter strip guidelines above
- avoid the cutting of trees directly on the stream bank
- avoid the use of rip-rap to stabilize banks.

8
Buffer Strips

Buffer strips are areas of light cutting along roads, where the intensity of cutting is restricted to maintain a forested appearance and an attractive landscape.

R Buffer strips will be left along the edges of publicly maintained ways, except along forest management roads in federal, state, county, or municipal forests, parks or reservations. Within buffer strips, no more than 50% of the basal area may be cut at any one time, and a waiting period of five years must elapse before another cut is made. The residual stand in the buffer strip will be composed of healthy growing trees well distributed over the area.

R Buffer strips will extend 50 feet back from the outer edge of the highway, except for designated scenic roads, where they will extend 100 feet from the highway.

R Hardwood slash must not be left more than 2 feet above the ground within 40 feet of any highway. Softwood slash must not be left on the ground within 40 feet of any highway, and must not be more than 2 feet above the ground between 40 and 100 feet of any highway.

9
Stream Crossings

Studies in Massachusetts have shown that stream crossings represent one of the principal ways that sediment can enter a water body. They do, however, prove necessary on the majority of jobs.

For purposes of Chapter 132, and determining when mitigation is necessary, a stream is defined as follows:

> **a body of running water, including brooks and creeks, which moves in a defined channel due to a hydraulic gradient, and which flows within, into, or out of an area subject to protection under the Wetlands Protection Act. A portion of a stream may flow through a water control structure such as a culvert or bridge. Such a body of running water, which does not flow throughout the year (intermittent) is a stream except for the portion up-gradient from all bogs, swamps, wet meadows, and marshes.**

R When a crossing is essential, existing old crossings will be rehabilitated and used, provided that it can be shown that this will cause less disturbance than constructing a new crossing.

R **Temporary crossing structures will be removed at the end of the operation, and the site will be stabilized.**

R The installation of permanent stream crossings and the construction of permanent roads involving fill through wetland resource areas requires the approval of the local Conservation Commission under the Wetlands Protection Act MGL 131 section 40. See page 33 for a description of this procedure.

R The rehabilitation, new construction, and stabilization of stream crossings will be done to the standards defined below:

Banks	***streambed***	***acceptable crossing method***
shallow *(less than one foot in height)*	rocky	ford with stabilized approaches, corduroy, culvert, bridge
	soft	corduroy, bridge, corduroy with culvert
steep *(greater than one foot in height)*	rocky	corduroy, culvert, bridge
	soft	corduroy, culvert, bridge

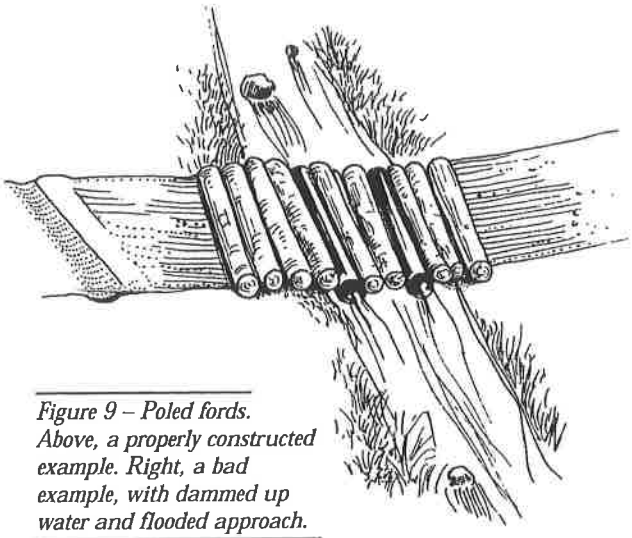
R All crossing will be made at right angles to the channel.

R When crossing involves fill or other closed or semi-closed structures which will obstruct flow, they will be designed to accommodate at least the 25-year storm (refer to the table of culvert sizes on p. 14).

R If a culvert is to be used, the Forest Cutting Plan must state the diameter of the culvert based on the culvert sizing table in this manual (p. 14).

R All banks and approaches to stream crossings will be stabilized during and at the end of the operation.

R All stream crossings will be accurately mapped and labeled on the Forest Cutting Plan map, and marked on the



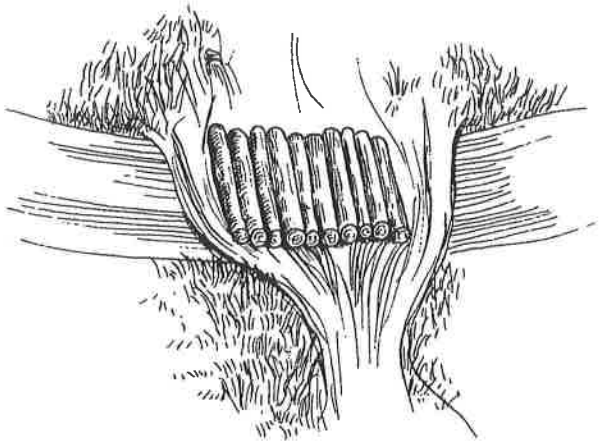


Figure 9 – Poled fords. Above, a properly constructed example. Right, a bad example, with dammed up water and flooded approach.

ground with paint or flagging at the time the Plan is filed.

R If a stream crossing must be changed during the operation, the Service Forester must be notified and approve the change before it is made.

R Within 1000 feet upstream of a public water supply reservoir, measured along the course of the stream from the high-water mark of the reservoir, all stream crossings must use a temporary bridge. Exceptions to this will require filing of an Environmental Notification form (ENF) in accordance with MGL Chapter 30, sections 61-62H and CMR 11.00.

G Avoid steep or undercut banks. Gentle banks minimize erosion. The approach to the crossing should be level for roughly 50 feet on both sides.

Crossing Options:

A. Corduroy, or Poled Ford:
Place logs in a stream parallel to the direction of flow. Logs should be large enough to keep the skidder out of the water, and should be level with the stream banks. Place one or several culverts in and amongst the logs, to permit streamflow though the ford, and prevent damming. Ductile iron culverts or pieces of gas pipeline can withstand great impact and support heavy logging equipment without collapsing, including fully-loaded forwarders.

B. Bridge:
From the standpoint of water quality, it is most advisable to use a bridge to keep the machine and hitch completely out of the water. This means that lubricant and fuel will not wash into the stream water, and sediment will not be dragged into the stream on the tires and hitch. Also, the banks will remain intact, and their disturbance will not represent another source of sediment. There are two ways to bridge a stream:

1. Skidder bridges can be constructed on-site.

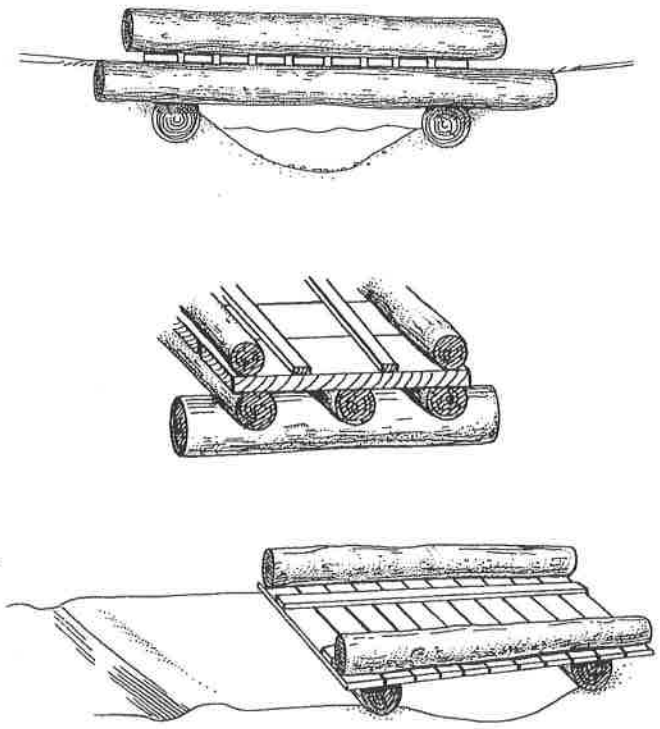


Figure 10 – A skidder bridge will include:
a) 3-6 stout tree-length logs used as stringers across the stream,
b) 4-inch planks used as decking, bumper logs added to the sides to keep the hitch from falling into the stream,
c) straight approach to line up the hitch,
d) sills or log abutments to improve stability, anchor the bridge in place, and elevate it above the level of the bank.

2. Re-usable temporary skidder bridge. There are many different designs possible, including the recommended one below.

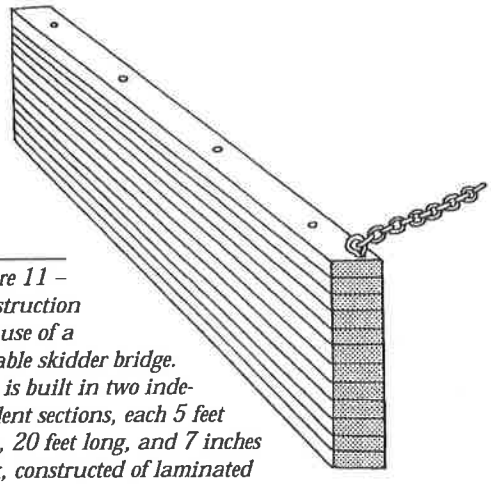
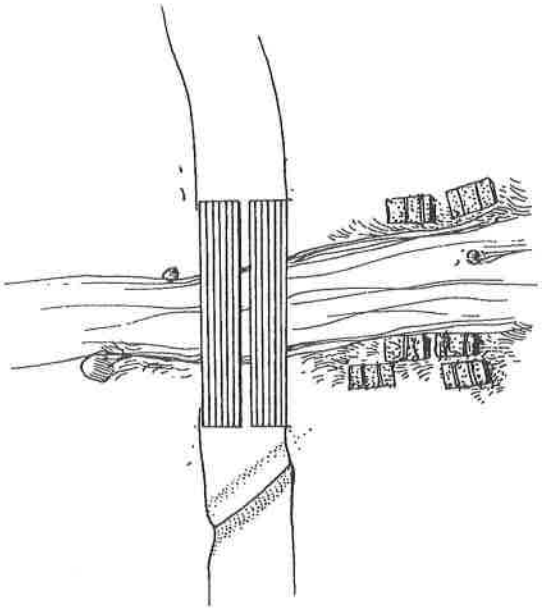


Figure 11 – Construction and use of a reusable skidder bridge.
a) It is built in two independent sections, each 5 feet wide, 20 feet long, and 7 inches thick, constructed of laminated timber bolted together.
b) A chain on one end facilitates skidding into place.



Sections are skidded into place from the landing, and located side-by-side at the crossing. At the end of the operation, the pieces can be skidded back to the landing, loaded onto a log truck, and moved to another site. It is important to stabilize the approaches while installing and removing portable or temporary skidder bridges.

C. Culverts:

(Refer to the culvert guidelines on p. 14.)

For all Stream Crossings:

Use hay bales staked at stream crossing approaches parallel to banks to catch sediment before it enters the stream (see p. 19). Locate hay bales prior to bridge installation to intercept as much sediment as possible. It is better to use hay bales or silt fence to intercept runoff before it gets into the stream than to use them in the stream itself. Do not use silt fence in a stream. However, if hay bales are used in the stream, they should be staked at least 15 feet downstream to prevent ponding at the crossing. Hay bales that become full of sediment should be removed, placed away from the stream, and replaced with fresh ones.

It is very important to stabilize the approaches to a stream crossing both during the logging operation and after completion. Unstable approaches are one of the primary ways that sediment can enter a stream. Although water bars are generally installed at the end of a timber harvest, it is advisable to install at least one directly uphill from a crossing to prevent water moving down a skid road from reaching a stream. **This waterbar will need to be occasionally reinforced during the course of the job.** The approaches can be corduroyed with poles to prevent rutting and the churning of soil. Consider staking a few hay bales in the skid road at the approach to a stream crossing at the end of the day or week, especially if there are showers or heavy rains in the forecast.

Although not covered under Chapter 132, permanent accessways/ stream crossings may be obtained by the following procedure:

I.
Under the wetlands regulations, 310 CMR 10.53(3)(r), "limited project":

A . File Notice of Intent under 310 CMR 10.53(3)(r), limited project for permanent access for forestry (if uncertain that activity will take place in an area subject to the wetland regulations you can file a Request for Determination of Applicability (RFD)- there is no fee associated with an RFD);

B. Work must conform to Order of Conditions, all seven conditions listed below, and any conditions determined necessary by the Conservation Commission;

C. Filing fee for the limited project Notice of Intent is minimal.

Conditions that must be met as part of the above approval:

1a. The road is designed and constructed in accordance with a Forest Cutting Plan approved by DEM under provisions of 304 CMR 11.00, and the Massachusetts Forestry Best Management Practices Manual OR

1b. The road is to be built on land with a permanent recorded Conservation Restriction and maintains the land in perpetual forest use.

2. The accessway is minimum practical width required for cutting and removal of trees;

3. Practical alternative access across upland not available;

4. Number of accessways in wetland resource area minimized;

5. Activities conducted when soil is frozen, dry, or otherwise stable to support equipment;

6. The accessway does not increase flood stage or velocity;

7. Design and installation done in accordance with Massachusetts Forestry BMP Manual and allows for 25-year storm.

II.
If the seven (7) conditions under 310 CMR 10.5393) (r) cannot be met, an Order of Conditions for a non-limited project activity must be obtained as follows:

A. File Notice of Intent under standard wetland regulation procedures.

B. Approval is based on engineering considerations and the ability of the activity to meet the wetland performance standards.

C. Work must be done in conformance with the Order of Conditions.

D. Notice of Intent filing fee will be dependent upon the project and the number of wetland crossings.

Order of Conditions received per either I or II above may be appealed to the Massachusetts Department of Environmental Protection (DEP). For further information see the wetland regulations 310 CMR 10.00. For general information see the appendix for Departmental contact, addresses, and phone numbers.

10
Wetlands

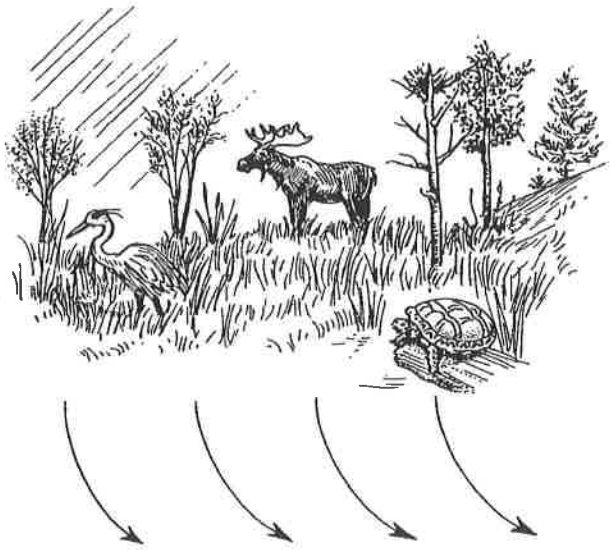


Figure 12 – cross-section of a wetland showing these functions:
1) filters that trap sediment, nutrients, and heavy metals from surface and subsurface flows
2) sources of groundwater recharge
3) buffers of heavy rains, releasing them slowly downstream to prevent flooding
4) habitat for a wide variety of wildlife species, and more than 40 threatened or endangered animal species in Massachusetts

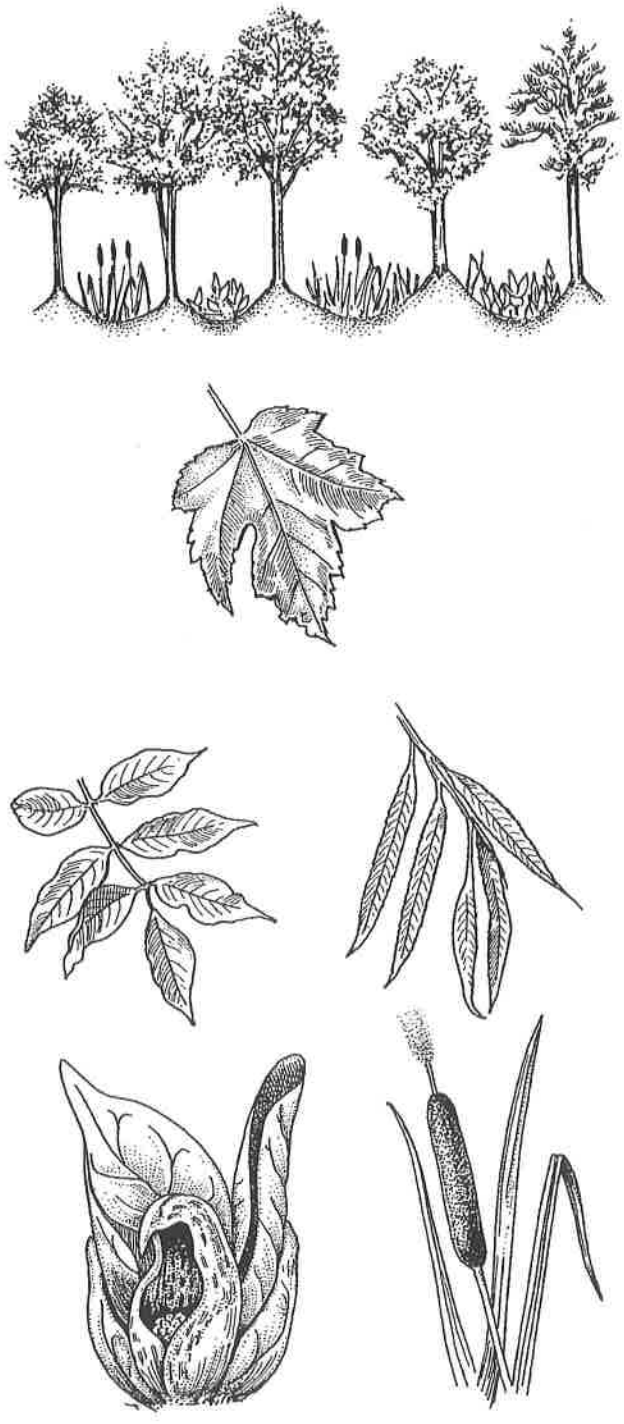
Wetlands in Massachusetts are legally identified in the Wetlands Protection Act (MGL Chapter 131 Section 40) and defined in the wetland regulations 310 CMR 10.00. In general, the wetland resource areas referenced in this BMP Manual are Bordering Vegetated Wetlands (BVWs). These areas are the result of inundated or saturated conditions for sufficient periods of time to cause a change in the plant community and soils. They are generally recognized by the type of plants that comprise the vegetated community (such as red maple, green or black ash, black

Figure 13 – Cross-section of a wetland depicting these features:
1) presence of water at or near the surface for a portion of the year – look for: drainage channels, high water marks, depressions, debris lines
2) plants adapted to wetland conditions, e.g., willow, red maple, green and black ash, cattail, skunk cabbage
3) poorly drained soils with mottling discoloration-indicators: spongy ground underfoot, black organic soils

gum, spicebush, skunk cabbage), the type of soils present (organic soils such as peat or muck and mineral soils gray or dull in color or with other wetness features such as mottling) and the evidence of water present at or near the surface for a significant length of time (look for drainage channels, water marks on fixed objects, water stained leaves, debris lines). Additional information on BVWs is presented in a handbook available from DEP entitled "Delineating Bordering Vegetated Wetlands".

Although wetlands may act as filters, this function may be compromised by excessive pollutant loads, which in turn may cause wetlands to become sources of non-point source pollution, and impair other functions. Thus, it is important to keep sediment out of wetlands, so as to not impair their function as filters. Runoff from roads, skid trails, and landings should not be directed into wetlands.

R All forest harvesting activities that take place within 100 feet of a wetland resource area must receive either an exemption to or a permit under MGL Chapter 131 the Wetlands Protection Act. A properly filed, approved, and followed Forest Cutting Plan provides an exemption to the normal filing requirements of the Wetlands Protection Act.



R Wetlands that will be crossed, logged in, or lie adjacent to any harvesting activity will be accurately shown and labeled on the Forest Cutting Plan map. The location of a crossing must be identified on the ground with paint or flagging.

R Roads through wetlands approved under Chapter 132 Forest Cutting Practices Act are temporary. Permanent roads through wetlands require Conservation Commission approval under Chapter 131 Wetlands Protection Act.

R Wetlands will not be operated in unless dry, frozen, or otherwise stable. When these conditions are not met, the Forest Cutting Plan requires special approval by the Service Forester, after showing that it will help avoid significant environmental damage.

R If the wetland crossing needs to change during the operation, the Service Forester must approve the change before it is made.

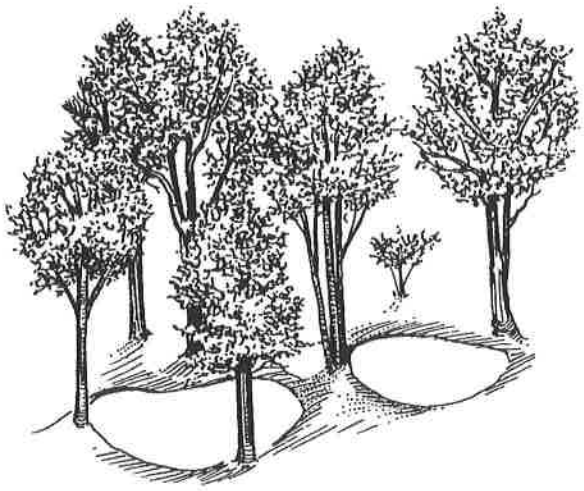
R maintain at least 50% basal area in wetlands.

G When operating in a wetland it is advisable to:

- concentrate skidding in a few well-defined corridors,
- use cable and winch as much as possible,
- use brush or corduroy to minimize ground pressure and rutting,
- reduce hitch volumes to minimize rutting,
- use BMPs to minimize sediment transport,
- avoid landings in wetlands,
- not store fuels or lubricants on landings in or within 100 feet of a wetland,
- not refuel or clean machinery on landings in or within 100 feet of a wetland,
- fell trees away from wetlands, to facilitate winching them out.

G **Isolated Vegetated Wetlands** are areas that are generally saturated by groundwater or covered by surface water long enough to produce hydric soil conditions and which, under normal circumstances, support wetland plant communities. Isolated Wetlands have many of the same characteristics as Bordering Vegetated Wetlands (BVWs), **except** that they do not border on a pond, lake, or stream, and are therefore not defined as wetland resource areas by the Wetlands Protection Act. Isolated Wetlands may perform some important water quality functions, and may also provide wildlife habitat. In order to maintain their ability to perform these functions, it is suggested that the standards required for Bordering Vegetated Wetlands (BVWs) **also** be applied to Isolated Wetlands. That is: avoid them if possible, cross only when the ground is frozen, dry, or otherwise stable, and harvest no more than 50% of the basal area at any one time.

11
Vernal Pools



A vernal pool is a confined basin depression which, at least in most years, holds water for at least two continuous months during the spring and/or summer, and which is free of adult fish populations. These areas provide essential breeding habitat for a variety of amphibian species such as wood frogs, spotted salamanders, and other important wildlife species.

Certified Vernal Pools are those that have been certified by the Massachusetts Division of Fisheries and Wildlife. For information on the location of Certified Vernal Pools, contact The Natural Heritage and Endangered Species Program (see appendix for address and phone number).

The following activities are required under Chapter 132, the Forest Cutting Practices Act, for Certified Vernal Pools, and are recommended for vernal pools in general.

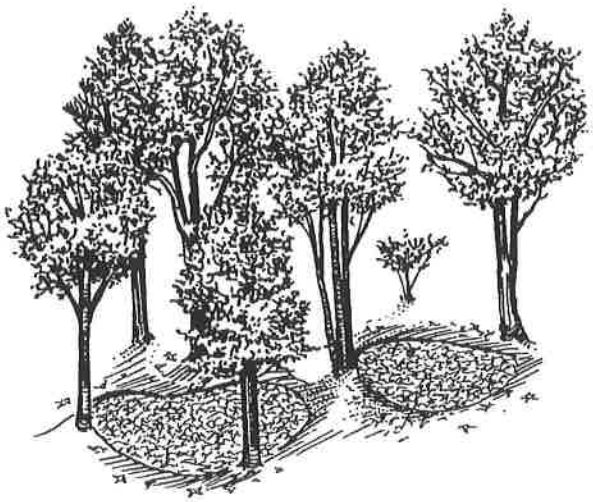


Figure 14 – Two vernal pools. Because of their temporary nature, vernal pools can be difficult to identify. Pools at left are full. Pools above are empty, and show identification features such as depression, matted leaves, and water lines on trees.

R Filter strip 50 feet in width around a Certified Vernal Pool, measured from its edge along the slope. No more than 50% of the basal area may be cut at any time, and a waiting period of five years must elapse before another cut is made. Exceptions to this standard may be made by the Service Forester, if it is shown in the Forest Cutting Plan that a heavier cut is necessary to protect environmental quality.

R Where slopes within the filter strip are 30% or greater, the filter strip will extend 100 feet from the Certified Vernal Pool, or to the point beyond 50 feet from the pool where a break in topography reduces the slope to less than 30%.

R No equipment may operate in the depression of a Certified Vernal Pool, and no logging equipment may operate in the filter strip except:

- to reduce environmental damage shown to be necessary in a statement in an approved Forest Cutting Plan,
- at an approved stream crossing,
- on a pre-existing logging road,
- in filter strips greater than 50 feet in width, beyond 50 feet from the water body. In the last case above, equipment can operate beyond 50 feet of the vernal pool, as long as no principal skid road is located there, disturbance of the forest floor is minimized, and any disturbed soil is promptly stabilized.

R Tree tops and slash shall be kept out of the Certified Vernal Pool depression. If an occasional top does land in the pool, leave it only if it falls in during the amphibian breeding season (approximately March 1 through July 1).

G Avoid making ruts deeper than 6 inches within 200 feet of a vernal pool. These can represent barriers to amphibian migration.

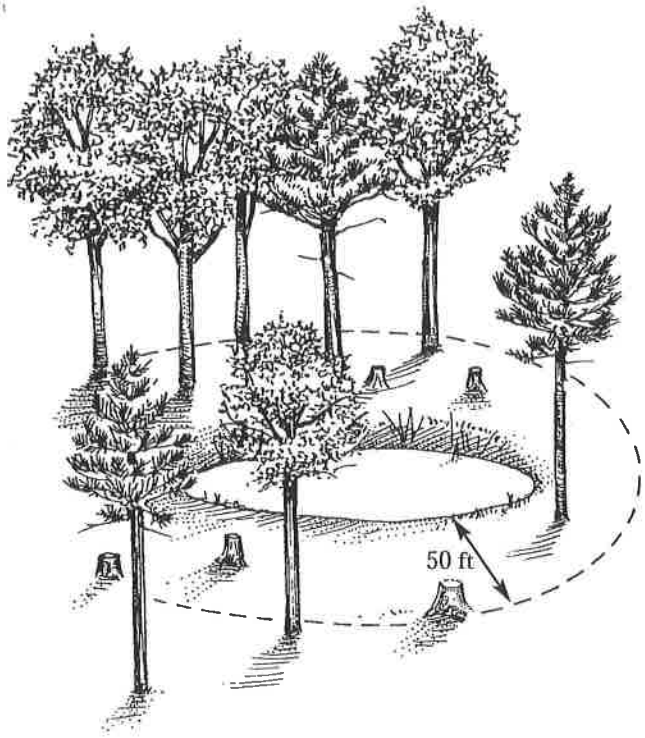


Figure 15 – vernal pool protection measures showing filter strip width and basal area retained.

12
Rare and Endangered Species

The Massachusetts Rare and Endangered Species Act prohibits the taking of rare or endangered species and the alteration of designated significant habitats without the approval of the Director of the Division of Fisheries and Wildlife. Activities conducted in accordance with an approved Forest Cutting Plan are presumed to be in compliance with the Massachusetts Rare and Endangered Species Act. Landowners, timber harvesters, and foresters are encouraged to contact the Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife (see appendix) to determine the applicability of this Act to their property or harvesting activities.

Upon receipt of a Forest Cutting Plan, the Service Forester will check the most recent edition of the "Massachusetts Natural Heritage Atlas" to see if the area to be harvested falls within an **Estimated Habitat of Rare Wetlands Wildlife**.

- If the harvest falls within an estimated habitat, the Plan will be forwarded to the Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program (NHESP).
- Upon receipt of the Cutting Plan, NHESP will have 15 business days to determine and report to DEM whether the proposed harvest will negatively impact rare wetlands wildlife habitat.
- If NHESP determines that the proposed harvest will negatively impact the habitat, it will advise DEM of its findings and recommend mitigation of the impact to the habitat.
- Upon receipt of NHESP's recommendations, the Service Forester shall modify the Cutting Plan to avoid negative impacts to the habitat.

Also, upon receipt of a Forest Cutting Plan, the Service Forester will check the most recent edition of the "Massachusetts Natural Heritage Atlas" to see if the proposed area to be harvested falls within a **High Priority Site of Rare Species Habitat.**

- If the harvest falls within a priority habitat, the Plan will be forwarded to NHESP.
- Upon receipt of the Cutting Plan, NHESP will have 10 business days to determine and report to DEM whether the proposed harvest may result in the taking of a rare species.
- If NHESP determines that the proposed harvest may result in the taking of a rare species, it will advise DEM of its findings and make recommendations to avoid the potential take.
- Upon receipt of NHESP's recommendations, the Service Forester shall modify the Cutting Plan to avoid a taking of rare species, and send NHESP a copy of the modified Plan. If the above process has been followed and the modified Cutting Plan complied with, it will be presumed that potential violations of the Massachusetts Endangered Species Act will have been avoided.

13
Seeding

Grasses and other herbaceous cover can stabilize bare mineral soil and minimize erosion. It is a good practice to seed disturbed areas following harvesting. The following table describes different seed mixtures. Mixture number 4 (creeping red fescue, birdsfoot trefoil, and tall fescue) has been traditionally successful in central New England.

None of the recommended grass species are native to Massachusetts. Some are even considered ecologically hazardous because they are so aggressive, and interfere with native plants. Tall fescue, crownvetch, and flatpea are particularly aggressive, or at least so successful that they keep native species from becoming established.

Seeding with native grasses would be preferable, but they are difficult to find commercially (see table of recommended native species below- try some of the larger nurseries in the northeast). A compromise alternative is to use rapidly stabilizing plants like **domestic ryegraass, red fescue, redtop, or Canada bluegrass** which will germinate quickly and stabilize the soil, but are not too aggressive and **will not persist or spread.** In the meantime, the soil is immediately stabilized, and the natural succession of native vegetation is allowed to progress.

Seed Mixture[a]	*Lbs/ Acre*	*Lbs/ 1000 ft²*	*soil ph range*
1. domestic ryegrass	20	0.45	4.5 - 7.5
2. creeping red fescue,	20	0.45	4.5 - 7.5
red top,	2	0.05	
tall fescue	20	0.45	
3. tall fescue[b],	20	0.45	5.5 - 7.5
flatpea[c]	3	0.65	
4. creeping red fescue[b],	2	0.45	4.5 - 7.5
birdsfoot trefoil[c,d],	8	0.20	5.5 - 7.5
tall fescue	20	0.45	4.5 - 7.5
5. crownvetch[c],	15	0.32	5.5 - 7.5
tall fescue,	20	0.45	
creeping red fescue,	20	0.45	
redtop	2	0.05	

[a] *suggested fertilizer rate for mixtures besides ryegrass is 400 lbs/acre of 5-10-10 or 5-10-5.* ***If stabilizing disturbed mineral soil within the filter strip, do not use fertilizer.*** *It may result in nutrient loading into the water body.*

[b] *good mixtures for shady areas*

[c] *innoculate seed*

[d] *better adapted for limestone soils*

It is recommended that the area to be seeded be limed at the rate of approximately 2 tons/ acre, depending on the pH of the soil.

Recommended times of seeding are from April 15 to June 15, or August 1 to September 15. Winter rye can be used as a temporary cover, and seeded between August 15 and October 15.

Spreading hay on the disturbed site will minimize erosion and also provide a source of seed. Use approximately 60 bales/acre.

The following grasses are **native to Massachusetts**, and would be good for stabilizing disturbed soils:

partial shade:

Agrostis hyemalis - ticklegrass
Deschampsia flexuosa - wavy hairgrass
Luzula multiflora - wood rush
Muhlenbergia schreberi - nimbleweed
Panicum clandestinum - deertongue
Panicum virgatum - switchgrass

moderate-to-heavy shade:

Agrostis perennans - upright bent
Brachyelytrum erectum - woodgrass
Bromus ciliatus - fringed bromegrass
Carex pensylvanica - Penn. Sedge
Cinna arundinacea - stout woodreed
Elymus virginicus - Virginia wildrye
Festuca obtusa - nodding fescue
Hystrix patula - bottlebrush grass
Juncus tenuis - path rush
Oryzopsis asperifolia - mountain ricegrass

open areas:

Andropogon gerardii - big bluestem
Andropogon virginicus - broom-sedge
Panicum virgatum - switchgrass
Schizachyrium scoparium - little bluestem
Sorghastrum nutans - indiangrass

14
Before Leaving the Job

- [ ] Pull temporary skidder bridges, and make sure that fords and other stream crossings are left in a stable, and free-flowing condition.

- [ ] Remove all temporary structures (e.g., culverts, bridges) from Wetland Resource Areas.

- [ ] Install appropriate water bars on skid trails, especially at the approach to the landing and stream crossings, steep slopes, and erodible areas.

- [ ] Notify Service Forester to schedule a final inspection.

- [ ] Seed and mulch the approaches to stream crossings and banks and steep sections of skid trails.

- [ ] Put brush or slash on skid roads, and seed where vulnerable to erosion. Close off access with a gate, cable, massive water bar, or some other means.

- [ ] Smooth and grade the landing. Seed or mulch to prevent erosion. Clear permanent culverts. Accentuate broad-based dips

- [ ] Smooth the woods road. There is significant aesthetic benefit to using hand tools, such as a hoe or fire rake, to smooth tire tracks and ruts- especially along the most visible sections of trails or roads.

15
Forest Chemical Management

Improperly applied fertilizers or pesticides (insecticides, herbicides, fungicides) may contaminate surface waterbodies as well as groundwater.

In all cases, by federal law, chemical users must follow the directions on the Environmental Protection Agency (EPA) labels on containers.

In Massachusetts, commercial applicators of pesticides which use or supervise the use of restricted or limited-use pesticides must be certified by the MA Pesticide Control Board. For more information, contact MA Department of Food and Agriculture (DFA), Pesticide Bureau at 617-727-3020.

MA Pesticide Control regulations (333 CMR 13.03) require a 400-foot buffer around public drinking water supplies. The regulations further state that no application shall result in pollution of any waterway, groundwater, or waterbody. Other restrictions include abutter notification and special provisions for exclusion areas. Applicators should be familiar with all of the restrictions contained in these regulations.

Use the following BMPs to prevent chemical contamination of surface and ground waters:

- Check local weather forecast before application. Do not apply if high wind or rain is predicted.
- Avoid applying chemicals when temperatures are high or relative humidity is low, to avoid rapid evaporation of chemicals.
- Abide by all restrictions on the label.
- For aerial spray applications, mark and maintain a 100-foot buffer around all water bodies. Ensure that there is no application to water bodies.

- For ground spraying and other types of application, mark and maintain a 25-foot buffer. Ensure that there is no direct application of chemicals to the waterbody.
- Calibrate spray equipment to apply chemicals uniformly and in correct quantities.
- Prevent leaks from equipment. check all equipment for leaking hoses, connections, and nozzles.
- Locate all mixing and loading areas outside of filter or buffer strips, or riparian areas.
- Dispose of pesticide wastes and containers according to labels and state/federal laws.
- Develop a spill contingency plan. Have onsite a spill clean-up kit including:

detergent or soap,

hand cleaner and water,

activated charcoal, adsorptive clay, saw dust, vermiculite, or other absorptive materials,

lime or bleach to neutralize pesticides in emergency situations,

tools such as shovels and containers for disposal,

protective clothing/gloves/masks

- Report spills immediately to the Pesticide Control Board and the Service Forester.
- Apply slow-release fertilizers when possible.
- Base fertilizer type and application rate on soil and/or foliar analysis when possible.
- Do not use fertilizers within filter strip or riparian zone due to possible nutrient loading.

16
Prescribed Burning and Wildfire

Though seldom used in Massachusetts, prescribed burning is a silvicultural tool that may lead to water quality degradation. Exposed soil following burns may lead to increased erosion.

According to 310 CMR 7.07 (1-6), open burning of brush, trees, and forestry debris must be conducted under the provisions of a properly executed permit from the local Fire Department or from the Department of Environmental Protection's (DEP) Division of Air Quality (DAQ). Prescribed burns may only occur between January 15 and May 1, during favorable atmospheric conditions.

The following BMPs have proven effective in reducing impacts:

- Do not conduct burns within 50 feet of a surface waterbody or wetland.
- Avoid construction of firelines within 50 feet of a waterbody or wetland.
- Locate firelines on contour as much as possible.
- Avoid burning on steep slopes or highly erodable soils.
- Revegetate and stabilize firelines and erosion-prone areas with herbaceous cover.
- Avoid applying chemical fire retardant to waterbodies.

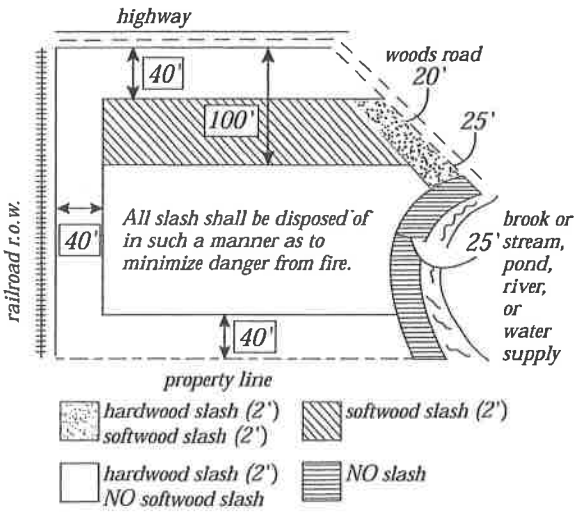
17
MA Slash Law Requirements

R Hardwood slash must not be left more than 2 feet above the ground within 40 feet of any boundary line or outer edge of any highway, or 20 feet of an established woods road.

R Softwood slash must not be left on the ground within 40 feet of any boundary line or outer edge of any highway, and must not be more than 2 feet above the ground between 40 and 100 feet of the outer edge of any highway or 25 feet of an established woods road.

R All slash must be disposed of in a manner as to minimize fire danger.

R No slash is permitted within 25 feet of any continuously flowing brook, stream, river, or any lake, pond, or water supply.



Appendices

1. Massachusetts Department of Environmental Management, Division of Forests and Parks Offices:

Statewide Office

DEM
100 Cambridge Street,
19th floor
Boston, MA 02202

617 626-1250 voice
617 626-1449 fax

Region 1 – Southeast
(Plymouth and Bristol Counties, Cape, and Islands):

Division of Forests & Parks
P.O. Box 66
South Carver, MA 02366

508 866-2580 voice
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Region 2 – Northeast
(Middlesex, Essex, and Norfolk Counties):

Division of Forests & Parks
P.O. Box 829
Carlisle, MA 01741

978 369-3350 voice
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Region 3 – Central
(Worcester County):

Division of Forests & Parks
P.O. Box 155
Clinton, MA 01510

978 368-0126 voice
978 368-0217 fax

Region 4 – Pioneer Valley
(Franklin, Hampshire, and Hampden Counties):

Division of Forests & Parks
Box 484
Amherst, MA 01004

413 545-5993 voice
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Hampton Ponds Field Office:
1048 North Road
Hampton Ponds State Park
Westfield, MA 01085

413 532-6872

Region 5 – Berkshires

Division of Forests & Parks
P.O. Box 1433
Pittsfield, MA 01202

413 442-8928 voice
413 442-5860 fax

2. Massachusetts Division of Fisheries and Wildlife Offices:

Massachusetts Division of Fisheries and Wildlife
Field Headquarters
1 Rabbit Hill Road
Westborough, MA 01581

508 792-7270 voice
508 792-7275 fax

3. Natural Heritage and Endangered Species Program:

Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

508 792-7270 voice
508 792-7275 fax

4. Massachusetts Department of Environmental Protection (DEP) Offices:

Boston office:

One Winter Street
Boston, MA 02108

617 292-5500 voice
617 556-1049 fax

Environmental Crimes Strike Force

617 556-1000 voice

Northeast regional office:

205 Lowell Street
Wilmington, MA 01887

978 661-7600 voice
978 661-7615 fax

Southeast regional office:

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Lakeville, MA 02347

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Division of Forests and Parks

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APPENDIX D – Invasive Species Documentation

The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts (with annotated list)

Massachusetts Invasive Plant Advisory Group

Partnering Organizations

American Nursery and Landscape Association
Arnold Arboretum of Harvard University
Brewster Conservation Administration
NSTAR Electric
Ecological Landscaping Association
Massachusetts Audubon Society
MA Department of Agricultural Resources
Div. of Regulatory and Consumer Services
MA Department of Conservation & Recreation
Div. of Water Supply Protection
MA Division of Fisheries and Wildlife
Natural Heritage and Endangered Species Program
Massachusetts Natural Heritage & Endangered Species Advisory Committee
Massachusetts Nursery and Landscape Association
New England Nursery Association
New England Wild Flower Society
Northeastern Weed Science Society
Silvio O. Conte National Fish & Wildlife Refuge
The Nature Conservancy
University of Massachusetts Extension Service

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Horticultural Research Institute

Massachusetts Executive Office of Environmental Affairs

Massachusetts Department of Fish and Game, Div. of Fisheries & Wildlife

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University of Connecticut
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Coordination provided by:

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Update: April 1, 2005

For most recent update, visit www.mnla.com or www.newfs.org

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Purpose and organizing principles of the Massachusetts Invasive Plant Advisory Group (MIPAG)

Formerly known as the Massachusetts Invasive Plant Group, the Massachusetts Invasive Plant Advisory Group (MIPAG) was formed in 1999 by the Ad Hoc Native Plant Advisory Committee to begin addressing the invasive plant issue in Massachusetts. The Executive Office of Environmental Affairs recognized it as part of the Massachusetts Council on Invasive Species. This Council was intended to serve as a coordinating mechanism for the various invasive species management activities undertaken by state agencies, federal agencies, and private organizations.

The Massachusetts Invasive Plant Advisory Group is a voluntary collaboration between public and private organizations concerned about the problem of invasive plants in Massachusetts. Eighteen entities are represented including state and federal governmental agencies in fish and wildlife, agriculture, and natural resources; the horticulture industry; academic science institutions; land management and nonprofit conservation organizations. Its members affirm their commitment to working within their individual organizations to substantially address the impact of species determined by scientific criteria to be Invasive, Likely Invasive, or Potentially Invasive in the Commonwealth of Massachusetts.

The first order of business of the MIPAG has been to determine which plant species are invasive in Massachusetts. With the assistance of Dr. Leslie Mehrhoff of the University of Connecticut, the group adopted a definition and set of biologically based criteria upon which to objectively evaluate plants suspected to be invasive in the state. The group contracted with Dr. Mehrhoff to gather existing data about these species and help the group assess which are currently invasive and which have the potential to become problematic in Massachusetts.

Findings from plant evaluations of 85 species (conducted in two phases) include an annotated list of Invasive, Likely Invasive, and Potentially Invasive species. The annotated list, as well as information about the evaluation process, definitions and criteria, and group member composition, are contained within this document and can also be found online at *www.mnla.com* and *www.newfs.org*. Also included on the annotated list are species that were considered but for which sufficient information or evidence is currently lacking for an adequate evaluation.

The MIPAG makes all its important decisions at its scheduled meetings by voting. In certain instances, representatives of the same member organization voluntarily share a vote and alternate their attendance. Quorum for any meeting must be 2/3 of the voting membership (currently 12), and any decision must pass by a 2/3 majority of members present. The only exception is when a vote is taken at a meeting to determine the status of a species under assessment by MIPAG criteria for invasiveness in Massachusetts. In this case, all voting members have the right to vote, with those absent from the meeting having not more than two additional weeks after the initial vote to submit their votes to the MIPAG recorder. Only one vote per organization is allowed. Agreed by quorum on 6/12/2002, "a 2/3 majority will be calculated only using affirmative and negative votes cast. Abstentions will not be included."

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Massachusetts Criteria for Evaluating Non-Native Plant Species for Invasiveness

(THESE CRITERIA HAVE NO OFFICIAL STATUS FOR MASSACHUSETTS)

The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as *"non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.* As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

The following criteria are being used to objectively evaluate and categorize plant species suspected of being, or with the potential to become, invasive in Massachusetts. They were developed by the George Safford Torrey Herbarium at the University of Connecticut and a subcommittee of the Massachusetts Invasive Plant Group representing science, nursery, and conservation professionals.

The criteria enable the separation of plants into the following categories:

- *Invasive Plants in Massachusetts*
- *Likely Invasive Plants in Massachusetts*
- *Potentially Invasive Plants in Massachusetts (species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth)*

For a species to be included on the list of species determined to be **Invasive, Likely Invasive or Potentially Invasive** in Massachusetts, it must be substantiated by scientific investigation (including herbarium specimens, peer-reviewed papers, published records and other data available for public review) to meet specific criteria. The process of reviewing individual plant species for their invasiveness in Massachusetts is ongoing and may result in a change in status pending new data and further review.

Tabular summary of criteria to be met

	Criteria that must be met
Base criteria	1-4
Invasive	1-9
Likely Invasive	1-5, at least one of 6-9, at least one of 10-12
Potentially Invasive	1-4, (not 5), 13-15

For a species to be designated as "INVASIVE", "LIKELY INVASIVE" or "POTENTIALLY INVASIVE" it must to meet certain base criteria (#1-4 below). The species must:

1. Be nonindigenous to Massachusetts.
2. Have the biologic potential for rapid and widespread dispersion and establishment in minimally managed habitats.
3. Have the biologic potential for dispersing over spatial gaps away from site of introduction.
4. Have the biologic potential for existing in high numbers away from intensively managed artificial habitats.

If a species does not meet all four of the previous criteria, stop here. The species cannot be listed at this time. If a species meets all four, go on to #5.

5. Be naturalized in Massachusetts (persists without cultivation in Massachusetts)

If a species meets Criteria 1-4 and Criterion 5, it may be considered "INVASIVE " or "LIKELY INVASIVE" in Massachusetts. Go to Criteria 6-9.

If it does <u>not</u> meet Criterion 5, it may be considered "POTENTIALLY INVASIVE" if it meets Criteria 13-15.

6. Be widespread in Massachusetts, or at least common in a region or habitat type(s) in the state.
7. Have many occurrences of numerous individuals in Massachusetts that have high numbers of individuals forming dense stands in minimally managed habitats
8. Be able to out-compete other species in the same natural plant community.
9. Have the potential for rapid growth, high seed or propagule production and dissemination, and establishment in natural plant communities.

If a species meet the initial five Criteria and Criteria 6-9 it may be considered a "INVASIVE" species in Massachusetts.

If a species meets the initial five Criteria, but does not meet all of Criteria 6-9 at this time, it may be considered a "LIKELY INVASIVE" species in Massachusetts if in addition it meets at least one of the following three Criteria (#10-12).

10. Have at least one occurrence in Massachusetts that has high numbers of individuals forming dense stands in minimally managed habitats
11. Have the potential, based on its biology and its colonization history in the northeast or elsewhere, to become invasive in Massachusetts.
12. Be acknowledged to be invasive in nearby states but its status in Massachusetts is unknown or unclear. This may result from lack of field experience with the species or from difficulty in species determination or taxonomy.

If the species meets the basic criteria for invasiveness (Criteria 1-4) but is not naturalized in Massachusetts (Criterion 5), the species may be considered "POTENTIALLY INVASIVE" in Massachusetts if it meets the following three criteria (#13-15):

13. The species, if it becomes naturalized in Massachusetts, based on its biology and biological potential, would pose an imminent threat to the biodiversity of Massachusetts **and**
14. Its naturalization in Massachusetts is anticipated, **and**
15. The species has a documented history of invasiveness in other areas of the Northeast.

DEFINITIONS TO ACCOMPANY "CRITERIA FOR EVALUATING NON-NATIVE PLANT SPECIES FOR INVASIVENESS IN MASSACHUSETTS"

Biologic potential - The ability of a species to increase its number, either sexually and/or asexually.

Invasive plants – Non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. *As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.*

Indigenous species - otherwise A species that occurs natively in Massachusetts. Indigenous species often have a pre-colonial presence (pre 1500) or have arrived in the region more recently without the aid of human intervention. Synonymous with native species.

Intensively managed habitats - Intensively managed habitats are habitats or land systems where management efforts and investments of time, money and labor occur frequently. Examples include manicured lawns, landscaped grounds, gardens, roadsides or agricultural lands for crops or livestock.

Likely Invasive plants – non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "Invasive plant" designation.

Minimally managed habitats - Minimally managed habitats are habitats where management efforts and investments of time, money and labor are infrequent or non-existent. These habitats may have been intensively managed for anthropogenic reasons at one time in their history. In some instances, management may be more intense but management is done for conservation purposes and is primarily aimed at preserving elements of biological diversity such as imperiled species or critical natural communities. Minimally managed habitats are similar to "natural areas" but the distinction is made in order to remove bias, misconceptions or ambiguities that surround the term "natural area".

Non-indigenous species - A species that is not native or naturally occurring (based on its biology, phylogeny, distribution and current knowledge about the species) within Massachusetts. A species may be indigenous to North America but non-indigenous in Massachusetts. Synonymous with non-native species.

Naturalized species - A non-indigenous taxon that occurs without the aid and benefits of cultivation in Massachusetts. Further, it implies two biological points: it freely and regularly reproduces in the wild, sexually or asexually, and occurrences persist over time.

Natural plant community - A natural plant community is an association or assemblage of plant species that repeatedly occur together in reoccurring patterns in a specific type of habitat. This assemblage can be characterized by dominant species and biological properties. A natural plant community implies a minimally managed situation where all or most of the species that make up the assemblage are indigenous to the defined area.

Occurrence – Existing example of a species on the landscape.

Potentially invasive plants – Non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth.

Spatial gaps - This term is used in reference to the ability of a species to disperse away from existing occurrences. The concept of crossing spatial gaps is used to distinguish those species that can disperse over discontinuities and become established elsewhere from species that spread across a habitat only by continual, uninterrupted growth.

Invasive, Likely Invasive, and Potentially Invasive Plants in Massachusetts: Findings from the Assessment Process by the Massachusetts Invasive Plant Advisory Group

Plants voted as: INVASIVE

"Invasive plants" are non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Acer platanoides L. **(Norway maple)**
A tree occurring in all regions of the state in upland and wetland habitats, and especially common in woodlands with colluvial soils. It grows in full sun to full shade. Escapes from cultivation; can form dense stands; out-competes native vegetation, including sugar maple; dispersed by water, wind and vehicles.

Acer pseudoplatanus L. **(Sycamore maple)**
A tree occurring mostly in southeastern counties of Massachusetts, primarily in woodlands and especially near the coast. It grows in full sun to partial shade. Escapes from cultivation inland as well as along the coast; salt-spray tolerant; dispersed by wind, water and vehicles.

Aegopodium podagraria L. **(Bishop's goutweed; bishop's weed; goutweed)**
A perennial herb occurring in all regions of the state in uplands and wetlands. Grows in full sun to full shade. Escapes from cultivation; spreads aggressively by roots; forms dense colonies in flood plains.

Ailanthus altissima (P. Miller) Swingle **(Tree of heaven)**
This tree occurs in all regions of the state in upland, wetland, & coastal habitats. Grows in full sun to full shade. Spreads aggressively from root suckers, especially in disturbed areas.

Alliaria petiolata (Bieb.) Cavara & Grande **(Garlic mustard)**
Synonym: *Alliaria officinalis* Andrz. Ex Bieb.
A biennial herb occuring in all regions of the state in uplands. Grows in full sun to full shade. Spreads aggressively by seed, especially in wooded areas.

Berberis thunbergii DC. **(Japanese barberry)**
A shrub occuring in all regions of the state in open and wooded uplands and wetlands. Grows in full sun to full shade. Escaping from cultivation; spread by birds; forms dense stands.

Cabomba caroliniana A.Gray **(Carolina fanwort; fanwort)**
A perennial herb occuring in all regions of the state in aquatic habitats. Common in the aquarium trade; chokes waterways.

Celastrus orbiculatus Thunb. **(Oriental bittersweet; Asian or Asiatic bittersweet)**
A perennial vine occuring in all regions of the state in uplands. Grows in full sun to partial shade. Escaping from cultivation; berries spread by birds and humans; overwhelms and kills vegetation.

Plants voted as: INVASIVE *(continued)*

Cynanchum louiseae Kartesz & Gandhi **(Black swallow-wort, Louise's swallow-wort)**
Synonyms: *Cynanchum nigrum* (L.) Pers. non Cav.; *Vincetoxicum nigrum* (L.) Moench
A perennial vine occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to partial shade. Forms dense stands, out-competing native species: deadly to Monarch butterflies.

Elaeagnus umbellata Thunb. **(Autumn olive)**
A shrub occurring in uplands in all regions of the state. Grows in full sun. Escaping from cultivation; berries spread by birds; aggressive in open areas; has the ability to change soil.

Euonymus alatus (Thunb.) Sieb. **(Winged euonymus; Burning bush)**
A shrub occurring in all regions of the state and capable of germinating prolifically in many different habitats. It grows in full sun to full shade. Escaping from cultivation and can form dense thickets and dominate the understory; seeds are dispersed by birds.

Euphorbia esula L. **(Leafy spurge; wolf's milk)**
A perennial herb occurring in all regions of the state in grasslands and coastal habitats. Grows in full sun. An aggressive herbaceous perennial and a notable problem in western USA.

Frangula alnus P. Mill. **(European buckthorn; glossy buckthorn)**
Synonyms: *Rhamnus frangula* L.; *R. frangula* var. *angustifolia* Loud.
Shrub or tree occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Produces fruit throughout the growing season; grows in multiple habitats; forms thickets.

Glaucium flavum Crantz **(Sea or horned poppy; yellow hornpoppy)**
A biennial and perennial herb occurring in southeastern MA in coastal habitats. Grows in full sun. Seeds float; spreads along rocky beaches; primarily Cape Cod and Islands.

Hesperis matronalis L. **(Dame's rocket)**
A biennial and perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Spreads by seed; can form dense stands, particularly in flood plains.

Iris pseudacorus L. **(Yellow iris)**
A perennial herb occurring in all regions of the state in wetland habitats, primarily in flood plains. Grows in full sun to partial shade. Out-competes native plant communities.

Lepidium latifolium L. **(Broad-leaved pepperweed; tall pepperweed)**
A perennial herb occurring in eastern and southeastern regions of the state in coastal habitats. Grows in full sun. Primarily coastal at upper edge of wetlands; also found in disturbed areas; salt tolerant.

Lonicera japonica Thunb. **(Japanese honeysuckle)**
A perennial vine occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Rapidly growing, dense stands climb and overwhelm native vegetation; produces many seeds that are bird dispersed; more common in southeastern Massachusetts.

Lonicera morrowii A.Gray **(Morrow's honeysuckle)**A shrub occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Part of a confusing hybrid complex of nonnative honeysuckles commonly planted and escaping from cultivation via bird dispersal.

Plants voted as: INVASIVE *(continued)*

Lonicera x bella Zabel [*morrowii* x *tatarica*] **(Bell's honeysuckle)**
This shrub occurs in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Part of a confusing hybrid complex of nonnative honeysuckles commonly planted and escaping from cultivation via bird dispersal.

Lysimachia nummularia L. **(Creeping jenny; moneywort)**
A perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Escaping from cultivation; problematic in flood plains, forests and wetlands; forms dense mats.

Lythrum salicaria L. **(Purple loosestrife)**
A perennial herb or subshrub occurring in all regions of the state in upland and wetland habitats. Grows in full sun to partial shade. Escaping from cultivation; overtakes wetlands; high seed production and longevity.

Myriophyllum heterophyllum Michx. **(Variable water-milfoil; Two-leaved water-milfoil)**
A perennial herb occurring in all regions of the state in aquatic habitats. Chokes waterways, spread by humans and possibly birds.

Myriophyllum spicatum L. **(Eurasian or European water-milfoil; spike water-milfoil)**
A perennial herb found in all regions of the state in aquatic habitats. Chokes waterways, spread by humans and possibly birds.

Phalaris arundinacea L. **(Reed canary-grass)**
This perennial grass occurs in all regions of the state in wetlands and open uplands. Grows in full sun to partial shade. Can form huge colonies and overwhelm wetlands; flourishes in disturbed areas; native and introduced strains; common in agricultural settings and in forage crops.

Phragmites australis (Cav.) Trin. ex Steud. subsp. **australis (Common reed)**
A perennial grass (USDA lists as subshrub, shrub) found in all regions of the state. Grows in upland and wetland habitats in full sun to full shade. Overwhelms wetlands forming huge, dense stands; flourishes in disturbed areas; native and introduced strains.

Polygonum cuspidatum Sieb. & Zucc. **(Japanese knotweed; Japanese or Mexican Bamboo)**
Synonym: *Fallopia japonica* (Houtt.) Dcne.; *Reynoutria japonica* Houtt.
A perennial herbaceous subshrub or shrub occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade, but hardier in full sun. Spreads vegetatively and by seed; forms dense thickets.

Potamogeton crispus L. **(Crisped pondweed; curly pondweed)**
A perennial herb occurring in all regions of the state in aquatic habitats. Forms dense mats in the spring and persists vegetatively.

Ranunculus ficaria L. **(Lesser celandine; fig buttercup)**
A perennial herb occurring on stream banks, and in lowland and uplands woods in all regions of the state. Grows in full sun to full shade. Propagates vegetatively and by seed; forms dense stands especially in riparian woodlands; an ephemeral that outcompetes native spring wildflowers.

Rhamnus cathartica L. **(Common buckthorn)**
A shrub or tree occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Produces fruit in fall; grows in multiple habitats; forms dense thickets.

Plants voted as: INVASIVE *(continued)*

Robinia pseudoacacia L. **(Black locust)**
A tree that occurs in all regions of the state in upland habitats. Grows in full sun to full shade. While the species is native to central portions of Eastern North America, it is not indigenous to Massachusetts. It has been planted throughout the state since the 1700's and is now widely naturalized. It behaves as an invasive species in areas with sandy soils.

Rosa multiflora Thunb. **(Multiflora rose)**
A perennial vine or shrub occurring in all regions of the state in upland, wetland and coastal habitats. Grows in full sun to full shade. Forms impenetrable thorny thickets that can overwhelm other vegetation; bird dispersed.

Trapa natans L. **(Water-chestnut)**
An annual herb occurring in the western, central, and eastern regions of the state in aquatic habitats. Forms dense floating mats on water.

Plants votes as: LIKELY INVASIVE

"Likely Invasive plants" are non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "Invasive plant" designation. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Ampelopsis brevipedunculata (Maxim.) Trautv. **(Porcelain-berry; Amur peppervine)**
A woody vine found primarily in southeastern counties of Massachusetts but known from some western counties as well. Occurs in upland woodland edges and thickets and grows in full sun to partial shade. Escapes from cultivation and is bird dispersed.

Anthriscus sylvestris (L.) Hoffmann **(Wild chervil)**
Synonym: *Chaerophyllum sylvestre* L.
A biennial or short-lived perennial herb with a few reported sites in minimally managed habitats scattered across the state. It occurs in old fields, wetlands, roadsides and proliferates in floodplain soils. Grows in full sun to partial shade. It has a very long taproot and is reported to be spreading in Vermont and Connecticut.

Berberis vulgaris L. **(Common barberry; European barberry)**
A shrub occurring in all regions of the state, primarily in uplands. It grows in full sun to full shade. The potential of this plant to spread is high; once common but widely eradicated because it is an alternate host for wheat rust; it hybridizes with Japanese barberry.

Cardamine impatiens L. **(Bushy rock-cress; narrowleaf bittercress)**
A winter annual or biennial herb found in western Massachusetts occurring in rich woods, rocky ledges, roadsides, and stream banks. It grows in full sun to full shade. Disperses seeds easily and is spreading rapidly in other parts of New England.

Centaurea biebersteinii DC. **(Spotted knapweed)**
Synonym: *Centaurea maculosa* auct. non Lam.
A biennial or perennial herb occurring in all regions of the state in upland and coastal habitats. Grows in full sun. Aggressively grows in well-drained, disturbed soils; serious problem in western states where it out-competes native grassland species, literature reports are currently lacking for this in the northeast.

Plants voted as: LIKELY INVASIVE *(continued)*

Cynanchum rossicum (Kleopov) Borhidi **(European swallow-wort; pale swallow-wort)**
Synonym: *Vincetoxicum rossicum* (Kleopov) Barbarich
A perennial herb occurring in the western region of the state in upland habitats. Grows in full sun to partial shade. Forms dense stands; found primarily in the lower Connecticut River Valley.

Egeria densa Planchon **(Brazilian waterweed; Brazilian elodea)**
Synonyms: *Anacharis densa* (Planch.) Victorin; *Elodea densa* (Planch.) Caspary
A perennial herb occurring in the eastern and southeastern regions of the state in aquatic habitats. Common in the aquarium trade; chokes waterways; currently only found in a few MA ponds.

Epilobium hirsutum L. **(Hairy willow-herb; Codlins and cream)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun. Seeds dispersed by wind and water; evidence currently lacking that this species out- competes other vegetation in minimally managed habitats.

Euphorbia cyparissias L. **(Cypress spurge)**
A perennial herb occurring in all regions of the state in upland habitats. Grows in full sun. Persists in open areas; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

Festuca filiformis Pourret **(Hair fescue; fineleaf sheep fescue)**
A perennial grass occurring in all regions of the state, in grasslands and open woodlands. Grows in full sun to partial shade. Common in minimally managed grassland habitats; more data needed on its ability to outcompete native species.

Glyceria maxima (Hartman) Holmburg **(Tall mannagrass; reed mannagrass)**
A perennial grass currently known from one marsh in Essex County. Grows in full sun to partial shade. Spreads vegetatively and produces viable seeds; forms dense stands.

Heracleum mantegazzianum Sommier & Levier **(Giant hogweed)**
A perennial herb occurring in scattered sites across all regions of the state; thrives in multiple habitats. Grows in full sun to full shade. Escapes from cultivation; seeds can be dispersed by water; can cause severe skin reactions.

Humulus japonicus Sieb. & Zucc. **(Japanese hops)**
An annual herbaceous vine with current records in western MA, but historical records from all regions of the state. Grows in floodplain forests and riverbanks in full sun to partial shade. Escapes from cultivation; capable of prolific growth.

Hydrilla verticillata (L.f.) Royle **(Hydrilla; water-thyme; Florida elodea)**
A perennial aquatic herb occurring in the southeastern region of the state. Only found in one MA pond currently (2004); easily dispersed by birds and humans; chokes entire water bodies.

Ligustrum obtusifolium Sieb. & Zucc. **(Border privet)**
A shrub occurring in all regions of the state in woodlands and woodland edges. Grows in full sun to full shade. Widespread and shade tolerant, bird dispersed; more data needed on density and distribution; flowers are needed to identify species.

Lonicera tatarica L. **(Tatarian honeysuckle)**
A shrub found from Boston westward in thickets, woods, and edges of woods. Can grow in full sun to full shade. Commonly confused with other non-native honeysuckles; crosses with Morrow's honeysuckle *(L. morrowii)* to produce the invasive hybrid Belle's honeysuckle *(L. xbella)*.

Plants voted as: LIKELY INVASIVE *(continued)*

Microstegium vimineum (Trin.) A. Camus **(Japanese stilt grass; Nepalese browntop)**
An annual grass occurring in the western region of the state in upland and wetland habitats. Grows in full sun to full shade. Forms dense stands; currently localized in the lower Connecticut River Valley; spreads in flood plains.

Miscanthus sacchariflorus (Maxim.) Franch. **(Plume grass; Amur silvergrass)**
This perennial grass is currently known to occur in central MA in wetland margins and roadsides. Grows in full sun. Spreads by rhizomes and develops dense stands along roadsides and adjacent native habitats.

Myosotis scorpioides L. **(Forget-me-not)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun to full shade. Escaping from cultivation; prolific in open wooded streams, stream-banks and wet meadows; evidence about its persistence is needed.

Myriophyllum aquaticum (Vell.) Verdc. **(Parrot-feather; water-feather; Brazilian watermilfoil)**
Synonym: *Myriophyllum brasiliense* Camb.
A perennial herbaceous aquatic occurring in southeastern MA along a shallow pond edge.
Grows in full sun to partial shade. Reproduces from fragments; commonly used in the water garden trade.

Najas minor All. **(Brittle water-nymph; lesser naiad)**
An annual herb occurring in the western region of the state in aquatic habitats. Chokes waterways; spread by humans and possibly birds; currently found only in Berkshire County (2002).

Nymphoides peltata (Gmel.) Kuntze **(Yellow floating heart)**
This aquatic perennial occurs in ponds in central MA. Grows in full sun to partial shade. Can create a dense floating mat on ponds and can reproduce from fragments.

Phellodendron amurense Rupr. (sensu lato) **(Amur cork-tree)**
Synonyms: *Phellodendron japonicum* Maxim.; *Phellodendron amurense* var. japonicum (Maxim.) Ohwi; *Phellodendron sachalinense* (F. Schmidt) Sarg.; *Phellodendron amurense* var. sachalinense F. Schmidt; *Phellodendron lavallei* Dode; *Phellodendron amurense* var. lavallei (Dode) Sprague
This tree occurs in uplands of eastern to central MA. Grows in full sun to full shade. A bird dispersed species that has escaped cultivation.

Pueraria montana (Lour.) Merrill **(Kudzu; Japanese arrowroot)**
Synonym: *Pueraria montana* var. *lobata* (Willd.) Maesen & S. Almeida
A perennial herbaceous vine found in southeastern MA. Occurs at Arnold Arboretum; uplands. Grows in full sun to partial shade. Present in MA and subject to control; marginally hardy in MA but has the potential to invade minimally-managed areas based on its performance elsewhere.

Ranunculus repens L. **(Creeping buttercup)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun to full shade. Common around springs and wetlands; evidence currently lacking that this species out- competes other vegetation in minimally managed habitats.

Rorippa amphibia (L.) Bess. **(Water yellowcress; great yellowcress)**
Synonyms: *Nasturtium amphibium* (L.) Ait. f.; *Sisymbrium amphibium* L.
A perennial herb occurring in central MA. Grows in wetlands in full sun to partial shade. Common and increasing in central MA river drainages; a major threat to riparian habitats forming dense stands at some locations.

Plants voted as: LIKELY INVASIVE *(continued)*

Rubus phoenicolasius Maxim. **(Wineberry; Japanese wineberry; wine raspberry)**
A shrub found in uplands of southern MA. Can grow in full sun to partial shade.
Animal and human dispersed; forms thickets.

Senecio jacobaea L. **(Tansy ragwort; stinking Willie)**
A biennial herb occurring in a few sites east of the Connecticut River; habitat is open uplands. Grows in sun or partial shade. This species is highly invasive in the Canadian Maritimes; may also spread from disturbed areas.

Tussilago farfara L. **(Coltsfoot)**
A perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Particularly problematic in lime seeps and disturbed sites; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

Plants voted as: POTENTIALLY INVASIVE

"Potentially invasive plants" are non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Arthraxon hispidus (Thunb.) Makino **(Hairy joint grass; jointhead; small carpetgrass)**
An annual grass historically known from Franklin County but not currently known from the state. Habitats elsewhere include roadsides, shores, ditches, and low woods and fields. Grows in full to partial shade. Is problematic in Connecticut and southward.

Carex kobomugi Ohwi **(Japanese sedge; Asiatic sand sedge)**
A perennial sedge established mainly in sand dunes and growing in full sun. There is only one current New England location--in Rhode Island; it can spread rapidly in dune systems.

Lonicera maackii (Rupr.) Herder **(Amur honeysuckle)**
A shrub having specimens and reports from a number of MA counties, but verification of naturalization at these locations is needed. The likely habitats are woods and woodland edges. Can grow in full sun or shade. Escapes from cultivation, but documentation needed regarding naturalized populations in MA; recognized as invasive in the Midwest and portions of the southeastern USA.

Polygonum perfoliatum L. **(Mile-a-minute vine or weed; Asiatic tearthumb)**
Synonym: *Ampelygonum perfoliatum* (L.) Roberty & Vautier
This annual herbaceous vine is not currently known to exist in MA, but has been found in RI and CT. Habitats include streamside, fields, and road edges in full sun to partial shade. Highly aggressive; bird and human dispersed.

EVALUATED PLANTS NOT MEETING CRITERIA
(Do not list at this time)

The following plants were evaluated for invasiveness by the Massachusetts Invasive Plant Advisory Group. They did not meet the necessary criteria to list them as Invasive, Likely Invasive or Potentially Invasive at the time of evaluation.

Actinidia arguta (Sieb. & Zucc.) Planchon ex Miq. **(Hardy kiwi; tara vine)**
A woody vine that is dioecious (i.e., with male and female flowers on separate individuals). It grows in full sun to partial shade. Can form dense stands; evidence needed to evaluate its reproductive ability and potential to establish new populations away from cultivation.

Akebia quinata (Houtt.) Dcne. **(Five-leaved Akebia; chocolate vine)**
A woody vine that grows in full sun to full shade. Can form dense stands; evidence needed to evaluate its reproductive ability and potential for establishment away from cultivation.

Catalpa speciosa (Warder) Warder ex Engelm. **(Northern catalpa)**
A tree that grows in full sun to partial shade. Preliminary data suggest that this species could be invasive in floodplain forests; more data is needed on its ability to out compete native species.

Cytisus scoparius (L.) Link **(Scotch broom; English broom)**
A shrub that grows in full sun to partial shade. Current evidence does not show that it is spreading rapidly from cultivation and out competing native species in Massachusetts.

Elaeagnus angustifolia L. **(Russian olive)**
A small tree or shrub that grows in full sun to full shade. Not currently known from minimally managed habitats in Massachusetts; invasive elsewhere in the United States; commonly confused with autumn olive (*Elaeagnus umbellata*).

Festuca ovina L. **(Sheep fescue)**
A perennial grass that grows in full sun. More data needed on its ability to outcompete native species in minimally managed habitats.

Ligustrum ovalifolium Hassk. **(California privet)**
Shrub. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed in identification and invasiveness.

Ligustrum sinense Lour. **(Chinese privet)**
A shrub that can tolerate full sun or shade. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed on identification and invasiveness.

Ligustrum vulgare L. **(European privet)**
Shrub. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed in identification and invasiveness.

Lonicera xylosteum L. **(Dwarf honeysuckle)**
Shrub. Reports of naturalized occurrences need verification in MA.

Miscanthus sinensis Anderss. **(Eulalia; Chinese silvergrass)**
A perennial grass that grows in full sun. More data needed for minimally managed habitats.

EVALUATED PLANTS NOT MEETING CRITERIA *(continued)*

Morus alba L. **(White mulberry)**
A tree that grows in full sun to partial shade. Reports of naturalized occurrences and invasiveness need verification in MA.

Polygonum sachalinense F. Schmidt ex Maxim. **(Giant knotweed)**
Synonyms: *Fallopia sachalinensis* (F. Schmidt ex Maxim.) Dcne.;
Reynoutria sachalinensis (F. Schmidt ex Maxim.) Nakai
A perennial herb that grows in full sun. Data needed on occurrences in minimally managed areas in MA; highly invasive in the maritime provinces of Canada.

Populus alba L. **(White poplar)**
A tree that grows in full sun. Data needed on occurrences in minimally managed areas.

Rorippa microphylla (Boenn. ex Reichenb.) Hyland ex A. & D. Löve **(Watercress; onerow yellowcress)**
Synonym: *Nasturtium microphyllum* Boenn. Ex Reichenb.
A perennial aquatic that grows in full sun to partial shade. There is difficulty in separating this species from *Rorippa nasturtium-aquaticum*; more data needed on its current status on the landscape and its impact on minimally managed habitats.

Rorippa nasturtium-aquaticum (L.) Hayek **(Watercress)**
Synonym: *Nasturtium officinale* Ait. f.
A perennial aquatic that grows in full sun to partial shade. There is difficulty in separating this species from *Rorippa microphylla*; more data needed on its current status on the landscape and its impact on minimally managed habitats.

Rosa rugosa Thunb. **(Japanese rose; rugosa rose)**
A shrub that grows in full sun. This is a widely planted urban & coastal plant; listing it as Invasive or Likely Invasive does not accurately reflect all the properties of this plant; there are no data at this time to suggest that this species is disruptive to native plant habitats in MA.

Sedum telephium L. ssp. telephium **(Live-forever; orpine; witch's moneybags)**
A perennial herb that can grow in full sun to shade. More data needed on taxonomy, nomenclature, and occurrences in minimally managed areas.

Verbascum thapsus L. **(Common mullein; flannel mullein; velvet plant)**
A biennial herb that grows in full sun. Although MIPAG does not feel this species meets the criteria for listing at this time, its occurrence in critical habitats (especially limestone cliff communities) is of concern; species has not been proven to have outcompeting qualities; more data needed on this species and the very similar *Verbascum phlomoides*, including taxonomy, persistence, and their impact on minimally managed habitats.

Species Reviewed (Phases I and II): Listed Alphabetically

Species	Common name	Category
Aegopodium podagraria	Bishop's goutweed; bishop's weed; goutweed	Invasive
Acer platanoides	Norway maple	Invasive
Acer pseudoplatanus	Sycamore maple	Invasive
Actinidia arguta	Hardy kiwi; tara vine	Do not list at this time
Ailanthus altissima	Tree of heaven	Invasive
Akebia quinata	Five-leaved Akebia; chocolate vine	Do not list at this time
Alliaria petiolata	Garlic mustard	Invasive
Ampelopsis brevipedunculata	Porcelain-berry; Amur peppervine	Likely invasive
Ampelygonum perfoliatum – see Polygonum perfoliatum		
Anacharis densa – see Egeria densa		
Anthriscus sylvestris	Wild chervil	Likely invasive
Arthraxon hispidus	Hairy joint grass; jointhead; small carpet grass	Potentially Invasive
Berberis thunbergii	Japanese barberry	Invasive
Berberis vulgaris	Common barberry; European barberry	Likely Invasive
Cabomba caroliniana	Carolina fanwort; fanwort	Invasive
Cardamine impatiens	Bushy rock-cress; narrowleaf bittercress	Likely Invasive
Carex kobomugi	Japanese sedge; Asiatic sand sedge	Potentially Invasive
Catalpa speciosa	Northern catalpa	Do not list at this time
Celastrus orbiculatus	Oriental bittersweet; Asian or Asiatic bittersweet	Invasive
Centaurea biebersteinii	Spotted knapweed	Likely Invasive
Centaurea maculosa – see Centaurea biebersteinii		
Chaerophyllum sylvestre – see Anthriscus sylvestris		
Cynanchum louiseae	Black swallow-wort; Louise's swallow-wort	Invasive
Cynanchum nigrum – see Cynanchum louiseae		
Cynanchum rossicum	European swallow-wort; pale swallow-wort	Likely Invasive
Cytisus scoparius	Scotch broom; English broom	Do not list at this time
Egeria densa	Brazilian water weed, Brazilian elodea	Likely Invasive
Elaeagnus umbellata	Autumn olive	Invasive
Elaeagnus angustifolia	Russian olive	Do not list at this time
Elodea densa – see Egeria densa		
Epilobium hirsutum	Hairy willow herb; Codlins and cream	Likely Invasive
Euonymus alatus	Winged euonymus; burning bush	Invasive
Euphorbia cyparissias	Cypress spurge	Likely Invasive
Euphorbia esula	Leafy spurge; wolf's milk	Invasive
Fallopia japonica - see Polygonum		

cuspidatum		
Fallopia sachalinensis - see Polygonum sachalinense		
Festuca filiformis	Hair fescue; fineleaf sheep fescue	Likely Invasive
Festuca ovina	Sheep fescue	Do not list at this time
Frangula alnus	European buckthorn; glossy buckthorn	Invasive
Glaucium flavum	Sea or horned poppy; yellow hornpoppy	Invasive
Glyceria maxima	Tall mannagrass; reed mannagrass	Likely Invasive
Hesperis matronalis	Dame's rocket	Invasive
Heracleum mantegazzianum	Giant hogweed	Likely Invasive
Humulus japonicus	Japanese hops	Likely Invasive
Hydrilla verticillata	Waterthyme, Florida elodea	Likely Invasive
Iris pseudacorus	Yellow iris	Invasive
Lepidium latifolium	Broad-leaved pepperweed; tall pepperweed	Invasive
Ligustrum obtusifolium	Border privet	Likely Invasive
Ligustrum ovalifolium	California privet	Do not list at this time
Ligustrum sinense	Chinese privet	Do not list at this time
Ligustrum vulgare L.	European privet	Do not list at this time
Lonicera japonica	Japanese honeysuckle	Invasive
Lonicera maackii	Amur honeysuckle	Potentially Invasive.
Lonicera morrowii	Morrow's honeysuckle	Invasive
Lonicera tatarica	Tatarian honeysuckle	Likely invasive
Lonicera xylosteum	Dwarf honeysuckle	Do not list at this time
Lonicera x bella [morrowii x tatarica]	Bell's honeysuckle	Invasive
Lysimachia nummularia	Creeping jenny; moneywort	Invasive
Lythrum salicaria	Purple loosestrife	Invasive
Microstegium vimineum	Japanese stilt grass; Nepalese browntop	Likely Invasive
Miscanthus sacchariflorus	Plume grass; Amur silvergrass	Likely Invasive
Miscanthus sinensis	Eulalia; Chinese silvergrass	Do not list at this time
Morus alba	White mulberry	Do not list at this time
Myosotis scorpioides	Forget-me-not	Likely Invasive
Myriophyllum aquaticum	Parrot feather; water-feather; Brazilian water-milfoil	Likely Invasive
Myriophyllum brasiliense - see Myriophyllum aquaticum		
Myriophyllum heterophyllum	Variable water-milfoil; two-leaved water-milfoil	Invasive
Myriophyllum spicatum	Eurasian or European water-milfoil; spike water-milfoil	Invasive
Najas minor	Brittle water-nymph; lesser naiad	Likely Invasive
Nasturtium amphibium - see Rorripa amphibia		
Nasturtium microphyllum – see Rorippa microphylla		
Nasturtium officinale - see Rorippa nasturtium-aquaticum		
Nymphoides peltata	Yellow floating heart	Likely Invasive

Phalaris arundinacea	Reed canary-grass	Invasive
Phellodendron amurense	Amur cork-tree	Likely Invasive
Phellodendron amurense var. japonicum - see Phellodendron amurense		
Phellodendron amurense var. lavallei - *see Phellodendron amurense*		
Phellodendron amurense var. sachalinense - see Phellodendron amurense		
Phellodendron lavallei - see Phellodendron amurense		
Phellodendron sachalinense - see Phellodendron amurense		
Phragmites australis	Common reed	Invasive
Polygonum cuspidatum	Japanese knotweed; Japanese or Mexican bamboo	Invasive
Polygonum perfoliatum	Mile-a-minute vine or weed; Asiatic tearthumb	Potentially Invasive
Polygonum sachalinense	Giant knotweed	Do not list at this time
Populus alba	White poplar	Do not list at this time
Potamogeton crispus	Crisped pondweed; curly pondweed	Invasive
Pueraria montana	Kudzu; Japanese arrowroot	Likely Invasive
Pueraria montana var. lobata – see Pueraria montana		
Ranunculus ficaria	Lesser celandine; fig buttercup	Invasive
Ranunculus repens	Creeping buttercup	Likely Invasive
Reynoutria sachalinensis – see Polygonum sachalinense		
Reynoutria japonica – see Polygonum cuspidatum		
Rhamnus cathartica	Common buckthorn	Invasive
Rhamnus frangula – see Frangula alnus		
Robinia pseudoacacia	Black locust	Invasive
Rorippa amphibia	Water yellowcress; great yellowcress	Invasive
Rorippa microphylla	Watercress; onerow yellowcress	Do not list at this time
Rorippa nasturtium-aquaticum	Watercress	Do not list at this time
Rosa multiflora	Multiflora rose	Invasive
Rosa rugosa	Japanese rose; rugosa rose	Do not list at this time
Rubus phoenicolasius	Wineberry; Japanese wineberry; wine raspberry	Likely Invasive
Sedum telephium ssp. telephium	Live-forever; orpine; witch's moneybags	Do not list at this time
Senecio jacobaea	Tansy ragwort; stinking Willie	Likely Invasive
Sisymbrium amphibium - see Rorripa amphibia		

Trapa natans	Water-chestnut	Invasive
Tussilago farfara	Coltsfoot	Likely Invasive
Verbascum thapsus	Common mullein; flannel mullein; velvet plant	Do not list at this time
Vincetoxicum nigrum – see Cynanchum nigrum		
Vincetoxicum rossicum – Cynanchum rossicum		

Species Reviewed (Phases I and II): Listed by Category

Species	Common name	Category
Acer platanoides	Norway maple	Invasive
Acer pseudoplatanus	Sycamore maple	Invasive
Aegopodium podagraria	Bishop's goutweed, bishop's weed; goutweed	Invasive
Ailanthus altissima	Tree of heaven	Invasive
Alliaria petiolata	Garlic mustard	Invasive
Berberis thunbergii	Japanese barberry	Invasive
Cabomba caroliniana	Carolina fanwort; fanwort	Invasive
Celastrus orbiculatus	Oriental bittersweet; Asian or Asiatic bittersweet	Invasive
Cynanchum louiseae	Black swallow-wort; Louise's swallow-wort	Invasive
Elaeagnus umbellata	Autumn olive	Invasive
Euonymus alatus	Winged euonymus, burning bush	Invasive
Euphorbia esula	Leafy spurge; wolf's milk	Invasive
Frangula alnus	European buckthorn, glossy buckthorn	Invasive
Glaucium flavum	Sea or horned poppy, yellow hornpoppy	Invasive
Hesperis matronalis	Dame's rocket	Invasive
Iris pseudacorus	Yellow iris	Invasive
Lepidium latifolium	Broad-leaved pepperweed, tall pepperweed	Invasive
Lonicera japonica	Japanese honeysuckle	Invasive
Lonicera morrowii	Morrow's honeysuckle	Invasive
Lonicera x bella [morrowii x tatarica]	Bell's honeysuckle	Invasive
Lysimachia nummularia	Creeping jenny, moneywort	Invasive
Lythrum salicaria	Purple loosestrife	Invasive
Myriophyllum heterophyllum	Variable water-milfoil; two-leaved water-milfoil	Invasive
Myriophyllum spicatum	Eurasian or European water-milfoil; spike water- milfoil	Invasive
Phalaris arundinacea	Reed canary-grass	Invasive
Phragmites australis	Common reed	Invasive
Polygonum cuspidatum	Japanese knotweed; Japanese or Mexican bamboo	Invasive
Potamogeton crispus	Crisped pondweed, curly pondweed	Invasive
Ranunculus ficaria	Lesser celandine; fig buttercup	Invasive
Rhamnus cathartica	Common buckthorn	Invasive
Robinia pseudoacacia	Black locust	Invasive
Rosa multiflora	Multiflora rose	Invasive
Trapa natans	Water-chestnut	Invasive
Ampelopsis brevipedunculata	Porcelain-berry; Amur peppervine	Likely invasive
Anthriscus sylvestris	Wild chervil	Likely invasive
Berberis vulgaris	Common barberry; European barberry	Likely Invasive
Cardamine impatiens	Bushy rock-cress; narrowleaf bittercress	Likely Invasive
Centaurea biebersteinii	Spotted knapweed	Likely Invasive
Cynanchum rossicum	European swallow-wort, pale swallow-wort	Likely Invasive
Egeria densa	Brazilian water weed; Brazilian elodea	Likely Invasive
Epilobium hirsutum	Hairy willow herb; Codlins and cream	Likely Invasive

Euphorbia cyparissias	Cypress spurge	Likely Invasive
Festuca filiformis	Hair fescue; fineleaf sheep fescue	Likely Invasive
Glyceria maxima	Tall mannagrass; reed mannagrass	Likely Invasive
Heracleum mantegazzianum	Giant hogweed	Likely Invasive
Humulus japonicus	Japanese hops	Likely Invasive
Hydrilla verticillata	Hydrilla; water-thyme; Florida elodea	Likely Invasive
Ligustrum obtusifolium	Border privet	Likely Invasive
Lonicera tatarica	Tatarian honeysuckle	Likely invasive
Microstegium vimineum	Japanese stilt grass, Nepalese browntop	Likely Invasive
Miscanthus sacchariflorus	Plume grass; Amur silvergrass	Likely Invasive
Myosotis scorpioides	Forget-me-not	Likely Invasive
Myriophyllum aquaticum	Parrot-feather; water-feather; Brazilian water-milfoil	Likely Invasive
Najas minor	Brittle water-nymph, lesser naiad	Likely Invasive
Nymphoides peltata	Yellow floating heart	Likely Invasive
Phellodendron amurense	Amur cork-tree	Likely Invasive
Pueraria montana	Kudzu; Japanese arrowroot	Likely Invasive
Ranunculus repens	Creeping buttercup	Likely Invasive
Rorippa amphibia	Water yellowcress; great yellowcress	Likely Invasive
Rubus phoenicolasius	Wineberry; Japanese wineberry; wine raspberry	Likely Invasive
Senecio jacobaea	Tansy ragwort; stinking Willie	Likely Invasive
Tussilago farfara	Coltsfoot	Likely Invasive
Arthraxon hispidus	Hairy joint grass; jointhead; small carpetgrass	Potentially Invasive
Carex kobomugi	Japanese sedge, Asiatic sand sedge	Potentially Invasive
Lonicera maackii	Amur honeysuckle	Potentially Invasive.
Polygonum perfoliatum	Mile-a-minute vine or weed; Asiatic tearthumb	Potentially Invasive
Actinidia arguta	Hardy kiwi; tara vine	Do not list at this time
Akebia quinata	Five-leaved Akebia; chocolate vine	Do not list at this time
Catalpa speciosa	Northern catalpa	Do not list at this time
Cytisus scoparius	Scotch broom; English broom	Do not list at this time
Elaeagnus angustifolia	Russian olive	Do not list at this time
Festuca ovina	Sheep fescue	Do not list at this time
Ligustrum ovalifolium	California privet	Do not list at this time
Ligustrum sinense	Chinese privet	Do not list at this time
Ligustrum vulgare L.	European privet	Do not list at this time
Lonicera xylosteum	Dwarf honeysuckle	Do not list at this time
Miscanthus sinensis	Eulalia; Chinese silvergrass	Do not list at this time
Morus alba	White mulberry	Do not list at this time
Polygonum sachalinense	Giant knotweed	Do not list at this time
Populus alba	White poplar	Do not list at this time
Rorippa microphylla	Watercress; onerow yellowcress	Do not list at this time
Rorippa nasturtium-aquaticum	Watercress	Do not list at this time
Rosa rugosa	Japanese rose; rugosa rose	Do not list at this time
Sedum telephium ssp. telephium	Live-forever; orpine; witch's moneybags	Do not list at this time
Verbascum thapsus	Common mullein; flannel mullein; velvet plant	Do not list at this time

Bulletin #2505

MAINE INVASIVE PLANTS

Common Buckthorn and Glossy Buckthorn

Rhamnus cathartica and *Frangula alnus*
(Buckthorn Family)

Threats to Native Habitats

Although seedlings of both buckthorns invade apparently stable habitats, they grow most successfully where there is ample light and exposed soil. These buckthorns have long growing seasons and rapid growth rates, and resprout vigorously after being topped. In North America, both species leaf out prior to most woody deciduous plants, and can retain their leaves well into autumn. Buckthorns rapidly form dense, even-aged thickets. The large leaves and continuous canopy create dense shade. Even-aged thickets are common in both wetlands and in woodland understories. Common buckthorn invasion is greatest in thinned or grazed woods, along woodland edges, and in openings created by windfalls. Common buckthorn's tolerance of moist, dry, or heavy clay soils increases its success in many types of habitats. Glossy buckthorn sometimes invades similar woodland habitats but more often invades wetlands that are comparable to its European wetland habitats. North American wetlands invaded by glossy buckthorn include wet prairies, marshes, calcareous fens, sedge meadows, sphagnum bogs, and tamarack swamps. Natural community composition, especially of upland deciduous woods and of wetlands, may be altered due to invasion of common buckthorn and glossy buckthorn. These species can cause habitat degradation, shade out rare species, and give rise to declines in native species diversity. Both buckthorns have become widespread in North America due to various disturbances, such as drainage, lack of fire, and woodland grazing and cutting, which have created ideal habitat for seedling establishment. Dispersal is accelerated by the birds and mammals that feed on the fruit of these species.

Description

Common buckthorn is a deciduous shrub or small tree that grows up to 20 feet in height. Dull green leaves are oval, edged with fine teeth, and one to two inches long. The leaves have several pairs of distinct veins that are curved toward the leaf tip. Leaf arrangement on the stem is alternate to nearly opposite. Twigs may be tipped with sharp, stout thorns. Small clusters of fragrant greenish-yellow flowers, each with four petals, grow from among the leaves. Like common buckthorn, glossy buckthorn is a deciduous shrub or small tree. It can readily be distinguished from common buckthorn by several obvious characters. Glossy buckthorn has similarly shaped leaves, but they are glossy or shiny and lack teeth on their margins. Flowers are also similar, but have five petals on glossy buckthorn. Plants of both species reach seed-bearing age quickly, and both produce drupes (berries). Care should be taken not to mistake the native alder-leaved buckthorn for

Buckthorn (top) and Glossy Buckthorn (photos by Mary W. Walker and Chris Mattrick, courtesy of the New England Wild Flower Society)

these non-natives. Alder-leaved buckthorn can be distinguished from common buckthorn by the lack of thorns at the end of its twigs, and it can be distinguished from glossy buckthorn by the presence of small teeth on its leaves.

Habitat

Potential habitats of common buckthorn are diverse and include open woods, thickets on exposed rocky sites, hedgerows, pastures, and roadsides. It grows in well-drained sand, clay, or poorly drained calcareous soils, but prefers neutral or alkaline soils. It is less vigorous in dense shade. Glossy buckthorn typically inhabits wetter, less shaded sites than common buckthorn. It grows in soils of any texture. Habitats include alder thickets and calcareous or limestone-influenced wetlands.

Distribution

Common buckthorn is native to Europe and grows in West and North Asia. Glossy buckthorn is native to North Africa, Asia, and Europe. In North America, common buckthorn is naturalized from Nova Scotia to Saskatchewan, south to Missouri and east to Virginia. Glossy buckthorn occurs from Nova Scotia to Manitoba, south to Minnesota, Illinois, New Jersey and Tennessee. These species were probably introduced to North America before 1800, but did not become widespread and naturalized until the early 1900s. In the past they have been cultivated for hedges, forestry plantings, and wildlife habitat. In Maine, common buckthorn is documented in nearly every county, while glossy buckthorn has only been documented in four counties.

Control

Cultural controls that have been used for management include cutting, mowing, girdling, excavation, burning, and "underplanting." Repeated cutting reduces plant vigor. Mowing maintains open areas by preventing seedling establishment. Glossy buckthorn girdled with a two- to three-centimeter-wide saw-cut, completely through the bark at the base, does not resprout. Girdling may be done at any time of the year. A five-second flame torch application around the stem kills stems less than 4.5 centimeters in diameter. Seedlings or small plants may be hand-pulled or removed with a grubbing hoe. Larger plants may be pulled out with heavy equipment. Excavation often disturbs roots of adjacent plants, or creates open soil readily colonized by new seedlings. This technique may be most useful to control invasion at low densities, or along trails, roads and woodland edges.

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Gleason, H.A. and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada.* New York: New York Botanical Garden.

For more information or for a more extensive list of references on invasive species contact:
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FACT SHEET: GIANT REED

Common Reed
Phragmites australis (Cav.) Trin. ex Steud.
Grass family (Poaceae)

NATIVE RANGE
Eurasia

DESCRIPTION
Common reed, or Phragmites, is a tall, perennial grass that can grow to over 15 feet in height. In North America, both native phragmites (*Phragmites australis* ssp. *americanus* Saltonstall, P.M. Peterson & Soreng) and introduced subspecies are found. Introduced Phragmites forms dense stands which include both live stems and standing dead stems from previous year's growth. Leaves are elongate and typically 1-1.5 inches wide at their widest point. Flowers form bushy panicles in late July and August and are usually purple or golden in color. As seeds mature, the panicles begin to look "fluffy" due to the hairs on the seeds and they take on a grey sheen. Below ground, Phragmites forms a dense network of roots and rhizomes which can go down several feet in depth. The plant spreads horizontally by sending out rhizome runners which can grow 10 or more feet in a single growing season if conditions are optimal.

Please see the table below for information on distinguishing betweeen native and introduced Phragmites.

ECOLOGICAL THREAT
Once introduced Phragmites invades a site it quickly can take over a marsh community, crowding out native plants, changing marsh hydrology, altering wildlife habitat, and increasing fire potential. Its high biomass blocks light to other plants and occupies all the growing space belowground so plant communities can turn into a Phragmites monoculture very quickly. Phragmites can spread both by seed dispersal and by vegetative spread via fragments of rhizomes that break off and are transported elsewhere. New populations of the introduced type may appear sparse for the first few years of growth but due to the plant's rapid growth rate, they will typically form a pure stand that chokes out other vegetation very quickly.

DISTRIBUTION IN THE UNITED STATES
Phragmites occurs throughout the lower 48 states and southern Canada. It has been reported to be invasive in natural areas in 18 states including Colorado, Connecticut, Delaware, Georgia, Indiana, Kentucky, Maryland, Michigan, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Virginia, Vermont, and Wisconsin, and the District of Columbia.

HABITAT IN THE UNITED STATES
Tidal and nontidal brackish and freshwater marshes, river edges, shores of lakes and ponds, roadsides, disturbed areas.

BACKGROUND
Preserved remains of native Phragmites that are 40,000 years old have been found in the southwest indicating that it is a part of the native flora of that region. In coastal areas, preserved rhizome fragments dating back 3000-4000 years have also been found in salt marsh sediments indicating that it is also native to these habitats. Native American uses of Phragmites include use of stems for arrow shafts, musical instruments, ceremonial objects, cigarettes, and both leaves and stems for constructing mats.

Introduced Phragmites is thought to have arrived in North America accidentally, most likely in ballast material in the late 18th or early 19th centuries. It established itself along the Atlantic coast and over the course of the 20th century, spread across the continent. In Europe Phragmites is grown commercially and is used for thatching, fodder for livestock, and cellulose production. It is also declining in parts of Europe which has been of concern to natural resource managers there. Here in the United States it is not used for many purposes.

BIOLOGY & SPREAD

While each Phragmites plant may produce thousands of seeds annually, seed viability is typically low although there appears to be a great deal of interannual variation in fecundity. Dispersal to new sites is typically by seed except along rivers and shorelines where fragments of rhizomes may be washed down to new sites where they can establish. Along roadsides, rhizomes fragments may also be transported by heavy machinery between sites. At this time, there is no evidence for hybrid native/introduced populations occurring in the field.

MANAGEMENT OPTIONS

Areas with large, established, populations of Phragmites are best restored using herbicides. Other options include mowing and prescribed burning.

Biological

At this time no means of biological control are available in the United States for treating Phragmites infestations.

Chemical

Glyphosate-based herbicides (e.g., Rodeo®) are the most effective control method for established populations. If a population can be controlled soon after it has established chances of success are much higher because the below-ground rhizome network will not be as extensive. Herbicides are best applied in late summer/early fall after the plant has flowered either as a cut stump treatment or as a foliar spray. It is often necessary to do repeated treatments for several years to prevent any surviving rhizomes from resprouting. When applying herbicides in or around water or wetlands, be sure to use products labeled for that purpose to avoid harm to aquatic organisms.

Fire

Prescribed burning after the plant has flowered, either alone or in combination with herbicide treatment, may also be effective. Burning after herbicide treatment also reduces standing dead stem and litter biomass which may help to encourage germination of native plants in the following growing season. Plants should not be burned in the spring or summer before flowering as this may stimulate growth.

Mechanical

This type of control (e.g., repeated mowing) may be effective at slowing the spread of established stands but is unlikely to kill the plant. Excavation of sediments may also be effective at control but if small fragments of root are left in the soil, they may lead to reestablishment.

CONTACTS

For more information on identification and control of Phragmites, contact:

- Dr. Kristin Saltonstall, Adjunct Research Scientist, Horn Point Laboratory, University of Maryland Center for Environmental Science, (914) 526-2498, ksalton at hpl.umces.edu

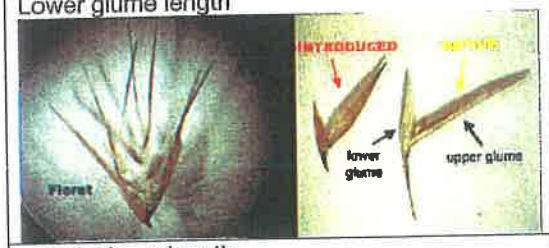
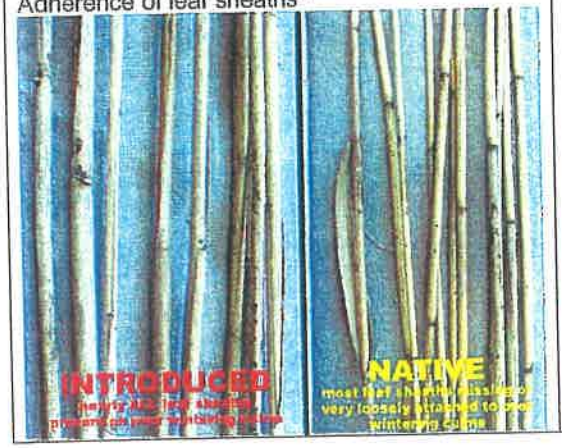
SUGGESTED ALTERNATIVE PLANTS

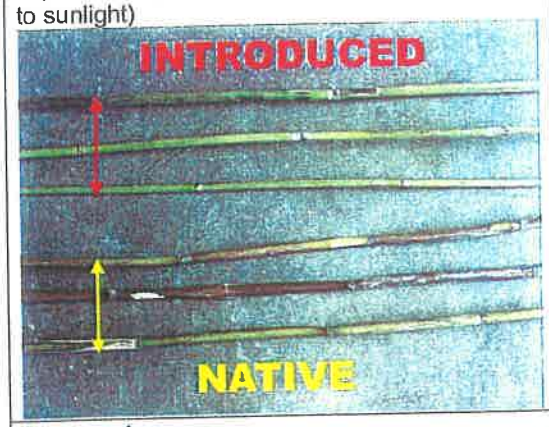
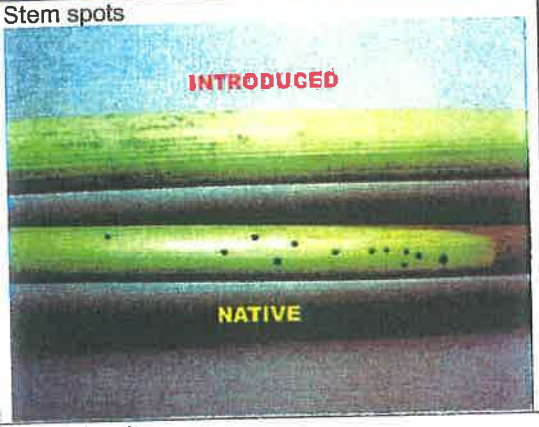
Native plant species that are adapted to local conditions should be used in restoration projects and as a substitute for Phragmites erosion control practices.

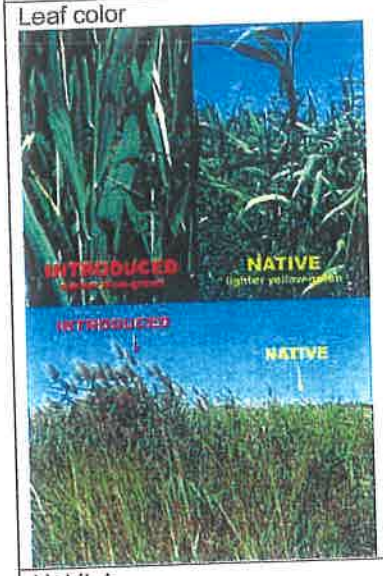
How to Distinguish Native and Introduced Phragmites plants:

It can be difficult to definitively distinguish native from introduced Phragmites plants without genetic testing due to the plasticity of the species and its ability to adapt to a wide range of conditions. However, a number of morphological characteristics have now been identified that can be used to determine a population's type. These characters can be subtle (e.g. color variation) and subjective making positive identification difficult. Given this, an assignment of native or introduced status to a population should not be made unless several characters clearly match the patterns shown in table 1.

Table 1: Morphological characters useful in distinguishing Native and Introduced Phragmites populations.*

CHARACTER **Photo**	**NATIVE**	**INTRODUCED**
Ligule width** 	1.0-1.7 mm	0.4-0.9 mm
Lower glume length 	3.0-6.5 mm	2.5-5.0 mm
Upper glume length	5.5-11.0 mm	4.5-7.5 mm
Adherence of leaf sheaths** 	Loose – both leaves and leaf sheaths are usually dropped as the plant senesces	Tight – leaves may drop off but leaf sheaths typically adhere tightly to dead stems

CHARACTER Photo	NATIVE	INTRODUCED
Stem color (look under the leaf sheaths, especially in places where the stem is exposed to sunlight) 	Summer – green to maroon, may have maroon color at the nodes only Winter – yellow to brown	Summer – typically all green with yellowish nodes although some lower nodes may have maroon color Winter – yellow
Stem spots 	Small round fungal spots MAY be present in late summer and on dead stems	Extremely rare. Patches of black filamentous fungi may be seen
Stem density	May occur as a monoculture, often co-occurs with other plant species	Typically grows as a monoculture, young newly established populations and those in areas of high salinity may be less dense

CHARACTER	NATIVE	INTRODUCED
Photo Leaf color 	Yellow-green – usually lighter than introduced	Blue-green in most habitats but may be yellow-green in brackish habitats
Habitat	Undisturbed sites MidAtlantic – fresh to oligohaline tidal marshes Midwest – fens, marshes	Highly disturbed to undisturbed sites, dominates brackish marshes along the Atlantic coast, common along roadsides throughout the U.S.

* This table should not be used to distinguish between Phragmites populations along the Gulf Coast where another type of Phragmites, the Gulf Coast type, which looks similar to introduced Phragmites, is also found.
** Most reliable characters distinguishing native from introduced Phragmites.

OTHER LINKS

- http://www.invasive.org/search/action.cfm?q=Phragmites%20australis
- http://www.lib.uconn.edu/webapps/ipane/browsing.cfm?descriptionid=85
- http://www.nps.gov/plants/alien/fact/pdf/phau1-powerpoint.pdf

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Bulletin #2509

MAINE INVASIVE PLANTS

Multiflora Rose, Rambler Rose

Rosa multiflora
(Rose Family)

Threats to Native Habitats

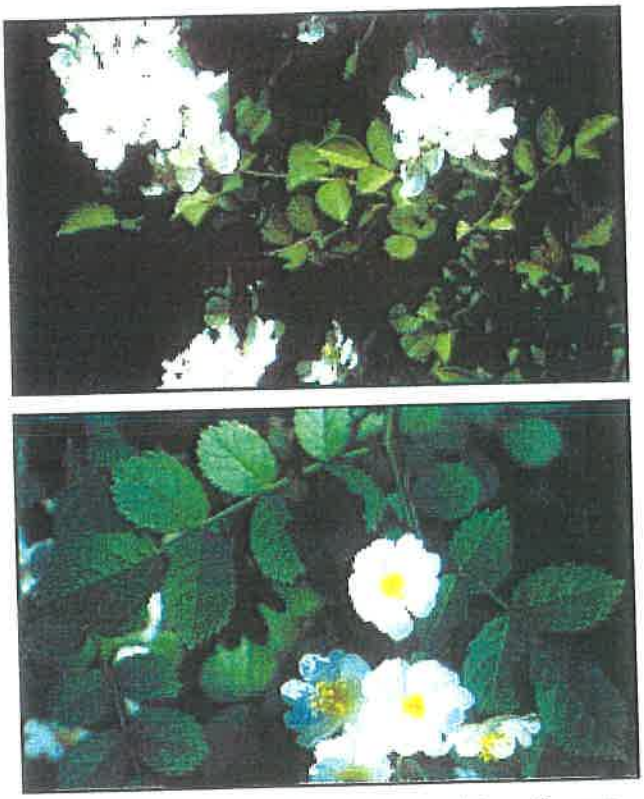
Multiflora rose is an aggressive colonizer of open unplowed land and is highly successful on forest edges. This prolific seed producer can create extremely dense, impenetrable thickets that crowd out other vegetation and inhibit regrowth of native plants. Associated vegetation of multiflora rose thickets is often limited to a few tree stems that have managed to overtop the rose before the thicket developed. Dense stands of multiflora rose can slow down forest regeneration: the species can dominate a forest understory. Anyone who has attempted to traverse a thicket of this plant would have few kind words for it, as its interweaving, abundantly-thorned branches snag on clothes and hair and can be quite painful. Large populations are sometimes associated with former plantings, but the plant has naturalized throughout much of the United States and continues to be spread with the help of birds.

Description

Multiflora rose is a robust perennial shrub with thorny arching stems. It has alternately arranged compound leaves, generally with seven or nine leaflets. It forms large clusters of fragrant white or pink flowers that bloom from June to July. Like other roses, it forms small red pulpy fruits called hips, which may be eaten by birds. It reproduces from seeds or by rooting at the tip of arching stems that touch the ground. It can be distinguished from native roses by its long arching stems and numerous small white flowers or hips depending on the season. To verify identification of this plant contact a natural resources professional.

Habitat

Multiflora rose prefers old fields, fencerows, power lines, roadsides, and forest edges. In other parts of its range it is successful in the understory of hardwood forests. It tolerates both moist and relatively dry conditions.



Multiflora Roses (photos by the Maine Natural Areas Program, and John A. Lynch, courtesy of the New England Wild Flower Society)

Distribution

Multiflora rose is native to eastern Asia. It was brought to North America in the late nineteenth century to be used in horticultural plantings. Since then it has been widely planted for a variety of reasons, including wildlife food and cover, erosion control, and as a living fence to border properties or pen livestock. Its use was historically advocated by the U.S. Soil Conservation Service and by some state conservation departments. Multiflora rose is now naturalized (established and reproducing in the wild) throughout much of the United States. In Maine, it is documented in Oxford, Waldo, and York Counties, but likely occurs in more.

Control

The best method of controlling multiflora rose is to prevent it from becoming established in the first place. It should be removed as soon as possible if it is found colonizing an area. Repeated mowing—at least six cuts per year near the ground for two or more years—can successfully eliminate light infestations. In areas where thickets have formed it may be necessary to use a bulldozer to remove the plants. Coarse mechanical removal by bulldozer or otherwise must be followed by removal of root sprouts or new growth from the seedbank if reinfestation is to be prevented. The herbicides glyphosate and triclopyr are also effective. Use a 2% solution of glyphosate or triclopyr mixed with a 0.5% surfactant, and thoroughly wet the leaves. To aid in the absorption of the herbicide apply when temperatures are greater than 65 degrees F. Herbicides can also be used in combination with mechanical treatments or as follow-up to a burn. Consult a licensed herbicide applicator before applying herbicides over large areas.

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For more information or for a more extensive list of references on invasive species contact:

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THE UNIVERSITY OF MAINE Cooperative Extension

DEPARTMENT OF CONSERVATION MAINE

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FACT SHEET: ORIENTAL BITTERSWEET

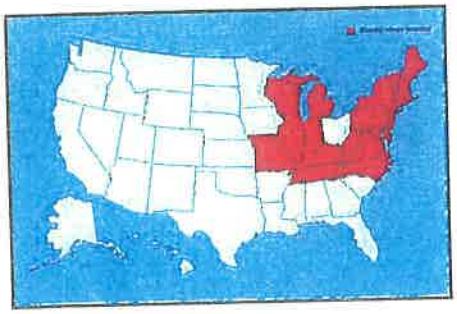
Oriental Bittersweet
Celastrus orbiculatus Thunb.
Staff-tree family (Celastraceae)

NATIVE RANGE
Eastern Asia, Korea, China and Japan

DESCRIPTION
Oriental bittersweet is a deciduous woody perennial plant which grows as a climbing vine and a trailing shrub. Stems of older plants 4 inches in diameter have been reported. The leaves are alternate, glossy, nearly as wide as they are long (round), with finely toothed margins. There are separate female (fruiting) and male (non-fruiting) plants. Female plants produce clusters of small greenish flowers in axillary clusters (from most leaf axils), and each plant can produce large numbers of fruits and seeds. The fruits are three-valved, yellow, globular capsules that at maturity split open to reveal three red-orange, fleshy arils each containing one or two seeds. The abundance of showy fruits have made Oriental bittersweet extremely popular for use in floral arrangements.

NOTE: Because Oriental bittersweet can be confused with our native American bittersweet (*Celastrus scandens*) which is becoming less and less common, it is imperative that correct identification be made before any control is begun. American bittersweet produces flowers (and fruits) in single terminal panicles at the tips of the stems; flower panicles and fruit clusters are about as long as the leaves; the leaves are nearly twice as long as wide and are tapered at each end. Oriental bittersweet produces flowers in small axillary clusters that are shorter than the subtending leaves and the leaves are very rounded. Comparing the two, American bittersweet has fewer, larger clusters of fruits whereas Oriental bittersweet is a prolific fruiter with lots and lots of fruit clusters emerging at many points along the stem. Unfortunately, hybrids of the two occur which may make identification more difficult.

ECOLOGICAL THREAT
Oriental bittersweet is a vigorously growing vine that climbs over and smothers vegetation which may die from excessive shading or breakage. When bittersweet climbs high up on trees the increased weight can lead to uprooting and blow-over during high winds and heavy snowfalls. In addition, Oriental bittersweet is displacing our native American bittersweet (*Celastrus scandens*) through competition and hybridization.



DISTRIBUTION IN THE UNITED STATES
Oriental bittersweet currently occurs in a number of states from New York to North Carolina, and westward to Illinois. It has been reported to be invasive in natural areas in 21 states (CT, DE, IL, IN, KY, MA, MD, ME, MI, MO, NC, NH, NJ, NY, PA, RI, TN, VA, VT, WI, and WV) and at least 14 national parks in the eastern U.S.

HABITAT IN THE UNITED STATES
Oriental bittersweet infests forest edges, woodlands, fields, hedgerows, coastal areas and salt marsh edges, particularly those suffering some form of land disturbance. While often found in more open, sunny sites, its tolerance for shade allows oriental bittersweet to invade forested areas.

BACKGROUND
Introduced into the U.S. in the 1860s as an ornamental plant, oriental bittersweet is often associated with old homesites, from which it has escaped into surrounding natural areas. Oriental bittersweet is still widely planted and maintained as an ornamental vine, further promoting its spread.

BIOLOGY & SPREAD

Oriental bittersweet reproduces prolifically by seed, which is readily dispersed to new areas by many species of birds including mockingbirds, blue jays and European starlings. The seeds germinate in late spring. It also expands vegetatively through root suckering.

MANAGEMENT OPTIONS

Manual, mechanical and chemical control methods are all effective in removing and killing Oriental bittersweet. Employing a combination of methods often yields the best results and may reduce potential impacts to native plants, animals and people. The method you select depends on the extent and type of infestation, the amount of native vegetation on the site, and the time, labor and other resources available to you. Whenever possible and especially for vines climbing up trees or buildings, a combination of cutting followed by application of concentrated systemic herbicide to rooted, living cut surfaces is likely to be the most effective approach. For large infestations spanning extensive areas of ground, a foliar herbicide may be the best choice rather than manual or mechanical means which could result in soil disturbance.

Biological

No biological controls are currently available for this plant.

Chemical

Systemic herbicides like triclopyr (e.g., Garlon® 3A and Garlon® 4) and glyphosate (e.g., Accord®, Glypro®, Rodeo®) are absorbed into plant tissues and carried to the roots, killing the entire plant within about a week. This method is most effective if the stems are first cut by hand or mowed and herbicide is applied immediately to cut stem tissue. Herbicide applications can be made any time of year as long as temperatures are above 55 or 60 degrees Fahrenheit for several days and rain is not expected for at least 24 hours. Fall and winter applications will avoid or minimize impacts to native plants and animals. Repeated treatments are likely to be needed. In areas where spring wildflowers or other native plants occur, application of herbicides should be conducted prior to their emergence, delayed until late summer or autumn, after the last killing frost occurs, or carefully targeted. Herbicidal contact with desirable plants should always be avoided. If native grasses are intermingled with the bittersweet, triclopyr should be used because it is selective for broad-leaved plants and will not harm grasses. Follow-up monitoring should be conducted to ensure effective control.

Glyphosate products referred to in this fact sheet are sold under a variety of brand names (Accord®, Rodeo®, Roundup Pro® Concentrate) and in three concentrations (41.0, 50.2 and 53.8% active ingredient). Other glyphosate products sold at home improvement stores may be too dilute to obtain effective control. Triclopyr comes in two forms – triclopyr amine (e.g., Garlon® 3A, Brush-B-Gone®, Brush Killer®) and triclopyr ester (e.g., Garlon® 4, Pathfinder®, and Vinex®). Because Garlon® 3A is a water-soluble salt that can cause severe eye damage, it is imperative that you wear protective goggles to protect yourself from splashes. Garlon® 4 is soluble in oil or water, is highly volatile and can be extremely toxic to fish and aquatic invertebrates. It should not be used in or near water sources or wetlands and should only be applied under cool, calm conditions.

Basal bark application

Use a string trimmer or hand saw to remove some of the foliage in a band a few feet from the ground at comfortable height. To the exposed stems, apply a 20% solution of triclopyr ester (Garlon® 4) (2.5 quarts per 3-gallon mix) in commercially available basal oil with a penetrant (check with herbicide distributor) to vine stems. As much as possible, avoid application of herbicide to the bark of the host tree. This can be done year-round although efficacy may vary seasonally; temperatures should be above 50 degrees F for several days.

Cut stem application

Use this method in areas where vines are established within or around non-target plants or where vines have grown into the canopy. Cut each vine stem close to the ground (about 2 in. above ground) and immediately apply a 25% solution of glyphosate (e.g., Accord®) or triclopyr (e.g., Garlon® 3A) mixed with water to the cut surface of the stem. The glyphosate application is effective at temperatures as low as 40°F and a subsequent foliar application may be necessary. The triclopyr application remains effective at low temperatures (<60°F) as long as the ground is not frozen. A subsequent foliar application may be necessary to control new seedlings. Homeowners can apply products like Brush-B-Gone®, Brush Killer® and Roundup Pro® Concentrate undiluted to cut stems. Using a paint brush or a plastic spray bottle, apply herbicide to the cut surface.

Foliar application
Use this method to control extensive patches of solid bittersweet. It may be necessary to precede foliar applications with stump treatments to reduce the risk of damaging non-target species. During foliar applications some of the herbicide is also absorbed through the stem for additional (basal bark) effect. Apply a 2% solution (8 oz per 3 gal. mix) triclopyr ester (Garlon® 4) or triclopyr amine (Garlon® 3A) mixed in water with a non-ionic surfactant to the leaves. In Rhode Island, concentrations as low as 1% in mid-summer and 0.05% in September have been very effective. Thoroughly wet the foliage but not to the point of runoff. The ideal time to spray is after much of the native vegetation has become dormant (October-November) to avoid affecting non-target species. A 0.5% concentration of a non-ionic surfactant is recommended in order to penetrate leaf cuticle. If the 2% rate is not effective try an increased rate of 3-5%. Ambient air temperature should be above 65°F.

For dense, low patches of bittersweet another alternative is to cut the entire patch to the ground early in the growing season. About one month later, apply 1-2% solution of triclopyr ester (Garlon® 4) or triclopyr salt (Garlon® 3A) in water to the previously cut patch using a backpack sprayer. This method has resulted in complete rootkill of the bittersweet and no off-target damage or root uptake by adjacent plants.

Manual and Mechanical
Small infestations can be hand-pulled but the entire plant should be removed including all the root portions. If fruits are present, the vines should be bagged in plastic trash bags and disposed of in a landfill. Always wear gloves and long sleeves to protect your skin from poison ivy and barbed or spined plants. For climbing vines, first cut the vines near the ground at a comfortable height to kill upper portions and relieve the tree canopy. Vines can be cut using pruning snips or pruning saw for smaller stems or a hand axe or chain saw for larger vines. Try to minimize damage to the bark of the host tree. Rooted portions will remain alive and should be pulled, repeatedly cut to the ground or treated with herbicide. Cutting without herbicide treatment will require vigilance and repeated cutting because plants will resprout from the base.

CONTACTS
For more information on the management of Oriental bittersweet, please contact:

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- Sue Salmons, sue_salmons at nps.gov, (202) 342-1443 ext. 217
- Jil Swearingen, jil_swearingen at nps.gov, (202) 342-1443 ext. 218

SUGGESTED ALTERNATIVE PLANTS
Several attractive native vines are available that provide nectar, seed and host plant material for butterflies, hummingbirds, and other wildlife. These include American bittersweet (*Celastrus scandens*) which is native to the eastern U.S. and should only be planted in areas where Oriental bittersweet is not well established or has been successfully controlled, to prevent hybridization with the native species. Other good alternatives include trumpet honeysuckle (*Lonicera sempervirens*), trumpet creeper (*Campsis radicans*), passionflower vine (*Passiflora lutea*), Dutchman's pipe (*Aristolochia macrophylla*) and native wisteria (*Wisteria frutescens*)*.

*If you wish to plant wisteria, make certain that it is the native species. Two commonly planted ornamental wisterias, Chinese wisteria (*Wisteria sinensis*) and Japanese wisteria (*Wisteria floribunda*), are exotic and aggressive invaders.

OTHER LINKS
- http://www.invasive.org/search/action.cfm?q=Celastrus%20orbiculatus
- http://www.lib.uconn.edu/webapps/ipane/browsing.cfm?descriptionid=27

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PHOTOGRAPH
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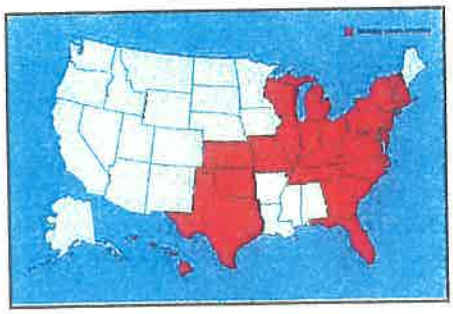
Fact Sheet: Japanese Honeysuckle

Japanese Honeysuckle
Lonicera japonica Thunb.
Honeysuckle family (Caprifoliaceae)

NATIVE RANGE
Japan and Korea

DESCRIPTION
Japanese honeysuckle is a perennial vine that climbs by twisting its stems around vertical structures, including limbs and trunks of shrubs and small trees. Leaves are oblong to oval, sometimes lobed, have short stalks, and occur in pairs along the stem. In southern and mid-Atlantic states, Japanese honeysuckle often remains evergreen – its leaves remain attached through the winter. In colder northern climates, the leaves may fall off after exposure to prolonged winter temperatures. Flowers are tubular, with five fused petals, white to pink, turning yellow with age, very fragrant, and occur in pairs along the stem at leaf junctures. Stems and leaves are sometimes covered with fine, soft hairs. Japanese honeysuckle blooms from late April through July and sometimes into October. Small black fruits are produced in autumn, each containing 2-3 oval to oblong, dark brown seeds about ¼ inch across.

ECOLOGICAL THREAT
In North America, Japanese honeysuckle has few natural enemies which allows it to spread widely and out-compete native plant species. Its evergreen to semi-evergreen nature gives it an added advantage over native species in many areas. Shrubs and young trees can be killed by girdling when vines twist tightly around stems and trunks, cutting off the flow of water through the plant. Dense growths of honeysuckle covering vegetation can gradually kill plants by blocking sunlight from reaching their leaves. Vigorous root competition also helps Japanese honeysuckle spread and displace neighboring native vegetation.



DISTRIBUTION IN THE UNITED STATES
Japanese honeysuckle occurs across the southern U.S. from California to New England and the Great Lakes region. Escaped populations also occur in Hawaii. Severe winter temperatures and low precipitation may limit its distribution in northern latitudes and in the West, respectively.

HABITAT IN THE UNITED STATES
A ubiquitous invader, Japanese honeysuckle thrives in a wide variety of habitats including fields, forests, wetlands, barrens, and all types of disturbed lands.

BACKGROUND
Japanese honeysuckle was introduced to the U.S. in the early to mid-1800s as an ornamental plant, for erosion control, and for wildlife forage and cover. Its highly fragrant flowers provide a tiny drop of honey-flavored nectar enjoyed by children.

BIOLOGY & SPREAD
Growth and spread of Japanese honeysuckle is through vegetative (plant growth) and sexual (seed) means. It produces long vegetative runners that develop roots where stem and leaf junctions (nodes) come in contact with moist soil. Underground stems (rhizomes) help to establish and spread the plant locally. Long distance dispersal is by birds and other wildlife that readily consume the fruits and defecate the seeds at various distances from the parent plant.

MANAGEMENT OPTIONS

Several effective methods of control are available for Japanese honeysuckle, including chemical and non-chemical, depending on the extent of the infestation and available time and labor.

Manual and Mechanical

For small patches, repeated pulling of entire vines and root systems may be effective. Hand pull seedlings and young plants when the soil is moist, holding low on the stem to remove the whole plant along with its roots. Monitor frequently and remove any new plants. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. An effective method for removal of patches of honeysuckle covering the ground is to lift up and hold a portion of the vine mass with a rake and have a chain saw operator cut the stems low to the ground. Mowing large patches of honeysuckle may be useful if repeated regularly but is most effective when combined with herbicide application (see below). Mow at twice a year, first in mid-July and again in mid-September. Plants can also be grubbed out using a pulaski or similar digging tool, taking care to remove all roots and runners. Burning removes above ground vegetation but does not kill the underground rhizomes, which will continue to sprout. In certain situations, tethered goats have been used to remove honeysuckle growth, but must be monitored to prevent their escape to the wild where they would become an added ecological threat.

Chemical

In moderate cold climates, Japanese honeysuckle leaves continue to photosynthesize long after most other plants have lost their leaves. This allows for application of herbicides when many native species are dormant. However, for effective control with herbicides, healthy green leaves must be present at application time and temperatures must be sufficient for plant activity. Several systemic herbicides (e.g., glyphosate and triclopyr) move through the plant to the roots when applied to the leaves or stems and have been used effectively on Japanese honeysuckle.

Following label guidelines, apply a 2.5% rate of glyphosate (e.g., Rodeo® for wetlands; Roundup® for uplands) mixed with water and an appropriate surfactant, to foliage from spring through fall. Alternatively, apply a 2% concentration of triclopyr (e.g., Garlon® 3A) plus water to foliage, thoroughly wetting the leaves but not to the point of drip-off. A coarse, low-pressure spray should be used. Repeat applications may be needed. Treatment in the fall, when many non-target plants are going dormant, is best. Also, a 25% glyphosate or triclopyr solution mixed with water can be applied to cut stem surfaces any time of year as long as the ground is not frozen.

Biological control

No biological control agents are currently available for Japanese honeysuckle.

USE PESTICIDES WISELY: Always read the entire pesticide label carefully, follow all mixing and application instructions and wear all recommended personal protective gear and clothing. Contact your state department of agriculture for any additional pesticide use requirements, restrictions or recommendations.

NOTICE: mention of pesticide products on this page does not constitute endorsement of any material.

CONTACTS

For more information on the management of Japanese honeysuckle, please contact:

- Lisa Jameson, National Park Service, Washington, DC; lisa_jameson at nps.gov
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- Sue Salmons, National Park Service, Rock Creek Park; sue_salmons at nps.gov

SUGGESTED ALTERNATIVE PLANTS

Vines that make good substitutes for Japanese honeysuckle include false jasmine (*Gelsemium sempervirens*), trumpet honeysuckle (*Lonicera sempervirens*), trumpet creeper (*Campsis radicans*), crossvine (*Bignonia capreolata*), native wisteria (*Wisteria frutescens*), jackman clematis (*Clematis jackmanii*), and others. Check with your state native plant society, a reputable native plant nursery, for recommendations for plants that are appropriate for your area and conditions.

OTHER LINKS

- http://www.invasive.org/search/action.cfm?q=Lonicera%20japonica
- http://www.lib.uconn.edu/webapps/ipane/browsing.cfm?descriptionid=65
- http://www.hear.org/starr/hiplants/images/thumbnails/html/lonicera_japonica.htm

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Virginia Native Plant Society VA NHP Japanese Honeysuckle Fact Sheet http://www.vnps.org/invasive/invloni.htm

APPENDIX E– Draft Conservation Restriction and Easement

CONSERVATION RESTRICTION AND EASEMENT

_____, 2010

AP Cambridge Partners II, LLC, a Delaware limited liability company, having a usual address c/o O'Neill Properties Group, 2701 Renaissance Boulevard, Fourth Floor, King of Prussia, PA 19406 ("Grantor"), acting pursuant to Section 31 et seq. of Chapter 184 of the General Laws, hereby grants to The Town of Belmont, acting by and through its Board of Selectmen, a Massachusetts municipal corporation having an address at 455 Concord Avenue, Belmont, Massachusetts 02478 ("Grantee") in perpetuity and exclusively for conservation purposes, the following described Conservation Restriction and Easement on a parcel of land located in the Town of Belmont, Massachusetts, constituting approximately _____ (__) acres, said parcel being described on the plan entitled "_____" (the "Plan") attached hereto as Exhibit A and made a part hereof [OR RECORDED HEREWITH (AS A SEPARATE PLAN)] the "Premises".

WHEREAS, the Grantor is the owner of record of the Premises by virtue of a deed from Arthur D. Little Real Estate Corporation. Said deed is registered with the Middlesex South District of the Land Court and recorded in the Middlesex South Registry of Deeds as document no. 1111887 and Book 30386, Page 240, respectively.

WHEREAS, the Grantor desires to convey to the Grantee a Conservation Restriction and Easement over the Premises for the purposes of conservation and protection of open space.

WHEREAS, the Premises contain unusual, unique or outstanding qualities, the protection of which in their natural or open condition will be of benefit to the public. These qualities include: wetlands and floodplains areas, wooded upland habitat, native grasses and wildflowers, and significant habitat for native plants and wildlife, as well as scenic beauty and opportunities for passive recreation consistent with the protection of open space and habitat. The views across Little Pond are important for their scenic values. The diversity of natural habitats on the Premises, and its location abutting the Division of Conservation and Recreation (the "DCR") Alewife Reservation, make this a parcel of ecological and conservation value. Baseline documentation of the conservation values of the Premises has been prepared by Grantor and approved by Grantee and is available for review in the offices of Grantee.

WHEREAS, the Grantor agrees to grant to the Grantee a Conservation Restriction and Easement for the purposes and upon the terms set forth herein.

NOW THEREFORE, in full consideration of the mutual covenants set forth hereinafter, the Grantor and Grantee agree as follows:

1. Purposes.

The Grantee hereby acquires this Conservation Restriction and Easement as hereby authorized by Sections 31-33 of Chapter 184 of the General Laws of the Commonwealth of Massachusetts, as amended, and as otherwise authorized by any and all powers and authorities.

The purpose of this Conservation Restriction and Easement are to ensure that the Premises are preserved and protected in perpetuity, in the name of and on behalf of the Town of Belmont, and are retained predominantly in their natural, scenic and condition for park use, habitat protection, watershed protection, and other conservation uses consistent with the spirit and intent of Article 97 of the Amendments to the Constitution of the Commonwealth of Massachusetts, and to prevent any use of the Premises that will significantly impair or interfere with the conservation values thereof.

2. Prohibited Acts and Uses.

Except as otherwise provided herein, the Grantor shall neither perform nor permit others to perform any of the following acts and uses on the Premises:

a) Constructing or placing of any building, fences, asphalt or concrete pavement, sign, utility pole, tower, conduit, line or other temporary or permanent structure or facility on or above the Premises;

b) Mining, excavating, dredging or removing from the Premises of soil, loam, peat, gravel, sand, rock or other mineral resource or natural deposit unless in accordance with Section 3(b) hereof;

c) Placing, filling, storing or dumping on the Premises of soil, refuse, trash, vehicle bodies or parts, rubbish, debris, junk, waste or other substance or material or the installation of underground storage tanks;

d) Cutting, removing or otherwise destroying trees, grasses or other vegetation, unless in accordance with Sections 3(a), 3(b), 3(c) or 3(f) hereof or as otherwise approved by the Grantee;

e) Activities detrimental to drainage, flood control, water, conservation, erosion control or soil conservation; and

f) Any other use of the Premises or activity which would materially impair significant conservation interests unless necessary for the protection of the conservation interests that are the subject of this Conservation Restriction and Easement.

3. Exceptions to Otherwise Prohibited Acts and Uses.

The following acts and uses otherwise prohibited in paragraph 2 are permitted, but only if such acts or uses do not materially impair significant conservation interests as determined by the Grantee:

a) The construction, erection and maintenance of storm water maintenance systems, including, without limitation, stormwater detention basins and floodplain compensation areas, to serve the adjacent land of the Grantor are permitted with

prior notice to the Grantee provided that such systems are located and constructed in a manner which minimizes the impact on the conservation values of the Premises and provided that the Grantor shall promptly restore the site of such installation, as nearly as may be practicable, to an ecologically improved condition as determined during the approval process with the Belmont Zoning Board of Appeals or Massachusetts Housing Appeals Committee.

b) The restoration and maintenance of the wetlands areas and the enhancement of certain uplands areas on the Premises in accordance with the plan entitled "Open Space Maintenance Plan, Belmont Uplands Site, Acorn Park Drive and Frontage Road, Belmont" dated_____, 2010, prepared by Epsilon Associates;

c) The general maintenance of, including, but not limited to, the mowing of grass and the selective removal of invasive wetland species within, any stormwater detention basins and floodplain compensation areas to ensure that the capacity of such basins and compensation areas are not diminished and the ecological value of the vegetation is retained as much as may be practicable, so long as the same is scheduled and conducted in a manner which avoids the nesting season of birds located at the Premises;

d) The right, but not the obligation, to monitor and study, or to permit others to monitor and study, plant and animal populations, plant communities, natural habitats and landscape features on the Premises with prior written approval from Grantee;

e) The right to conduct, or permit others to conduct, management of the Premises for the benefit of native fauna (including ecologically appropriate methods to promote native species and to manage invasive species) and/or for the purpose of identifying and restoring landscape and/or native plant features within the Premises, with prior written approval from Grantee; and

f) The installation, maintenance and use of new underground public utilities to serve the adjacent land of the Grantor is permitted with prior notice to the Grantee provided that such utilities are located and constructed in accordance with all applicable laws, ordinances, by-laws, codes and regulations and in a manner which minimizes the impact on the conservation values of the Premises and provided that the Grantor shall promptly restore the site of such installation, as nearly as may be practicable, to an ecologically improved condition.

4. Permitted Acts and Uses.

All acts and uses not prohibited by Paragraphs 3 and 4 are permissible if they are clearly consistent with the conservation purposes of this Conservation Restriction and Easement and with the prior approval of Grantee. All uses must comply with local, state, and federal laws.

5. Notice and Approval.

Whenever notice to or approval by Grantee is required under the provisions of Paragraphs 3 or 4, Grantor shall notify Grantee in writing not less than ninety (90) days prior to the date Grantor intends to undertake the activity in question. The notice shall describe the nature, scope, design, location, timetable and any other material aspect of the proposed activity in sufficient detail to permit Grantee to make an informed judgment as to its consistency with the purposes of this Conservation Restriction and Easement. Where Grantee's approval is required, Grantee shall grant or withhold its approval in writing within ninety (90) days of receipt of Grantor's written request therefor. Grantee's approval shall not be unreasonably withheld, but shall only be granted upon a showing that the proposed activity shall not materially impair the purposes of this Conservation Restriction and Easement. Failure of Grantee to respond in writing within such ninety (90) days shall be deemed to constitute approval by Grantee of the request as submitted, so long as the request sets forth the provisions of this section relating to deemed approval after the passage of time.

6. Access.

The Grantee through its duly designated officers, directors, members, employees, representatives, or agents shall have the right to enter the Premises, following reasonable notice and at reasonable times and in a reasonable manner for the purpose of inspecting the Premises, determining compliance with the terms of this Conservation Restriction and Easement and preventing, abating, or remedying any violations thereof.

7. Use by Others.

Except as provided in the foregoing paragraph, no rights to enter the Premises are granted hereby to the Grantee, to the public or to any other person.

8. Legal Remedies of Grantee.

a) Legal and Injunctive Relief. The rights hereby granted shall include the right to enforce this Conservation Restriction and Easement by appropriate legal proceedings and to obtain injunctive and other equitable relief against any violations, including, without limitation, relief requiring restoration of the Premises to its condition prior to the time of the injury complained of (it being agreed that the Grantee may have no adequate remedy at law), and shall be in addition to, and not in limitation of, any other rights and remedies available to the Grantee.

b) Reimbursement of Costs and Enforcement. The Grantor, and thereafter the successors and assigns of the Grantor, covenant and agree to reimburse the Grantee for all reasonable consents and expenses (including without limitation reasonable counsel fees) incurred in enforcing this Conservation Restriction and Easement or in remedying or abating any violation thereof. The reimbursement obligation of any party hereunder shall be limited to violations caused or

permitted by said party within a portion of the Premises then owned by such party.

c) Grantee's Disclaimer of Liability. By its acceptance of this Conservation Restriction and Easement, the Grantee does not undertake any liability or obligation relating to the condition of the Premises.

d) Severability Clause. If any provision of this Conservation Restriction and Easement shall to any extent be held invalid, the remainder shall not be affected.

e) Non-Waiver. Any election by the Grantee as to the manner and timing of its right to enforce this Conservation Restriction and Easement or otherwise exercise its rights hereunder shall not be deemed or construed to be a waiver of such rights.

9. Assignability.

a) Running of the Burden. The burdens of this Conservation Restriction and Easement shall run with the Premises in perpetuity, and shall be enforceable against the Grantor and the successors and assigns of the Grantor holding any interest in the Premises.

b) Execution of Instruments. The Grantee is authorized to record or file any notices or instruments appropriate to assuring the perpetual enforceability of this Conservation Restriction and Easement. The Grantor on behalf of itself and its successors and assigns appoints the Grantee its attorney-in-fact to execute, acknowledge and deliver any such instruments on its behalf. Without limiting the foregoing, the Grantor and its successors and assigns agree themselves to execute any such instruments upon request.

c) Running of the Benefit. The benefits of this Conservation Restriction and Easement shall be in gross and shall not be assignable by the Grantee, except in the following instances and from time to time:

(i) as a condition of any assignment, the Grantee requires that the purpose of this Conservation Restriction and Easement continue to be carried out;

(ii) the assignee, at the time of assignment, qualifies under Section 170(h) of the Internal Revenue Code of 1986, as amended, and applicable regulations thereunder, and under Section 32 of Chapter 184 of the General Laws as an eligible donee to receive this Conservation Restriction and Easement directly; and

(iii) the grantee complies with the provisions required by Article 97 of the Amendments to the State Constitution.

10. Subsequent Transfers.

The Grantor agrees to incorporate by reference the terms of this Conservation Restriction and Easement in any deed or other legal instrument by which it divests itself of any interest in all or a portion of the Premises.

11. Acts Beyond the Grantor's Control.

Nothing contained in this Conservation Restriction and Easement shall be construed to entitle the Grantee to bring any action against this Grantor for any injury to or change in the Premises resulting from causes beyond the Grantor's control, including, but not limited to, trespass, fire, flood, storm, and earth movement, or from any prudent action taken by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the Premises resulting from such causes.

12. Termination of Rights and Obligations.

Notwithstanding anything to the contrary contained herein, the rights and obligations under this Conservation Restriction and Easement of any party holding any interest in the Premises terminate upon transfer of that party's interest, except that liability for acts or omissions occurring prior to transfer, and liability for the transfer itself if the transfer is in violation of this Conservation Restriction and Easement, shall survive the transfer.

13. Estoppel Certificates.

Upon request by the Grantor, the Grantee shall within thirty (30) days execute and deliver to the Grantor any document, including an estoppel certificate, which certifies the Grantor's compliance with any obligation of the Grantor contained in this Conservation Restriction and Easement.

14. Effective Date.

This Conservation Restriction and Easement shall be effective when the Grantor and the Grantee have executed it, the administrative approvals required by Section 32 of Chapter 184 of the General Laws have been obtained, and it has been recorded, or if registered land, it has been registered.

15. Recordation.

The Grantor shall record this instrument in timely fashion in the Middlesex County Registry of Deeds.

Executed under seal this ___ day of _____, 2010.

AP CAMBRIDGE PARTNERS II, LLC

By: AP Cambridge Partners Management Co., LLC

By: _____
Name: J. Brian O'Neill
Title: Manager

COMMONWEALTH OF MASSACHUSETTS

_____, ss.

_____, 2010

Then personally appeared the above-named J. Brian O'Neill, manager of AP Cambridge Partners Management Co., LLC, a Delaware limited liability company, which limited liability company is a manager of AP Cambridge Partners II, LLC, a Delaware limited liability company (the "LLC"), proved to me through satisfactory evidence of identification, which was _____, to be the person whose name is signed on the preceding document, and acknowledged the foregoing instrument to be his free act and deed and the free act and deed of AP Cambridge Partners Management Co., LLC, in its capacity as manager of the LLC, before me

NOTARIAL SEAL

_____
Notary Public
My Commission Expires:_____

ACCEPTANCE OF GRANT

The above Conservation Restriction and Easement is accepted this ___ day of _____, 2010.

TOWN OF BELMONT

By: _____
Selectman

By: _____
Selectman

By: _____
Selectman

COMMONWEALTH OF MASSACHUSETTS

MIDDLESEX, ss. _____, 2010

Then personally appeared the above-named _____, _____ of _____ and, proved to me through satisfactory evidence of identification, which was _____, to be the person whose name is signed on the preceding document, and acknowledged the foregoing instrument to be (his/her) free act and deed, and the free act and deed duly authorized _____, before me.

_____
Notary Public
My Commission Expires:

APPROVAL BY SELECTMEN

We, the undersigned Board of Selectmen of the Town of Belmont, Massachusetts, hereby certify that at a meeting duly held on _____, 2010 the Selectmen voted to approve the foregoing Conservation Restriction and Easement to the Town of Belmont for the preservation of the natural resources of said Town pursuant to Massachusetts General Laws Chapter 184, Section 2.

_____
Selectman

_____
Selectman

_____
Selectman

APPROVAL BY SECRETARY OF ENVIRONMENTAL AFFAIRS
COMMONWEALTH OF MASSACHUSETTS

The undersigned Secretary of the Executive Office of Environmental Affairs of the Commonwealth of Massachusetts hereby certifies that the foregoing Conservation Restriction and Easement to the Town of Belmont has been approved in the public interest pursuant to Massachusetts General Laws Chapter 184, Section 32. Said approval is not to be construed as representing the existence or non-existence of any pre-existing rights, if any, in and to the Premises, and any such pre-existing rights if any, are not affected by the granting of this Conservation Restriction and Easement.

Date:_____

_____
Secretary, Executive Office of
Environmental Affairs

1505823.1

EXHIBIT C

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT CH40B SUBSIDIZED HOUSING INVENTORY

Belmont

DHCD ID #	Project Name	Address	Type	Total SHI Units	Affordability Expires	Built w/ Comp. Permit?	Subsidizing Agency
278	Belmont Village	59 Pearson Road	Rental	100	Perp	No	*DHCD*
279	Sherman Gardens	131 Sycamore St.	Rental	80	Perp	No	*DHCD*
280	Waverly Oaks Apartments	637 Trapelo Rd.	Rental	74	Perp	No	*DHCD*
281	n/a	104 Clark Ln	Rental	8	Perp	No	*DHCD*
4209	DDS Group Homes	Confidential	Rental	43	N/A	No	*DDS*
8460	B Street	B Street	Ownership	1	perp*	NO	*HUD*
8461	B Street	B Street	Ownership	1	perp*	NO	*HUD*
							HUD
8462	B Street	B Street	Ownership	1	perp*	NO	*HUD*
9080	DMH Group Homes	Confidential	Rental	12	N/A		*DMH*
9410	Waverly Woods Apartments	2-12 Olmstead Drive	Rental	40	2106*	NO	*DHCD*
9760	Oakley Neighborhood	Belmont St, Lawndale St and Oakley Rd	Ownership	3	Perp	NO	*DHCD*
9945	The Residences at Acorn Park	One Acorn Park Drive	Rental	298	Perp	YES	*MassHousing*
	Belmont Totals			661	**Census 2010 Year Round Housing Units**		10,117
					Percent Subsidized		6.53%

This data is derived from information provided to the Department of Housing and Community Development (DHCD) by individual communities and is subject to change as new information is obtained and use restrictions expire.