DESIGNING DISPERSED, SMALL-SCALE GREEN INFRASTRUCTURE SYSTEMS

CAMBRIDGE, MA

Katie Friedman, Charles River Watershed Association
Overview

Charles River Watershed Association

City of Cambridge Green Streets Project

Process of developing conceptual GI designs

Take-aways
Charles River Watershed Association

- Protecting, preserving and enhancing the Charles River and its watershed through science, advocacy and the law.

- Founded in 1965 by concerned citizens

- Focused on a “science-based” understanding of interactions in the watershed

- Staff includes watershed scientists, a watershed engineer, an attorney, and an urban designer and planner
Charles River Watershed

- 80 miles from Hopkinton to Boston Harbor
- 500 ft elevation drop
- 308 square miles
- 1 million residents
- Encompasses 35 cities and towns, 23 on the river
Water Quality Monitoring

- Began in 1995
- 35 permanent sampling sites on river; 2 additional “roving” samples collected each month
- Currently over 80 active volunteers
E. coli

Phosphorus

Average concentration of total phosphorous at sampling sites in 2016.
**Total Maximum Daily Load (TMDL)**

- Percent phosphorus reduction required by municipality to meet water quality standards

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| **Boston**                       |            |            |                          |                           |                        |             |        |           |       |                             |
| Drainage Area (ha)               | 587.1      | 541.5      | 2,556.5                  | 43.4                      | 20.2                   | 7.4         | 688.2  | 1,444.0   | 5,888.27|                           |
| 1998-2002 Loading (kg/yr)        | 996.4      | 796.4      | 2,892.4                  | 24.6                      | 0.9                    | 3.7         | 89.7   | 49.6      | 4,853.77|                           |
| TMDL Loading (kg/yr)             | 343.7      | 274.7      | 997.6                    | 8.5                       | 0.5                    | 2.4         | 89.7   | 32.0      | 1,749.04| 64.0%                      |

| **Brookline**                    |            |            |                          |                           |                        |             |        |           |       |                             |
| Drainage Area (ha)               | 135.9      | 10.0       | 588.2                    | 209.4                     | 254.8                  | 42.9        | 157.0  | 357.1     | 1,755.51|                           |
| 1998-2002 Loading (kg/yr)        | 230.7      | 14.8       | 665.5                    | 118.5                     | 11.6                   | 21.7        | 20.5   | 12.3      | 1,095.54|                           |
| TMDL Loading (kg/yr)             | 79.6       | 5.1        | 229.5                    | 40.9                      | 6.3                    | 14.0        | 20.5   | 7.9       | 403.81 | 63.1%                      |

| **Cambridge**                    |            |            |                          |                           |                        |             |        |           |       |                             |
| Drainage Area (ha)               | 123.1      | 126.9      | 205.7                    | 0.0                       | 0.0                    | 3.1         | 181.7  | 640.42    | 65.2% |                           |
| 1998-2002 Loading (kg/yr)        | 208.9      | 186.6      | 232.7                    | 0.0                       | 0.0                    | 0.4         | 6.2    | 634.84    |       |                           |
| TMDL Loading (kg/yr)             | 72.0       | 64.3       | 80.3                     | 0.0                       | 0.0                    | 0.4         | 4.0    | 221.09    |       |                           |
Total Maximum Daily Load (TMDL)

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**CRWA’s Blue Cities Initiative**

*Blue Cities* is a water-oriented approach to urban development and redevelopment that promote designs for the built environment that engages with every stage of the water cycle. Going beyond “green” building, “blue cities” embraces green infrastructure design with the aim of restoring the natural water cycle in the built environment.
Cambridge Green Streets Projects
Cambridge Green Streets Projects

- Federal 604(b) funds via MassDEP
- City of Cambridge DPW partnered with CRWA

**Goal:**
- Develop conceptual green street design plans for three public rights of way
- Integrate GI guidance with the City’s five-year roadway improvement plan.
Project tasks
Task 1: Existing Conditions Assessment
Project tasks

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Task 2: Conceptual Green Street Designs
Project tasks

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Task 3: Green Street Guidance Document
Project tasks

Task 1: Existing Conditions Assessment

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Task 3: Green Street Guidance Document

Task 4: Stakeholder Engagement

City of Cambridge Green Streets Survey
Task 1: Existing Conditions Assessment

- Watershed Level
- City Level
- Street/Neighborhood Level
Site visits
Task 2: Conceptual Green Street Designs
Task 2: Conceptual Green Street Designs

- Develop water quality goals for site specific designs
  - eg. Capture, treat, and store 1” rainfall in 24 hrs

- Identify locations for treatment systems and calculate approximate footprints
  - eg. Corner bumpouts, tree trenches, basins

- Calculate expected pollution load reductions from the proposed designs
  - “Simple-dynamic” method for infiltration
Sizing and siting

Proposed Conditions

Existing Sidewalk 3 ft  Infiltration Planter 7 ft  Sidewalk Extension 5 ft  Travel Lane 10 ft  Travel Lane 10 ft  Parking Lane 7 ft  Sidewalk 8 ft

50 Feet

Proposed Conditions

Sidewalk 5 ft  Infiltration Planter 3 ft  Parking Lane 7 ft  Travel Lane 10 ft  Travel Lane 10 ft  Parking Lane 7 ft  Sidewalk 8 ft

50 Feet
Sizing and siting
Task 3: Green Street Guidance Document
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- Guidance document for use by municipal staff, volunteer boards/commissions and private developers.

- Document challenges to implementing green streets in Cambridge’s dense urban environment.

- Document low impact development strategies to use as viable tools.
Task 3: Green Street Guidance Document

- Guidance document for use by municipal staff, volunteer boards/commissions and private developers.

- Document challenges to implementing green streets in Cambridge’s dense urban environment

- Document low impact development strategies to use as viable tools

- Sidewalk and roadway width
- Parking demand
- Land availability
Task 3: Green Street Guidance Document

- Guidance document for use by municipal staff, volunteer boards/commissions and private developers.

- Document challenges to implementing green streets in Cambridge’s dense urban environment.

- Document low impact development strategies to use as viable tools:
  - Tree trenches
  - Rain garden bump outs
  - Permeable pavement
  - Incentives for private property owners

- Sidewalk and roadway width
- Parking demand
- Land availability
Task 4: Stakeholder Engagement
Identify multi-sector, City-wide goals that green street implementation can help achieve

- Open space plan
- Tree canopy goals
- Bicycle plan
- Climate change preparedness
Task 4: Stakeholder Engagement

- Identify multi-sector, City-wide goals that green street implementation can help achieve

- Online resident survey to obtain feedback on green street design elements

- Open space plan
- Tree canopy goals
- Bicycle plan
- Climate change preparedness
Resident survey

Q1 In your opinion, what are the most important qualities of a safe and pleasant residential street? Please pick up to 3.

- Wide sidewalks
- Designated bike lanes
- Wide automobile lanes
- Slow traffic
- Parking
- Shade trees and/or landscaping

Answered: 203  Skipped: 1

Q2 What are your concerns about your street as it currently exists? Please pick up to 3.

- Traffic speed too fast
- Traffic speed too slow
- Difficult for a pedestrian to navigate
- Difficult for a bicycle to navigate
- Lack of trees/landscaping
- Lack of parking
- Flooding
- Difficult intersection(s) (for cars, pedestrians and/or bicycles)
- Health of existing trees

Answered: 194  Skipped: 10
Take-aways

- Buy-in from residents
- Dedication from the City
- Opportunities for GI in densely populated urban environments
- Serve as a case study for municipalities throughout the Charles River watershed and beyond
Thank you!

City of Cambridge
Massachusetts
Department of Environmental Protection
EPA Region 1

Katie Friedman
kfriedman@crwa.org
Rita Barron Fellow
Charles River Watershed Association