

Green Routes Network Plan

A Bicycle Network Master Plan

Brookline Bicycle Advisory Committee

November 10, 2008

1. Vision for a Bikable Community

Bicycling is a sustainable, economical, and convenient mode of transportation for short and medium distance trips, and is a popular form of recreation for young and old. Bicycling is good for the environment, for public health, and for reducing traffic congestion and parking demand. It offers older children a measure of independence, and is a practical mode of transportation to Brookline High School, sports fields, and other local destinations.

Brookline already has many conditions conducive to bicycling – compact development, proximity to major employment centers, relatively flat geography, and a temperate climate. With 1.5% of trips made by bicycle (US Census, 2000), Brookline has the third highest bicycle use of any community in Massachusetts. Traffic counts conducted in September 2008 showed more than 1,000 bicyclists per hour passing 11 checkpoints combined, including more than 100 people riding daily to Brookline High School, and 50 bicycles parked at racks in Coolidge Corner on a Saturday.

However, bicycle use in Brookline is far below its potential. For most residents, getting outside one’s immediate neighborhood requires negotiating heavily trafficked streets, exposing them to a level of stress and danger that most people – especially children, seniors, and women – prefer to avoid. Every community with high bicycle use, whether in the Netherlands, Denmark, Davis (CA), or Boulder (CO), offers an extensive network of *low traffic stress bike routes*.

Brookline’s quiet local streets are ideal for bicycling, but they are not connected in a network that facilitates across-town travel. Even the town’s few dedicated bicycle facilities subject cyclists to high traffic stress. The bicycle lanes on Beacon Street and on Harvard Street disappear at intervals, leaving cyclists in heavy traffic, and barely clear the ‘door zone’ of high turnover parking lanes in the St. Mary’s and Washington Square districts. The Muddy River path is interrupted by the dangerous crossing of Route 9. The Charles River bicycle paths lie just a few hundred yards from Essex Street in Brookline, but the dangerous crossings approaching Commonwealth Avenue renders them practically inaccessible to many.

The need for safe and “green” bicycle routes is a recurring theme in recent Town planning documents. The *Parks, Open Space and Recreation Strategic Master Plan* (2006) reported that “*more trails and bike paths*” was the third most popular funding priority among Brookline residents. Echoing the Conservation Committee’s plan *Open Space 2005*, it also stated:

Brookline needs to establish a network of open space corridors, including “green” streets with bicycle lanes and pathways that are valued for their environmental, aesthetic and economic benefits.

... There are few safe and satisfactory non-vehicular routes, even for intrepid bikers, both in the heavily developed areas of north Brookline and the less dense sections of south Brookline. Moreover, the routes that exist do not connect the public to the Town's major open space areas. The existing bicycle and pedestrian routes lack a 'green' landscape that would provide aesthetically pleasing surroundings and a safe buffer between non-vehicular users and automobile drivers.

In like manner, *Brookline Comprehensive Plan 2005-2015*, the Town's master plan, recommended that the Town

... prepare a bicycle/pedestrian master plan that outlines a system of connections between neighborhoods, activity centers, and public open spaces.

... provide safe and attractive pedestrian and bicycle access Town-wide to all major open space destinations.

Brookline's favorable urban structure offers the potential to create the network of low traffic stress and "green" bicycle routes that its citizens want. Other communities' experiences suggest that Brookline could have 5 to 10% of its trips being made by bicycle within a few years. Young people will routinely cycle to school and to athletic fields for games and practice. Residents will shop and run errands by bicycle, reducing motor vehicle parking demand. New greenways will better connect South Brookline to the rest of town, a boon to walkers, joggers, and bicyclists alike. Families will enjoy riding along Brookline's green routes, with easy access to the Town's open spaces and to regional paths. More adults will bicycle to work, getting the exercise and fresh air they need while saving money, enjoying their commute, and contributing to a sustainable environment.

Creating this network of green routes requires deliberate planning, budgeting, and refocused priorities. Some of the network can be created at minimal capital expense using road markings and traffic management changes such as parking restrictions. Other parts of the network will require modest capital improvements such as curb ramps and extensions. Some streets, notably in south Brookline, will require major new infrastructure, likely requiring state or federal funding. With reasonable aid infusions for five large projects, most of the Green Routes Network can be accomplished in 10 years at a cost of about \$2 per year per resident.

This Master Plan is organized into the following sections:

- 🚲 Section 2: Network map
- 🚲 Section 3: Description of roadway treatments
- 🚲 Section 4: Signing the network
- 🚲 Section 5: Project list with budget and timeline

This Master Plan should be complemented with other Town efforts to improve conditions for cycling, including provisions for bicycle parking, safety education, traffic law enforcement, and ensuring that every street project undertaken or permitted by the Department of Public Works includes all reasonable accommodation of bicycles and pedestrians. The network evolution should also be coordinated with regional plans and plans in Boston, Newton, and Cambridge, in order to maximize its benefit to the entire region.

2. Network Map

In one sense, the Town's bicycle network includes the full street network. Bicyclists are permitted to use, intended to use, and do use every street in the Town, from small residential streets to Route 9. Therefore, it is important that every street be made as safe and accommodating of bicycles as possible, and that bicycle needs be considered whenever roadwork is done.

However, for deliberate planning of a bicycle-related safety improvements, a more limited *Green Routes* network has been identified, shown in Figure 1. It connects every neighborhood with important local destinations including the high school, libraries, parks, and commercial districts; it also connects to important bicycling routes at the Town limits, including the Charles River bike paths. Because bicycling requires exertion, the network is a fine mesh, avoiding circuitous routes that might be acceptable for motor traffic. It favors routes that minimize traffic stress, avoid hills, are esthetically pleasant, and minimize stops. It proposes routes that cyclists themselves prefer, because there is no benefit to designating routes that bicyclists won't follow.

As shown in Figure 1, the network may be divided for planning purposes into four levels:

- *Level One: Muddy River Path.* Top priority should be assigned to re-establishing the continuity of this historic greenway for cyclists and pedestrians.
- *Level Two: Slow traffic streets.* A large part of the bicycle network will use low speed, low turbulence streets. Where traffic volumes are low, bicycles will share space with motor traffic; where traffic volumes are higher, bicyclists will be offered dedicated bicycle lanes or, where roadway space is lacking, priority treatments that advise motorists to yield space to bicyclists. This part of the network can be developed at low cost and quickly by adding key connections and modest traffic restrictions.
- *Level Three: New greenways.* Because it lacks a dense street grid, many bicycle routes in South Brookline have to follow arteries carrying relatively high speed motor traffic. Physically separate facilities offer the best alternative for bicycle accommodation in this environment, and can often be achieved by means of "road diets" that will reduce the amount of pavement, lower stormwater runoff, and permit the development of tree-lined greenways that will benefit pedestrians as well as cyclists. This part of the network will involve extensive roadway changes, entailing considerable expense and planning effort.
- *Level Four: Main streets.* Beacon Street, Harvard Street, and Washington Street are Brookline's "main streets," carrying through traffic while also hosting commercial centers with high turnover parking. These important functions limit the degree to which roadway space can be devoted to bicycles. However, because of their importance both as through routes and as destinations, these streets should be improved to accommodate as wide a segment of the bicycling population as possible.

3. Roadway Treatments

While there are some bicyclists who don't mind mixing with relatively high speed motor traffic, the vast majority of the population can be classified as "traffic-intolerant bicyclists": people who can follow the rules of the road, and who don't mind riding on low-speed, low-traffic local streets, but who elsewhere want to be separated from the stress of sharing space with motor traffic. The *Green Routes* network aims to accommodate traffic-intolerant cyclists by offering the degree of separation from traffic that they need,

using a variety of designs. In addition to off-road paths such as the Muddy River paths and directing cyclists along residential streets with low traffic volumes and speeds, the *Green Routes* network includes the following roadway treatments.

- 🚲 **Bike lanes** designate exclusive space for bicyclists, and are appropriate on moderate speed streets with “low turbulence,” i.e., avoiding high turnover parking lanes and intersection approaches with heavy right turning traffic. Where there is parallel parking, bike lanes have to be wide enough to allow bicyclists to avoid the “door zone.” Bike lanes that terminate abruptly (e.g. in order to make space for a turning lane) make roads unaccommodating for most bicyclists.
- 🚲 **Bicycle priority lanes** are shared (bike and car) travel lanes with “bicycle zone” indicated by roadway markings. These lanes are appropriate for streets with speeds up to 30 mph. Cambridge is designating a bicycle zone using shared lane arrows (“sharrows”) in several new roadway projects; these markings are also popular on the West Coast and in Montreal. Markings that delineate a bicycle priority zone will allow cyclists to travel more confidently on streets such as Carlton Street, Park Street, and sections of Beacon Street that lack a bike lane.
- 🚲 **Bike boxes.** A bike box is a marked queuing area for bikes between the stop line and the crosswalk at a signalized intersection. Bike boxes improve bike safety by putting bikes ahead of queued cars that may turn right when the light changes, and by giving left-turning bicyclists a protected path during the red phase of the cycle. By setting back the motor vehicle stop line, they also improve pedestrian comfort and visibility.
- 🚲 **Contraflow lanes** make a street open for two-way bicycle traffic while keeping it one-way for motor traffic. A street with contraflow is like any other two-way street, with all traffic keeping to the right of a centerline; however, the lane in the contraflow direction is narrow because only bikes are permitted in that direction. An analogy is contraflow bus lanes, used on Washington Street in Boston and in other cities. “One Way” and “Do Not Enter” signs on such streets get a supplementary plaque, “Except Bicycles.”

In Brookline, one-way restrictions are often applied as a deliberate measure to keep through traffic off residential streets, making those streets ideal for contraflow bicycling. In many situations, contraflow offers bicyclists safer and more direct routes. Contraflow has an excellent safety record in European and American cities. Cambridge has four contraflow sections; Provincetown has two-way bicycling and one-way motor traffic all along Commercial Street, its principal thoroughfare. Several of Brookline’s one-way streets such as Netherlands Road and Essex Street already carry considerable contraflow bicycle traffic. Formally designating such streets two-way for bicycles using signs and markings should improve safety, because it will raise motorist expectations of finding opposing bicycle traffic. Formal designation is necessary before any route with contraflow can be marked with signs or on a map; it also a powerful way of indicating that bikes are intended users of our streets.

Where space permits, contraflow lanes can be marked with a centerline dividing the street by direction of travel. On very narrow streets with speeds around 20 mph (e.g., Monmouth Street between Hawes and Carlton), contraflow can be provided without marking a centerline, just as most local streets serve two-direction traffic without a centerline. This scheme is used safely on hundreds of narrow streets in the Netherlands and in Brussels. We recommend using intermittent markings, as does Brussels to alert motorists to the possibility on contraflow bikes and to guide bikes to keep to the right.

Table 1: Streets Recommended for Bicycle Contraflow

Cottage Street	Hawas Street	Park Street
Davis Avenue	Ivy Street	Parkway Road
Dudley Street	Kent Street	St. Mary's Street
Essex Street	Middlesex Road	Sumner Road
Green Street	Monmouth Street	Westbourne Terr.
Greenough Street	Netherlands Road	

- 🚲 **No Passing Bicycles Zones** are appropriate on short sections of streets that are too narrow for a car to pass a bike without crossing the centerline, and where crossing the centerline is dangerous because of frequent intersections or limited sight distance. One example application is on Carlton Street going southbound from Beacon Street, where motorists frequently squeeze past bicyclists with very little clearance, and can often be seen driving on the wrong side of the road as they approach the 90 degree turn onto Colchester Street. Another example is on curved sections of Heath Street. A posted passing restriction would encourage bicyclists to ride at a safe distance from the curb, making the restriction self-enforcing, and relieving motorists of the stress of seeking an opportunity to pass when it really isn't safe to pass.
- 🚲 **Road diets** reduce the number of lanes on a road, usually to one in each direction, plus short extra lanes where needed for capacity at intersections. Candidates include Lee / Clyde Streets, Hammond Street, and Newton Street / West Roxbury Parkway bordering the Putterham Golf Course. The reclaimed space can be used to create greenways with tree lawns and shared use paths.
- 🚲 **Roadside bicycle paths**, also called *cycle tracks*, run parallel to a road, but are physically separated from travel lanes by a curb or buffer. They are the most common bicycle accommodation in the Netherlands and Denmark, countries that have set the standard for high levels of bicycle use and safety.

One-way paths lying on either side of the road, as on Vassar Street in Cambridge, work well in many situations. Two-way paths, as on Memorial Drive, may be preferred on roads with few intersections and where safe transitions at path endpoints can be provided.

Normally, roadside bike paths are distinct from the sidewalk. However, in a park or greenway, it can take the form of a shared-use path. Section of the bike path can also be shared with automobiles if limited to a driveway function (access to a few homes) and engineered for driveway speeds.

4. Signing the Network

As *Green Routes* are established, they will be marked using *wayfinding* or *destination signage*. In this scheme, routes are not named or numbered, but are indicated by signs stating where the route goes, as shown in Figure 2a (from the Netherlands) and 2b (based on a style developed in Chicago). They use a single sign to convey the same information carried by three signs in the old U.S. standard format (Figure 2c, from our own Harvard Street). To the extent possible, Brookline's signing scheme should be coordinated with signing plans in other metro region communities.

Besides guiding cyclists, destination signs market the Town's bike routes and commercial areas, promoting bicycling and bicycle tourism. They also convey to motorists and cyclists alike the powerful message that our society supports bicycling.

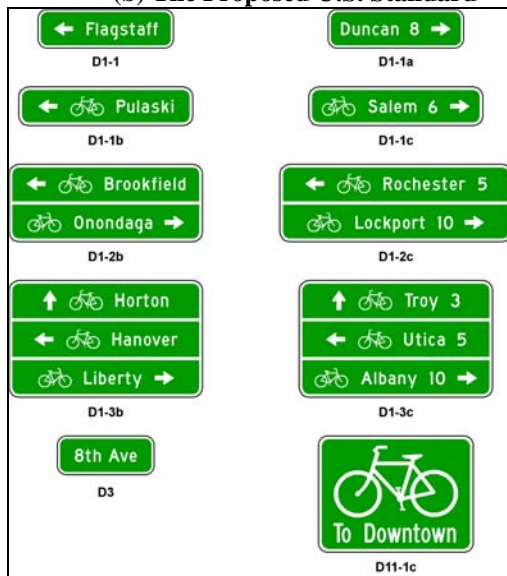
Another way to guide cyclists is to mark the pavement with a double chevron (>>) on intersection approaches, tilting the chevrons to the right or when the bike route is turning. This kind of marking, used in Brussels, is especially valuable on bike routes that follow side streets.

**Figure 2: Destination Signs
(a) In the Netherlands**



(c) Old Style Three-Piece Sign (Harvard Street, Brookline, MA)

(b) The Proposed U.S. Standard



Source for (a) and (b): “Proposed D1 & D11 Series Bicycle Guide Signs.” Technical Committee Recommendation, NCUTCD Bicycle Technical Committee, 6/23/05, revised 1/20/06.

5. Projects to Develop the Green Route Network

Implementation of Brookline *Green Routes* has been divided into almost 40 projects listed in the following table. A rough budget for each project is given, along with a target year. The timeline anticipates an annual budget of about \$110,000 in Town funds for 10 years, amounting to \$2 per resident per year, in addition to state and federal aid on the most expensive projects. The “local budget impact” estimates the Town’s share of the budget, and appears as zero for small sidewalk repair, signage, and marking projects that can be done within the Town’s normal maintenance program.

All the designs proposed in this section are conceptual; final approval of any particular project requires detailed design and appropriate review.

Table 2: Recommended Projects and Timeline

	Target Year	Project	Summary	Total Cost (\$)	Local Budget Impact	Opportunities & Obstacles
1	2009	Carlton / Essex / Ivy Street bike lanes	Bike lanes and bike priority lanes from Longwood & Chapel to Essex & Dummer via Carlton St	33,000	33,000	Part of Carlton St neighborhood traffic safety project. Lose 2 metered parking spots and 5 2-hr spots near Beacon St. Potential funding: MASCO
2	2009	Cypress Street bike lanes	From Wash. St. to Riverdale Circle, including short sections of High and Chestnut. Bike priority lanes in narrower sections north of Rt 9.	30,000	30,000	Lose 5 metered spaces near the D-line bridge, plus a few more south of Route 9. Potential funding: Community Development Block Grant.
3	2009	Essex - Commonwealth connector	Curb ramps to create a crossing for NB bikes to get from Essex St. to the Mountfort NB street and/or sidewalk	40,000	40,000	State or BU funds may be available (Mass Pike deck project). Can't wait for Urban Ring project.
4	2009	Heath Street passing restrictions	"No Passing Bikes" zones	3,000		
5	2009	Netherlands - Parkway - Aspinwall bike lanes	Contraflow bike lanes on NL Rd. and on Parkway Rd. Bike lanes in both directions on Aspinwall from Kent to NL Rd.	-	-	Part of Riverway Island Neighborhood traffic safety project
6	2010	Muddy River Path's crossing of Brookline Ave at Parkway Road	Signal (part of the Aspinwall intersection), curb extension on path side, ramp to path	90,000	90,000	Lose 2 metered parking spaces

	Target Year	Project	Summary	Total Cost (\$)	Local Budget Impact	Opportunities & Obstacles
7	2010	Beacon Street priority lanes	Bike priority lanes where there is no bike lane	18,000	18,000	
8	2010	Repairs to Brookline Ave path	Subgrade and paving improvements to eliminate root-caused bumps	6,000	-	Part of sidewalk repair work
9	2010	Green Street and John Street bike lanes	Contraflow lane on Green St. Bike lanes on John St.	6,000		
10	2010	Longwood Ave. priority lanes	Bicycle priority lanes	5,000		
11	2010	Centre Street bike lanes	Bike lane on one side; bike priority lane on the other	3,000	-	
12	2011	Beacon / Webster / Park bike path	Sidewalk-level bike path on S. side of Beacon from Webster to Park (involves curb shifts on Beacon St)	75,000	75,000	
13	2011	Coolidge Corner south bypass	Contraflow bike lane on Webster St; bike box on Longwood	18,000	18,000	Requires removal of in-street tree pit on Webster St.
14	2011	Park Street bike lanes	Contraflow lane on Park St. from Marion to Beacon; bike lanes and bike priority lanes on the rest of Park; bike lanes on Washington St. from Park to Greenough.	5,000	-	
15	2011	Coolidge Corner north bypass	Bike lanes through Centre St. East lot from Green St to Centre St	3,000	3,000	Harvard / Green intersection may be part of a larger traffic project. Uses privately owned driveway. Lose 1 metered parking spot. Could cost more if a curb extension is included.
16	2011	Destination signage	Destination signs on the completed part of the network. Later projects should include destination signs as additional network sections are added.	15,000	15,000	

	Target Year	Project	Summary	Total Cost (\$)	Local Budget Impact	Opportunities & Obstacles
17	2012	Muddy River Path: Bridge over Route 9	Barrier-separated two-way path across existing highway bridge by shifting travel lanes. From Pond St., path stays on Boston side of the Muddy River to the River Rd on-ramp, with no access to north side of Route 9. Close off-ramp to River Road. Realign connector from R-way to Brookline Ave at northern end of River Rd to have right angle intersections.	700,000	80,000	Positive: \$600,000 federal earmark; strong historical need. Obstacles: MHD permission to use bridge; DCR and City of Boston cooperation; Boston funding for its share
18	2012	River Road: narrower, Muddy River footpath	Make River Road one-way and narrower; built footpath on Muddy R side	120,000	-	One-way traffic circulation poses challenges. Parking revenue offsets cost (with financing question)
19	2012	Route 9 cycle track, south side, from Walnut to Pond)	Multi-use path on south side of Rt 9 from Pond St to (relocated) Walnut St.	-	-	Part of Gateway East project. Potential funding: Community Development Block Grant.
20	2012	Muddy River Path: Route 9 at-grade crossing	Wide median refuge by reducing travel lanes to 2 inbound, 2 + bus lane outbound.		-	Part of Gateway East project
21	2013	Chestnut Hill commercial district bike lanes and paths	Bike lanes on Hammond from Middlesex to shopping center; bike path through shopping center to HP Parkway and to Tulley St. Some bike path to be built as sidewalk extension.	40,000	20,000	Involves shopping center, state highway. Coordinate with Newton to extend to Middlesex. Mitigation funding from Chestnut Hill area development may be possible.
22	2013	Brookline High area bike lanes	Contraflow bike lanes on Sumner and Davis; improve path ramps to Greenough and widen sidewalk across from BHS to become shared use path	25,000	25,000	

	Target Year	Project	Summary	Total Cost (\$)	Local Budget Impact	Opportunities & Obstacles
23	2013	Kent Street bike lanes	Aspinwall to Harvard, including contraflow from Harvard to Station; intersection improvements at "Harvard Square" to channel bike traffic from Davis and Washington into contraflow lanes. Also, bike lanes on Aspinwall from Kent to NL Rd	10,000	10,000	Budget assumes Harvard Square intersection improvements are done as part of another project. Lose 5 metered parking spaces at Kent / Harvard. Lose some 2-hour parking in the Kent / Aspinwall area.
24	2013	Clark Road bicycle priority lanes	From Sumner St. to Dean Rd	8,000	8,000	
25	2013	Dean Road bike lanes	Bike lanes on uphill side of Dean Rd., Crafts to Clark	3,000	3,000	Prohibit parking on westbound side
26	2013	Middlesex Road bike lanes	Contraflow bike lane, Circuit to Reservoir; bicycle lanes and bike priority lanes from Circuit to Hammond; ramp to Reservoir Rd. bridge over D-line	3,000	3,000	Coordinate with Newton at both the Hammond St and Reservoir Rd end
27	2014	Lee / Clyde greenway	Road diet to 1 lane per direction; greenway / service road on east side	3,000,000	300,000	Major planning effort to make this a "green street"
28	2014	Miscellaneous bike lanes	Bike lanes, bike priority lanes, and contraflow lanes on streets including St. Mary's, Westbourne, Allendale, ...	30,000		
29	2015	Rt 9 crossing at Chestnut Hill Ave	Crossing improvements to connect Chestnut Hill Ave., Heath St, and Lee St.	40,000	40,000	also a pedestrian safety improvement
30	2015	Brookline reservoir area bike lanes and paths	Bike path along reservoir park from Heath & Lee to Dudley Rd & Dudley Way; contraflow bike lane on Dudley Rd fronting reservoir; sidewalk-level bike path along Dudley Way near Warren St; bike priority lanes on Warren St.; contraflow lane on Cottage St.	70,000	70,000	Affects Reservoir park










	Target Year	Project	Summary	Total Cost (\$)	Local Budget Impact	Opportunities & Obstacles
31	2015	Beacon Street crossing at Tappan / Williston		6,000	6,000	
32	2016	West Roxbury Parkway bikeway	Road diet in multi-lane sections of WRP and Newton St, with through traffic on one road and the other for bikes / peds. Bike lanes on the rest of WRP. Geometric changes needed at transitions.	400,000	40,000	DCR roadway. Horace James Circle safety improvement project (with possible funding from developer) are expected to pay for roadway changes on approaches to the circle. Low budget reflects an inexpensive solution with existing pavement maintained.
33	2016	Winchester Street bicycle safety improvement	Additional (but gentler) speed humps; bicycle priority lanes	20,000		
34	2017	Newton / Grove greenway	Roadside bike paths from Clyde / Newton to Putterham; bike lanes on Newton from Grove to WR Pkway	1,500,000	150,000	Major planning effort to make this a "green street"
35	2017	Walnut Street safety improvement	Additional (but gentler) speed humps; bicycle priority lanes	20,000		
36	2018	Beacon Street: widen bike lanes	Reduce travel lanes to 11 ft and widen bike lane to 6 ft	40,000	40,000	
37	2019	Hammond Street greenway	Road diet to one lane per direction (except at Rt 9 junction). Median refuge at Woodland Rd.	2,500,000	250,000	Major planning effort to make this a "green street."
38	2024	Hammond Pond Parkway multi-use path	Bike path along the entire length of the Parkway, with connection to Skyline Park	800,000	200,000	DCR roadway. Coordinate with Newton to extend to Beacon St.

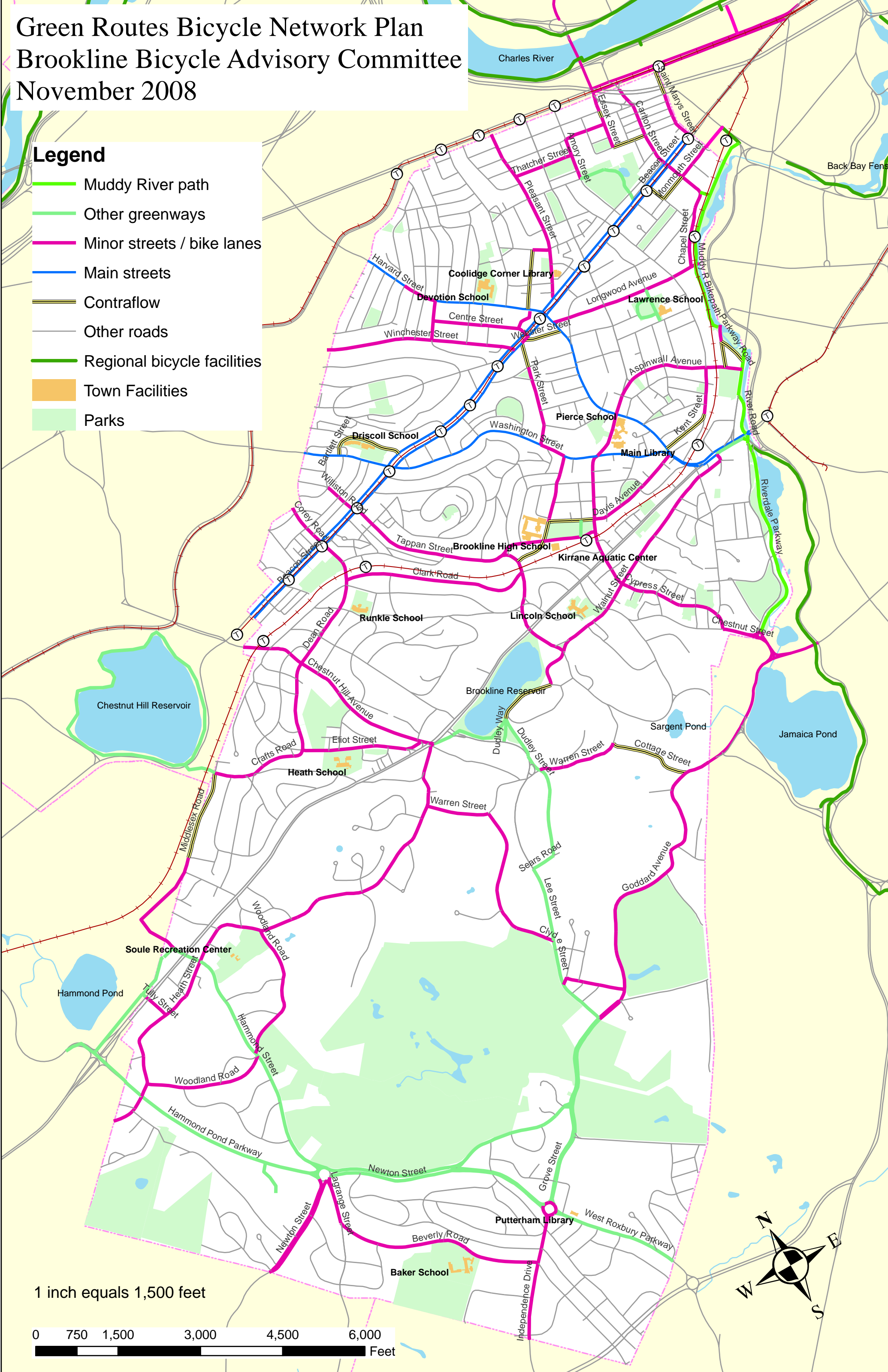
Green Routes Bicycle Network Plan

Brookline Bicycle Advisory Committee

November 2008

Legend

-  Muddy River path
-  Other greenways
-  Minor streets / bike lanes
-  Main streets
-  Contraflow
-  Other roads
-  Regional bicycle facilities
-  Town Facilities
-  Parks



1 inch equals 1,500 feet

