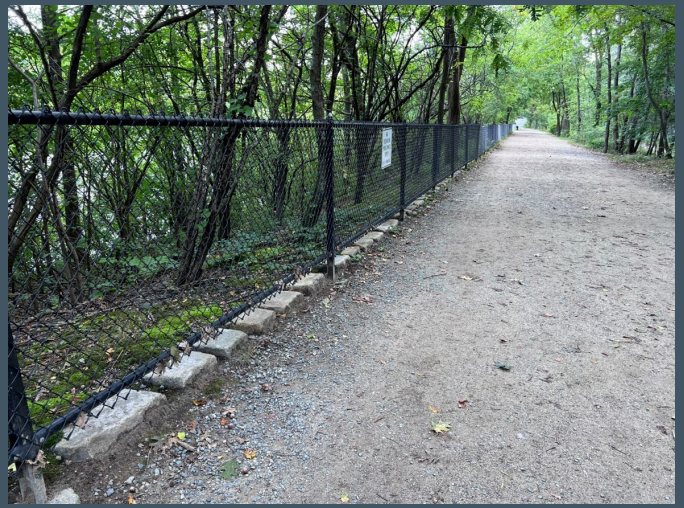
Pine Grove Restoration and Perimeter Road Improvements



Fresh Pond Advisory Board

16 November 2023

CAMBRIDGE WATER DEPARTMENT

HATCH

Agenda

- Project Overview
- Priorities and Goals
- Circulation and Access Studies
- Pine Grove Assessment
- Perimeter Road Improvements
- Next Steps

OUR TEAM

SOIL SCIENCE EXPERT

– Michael Agonis, Pine & Swallow

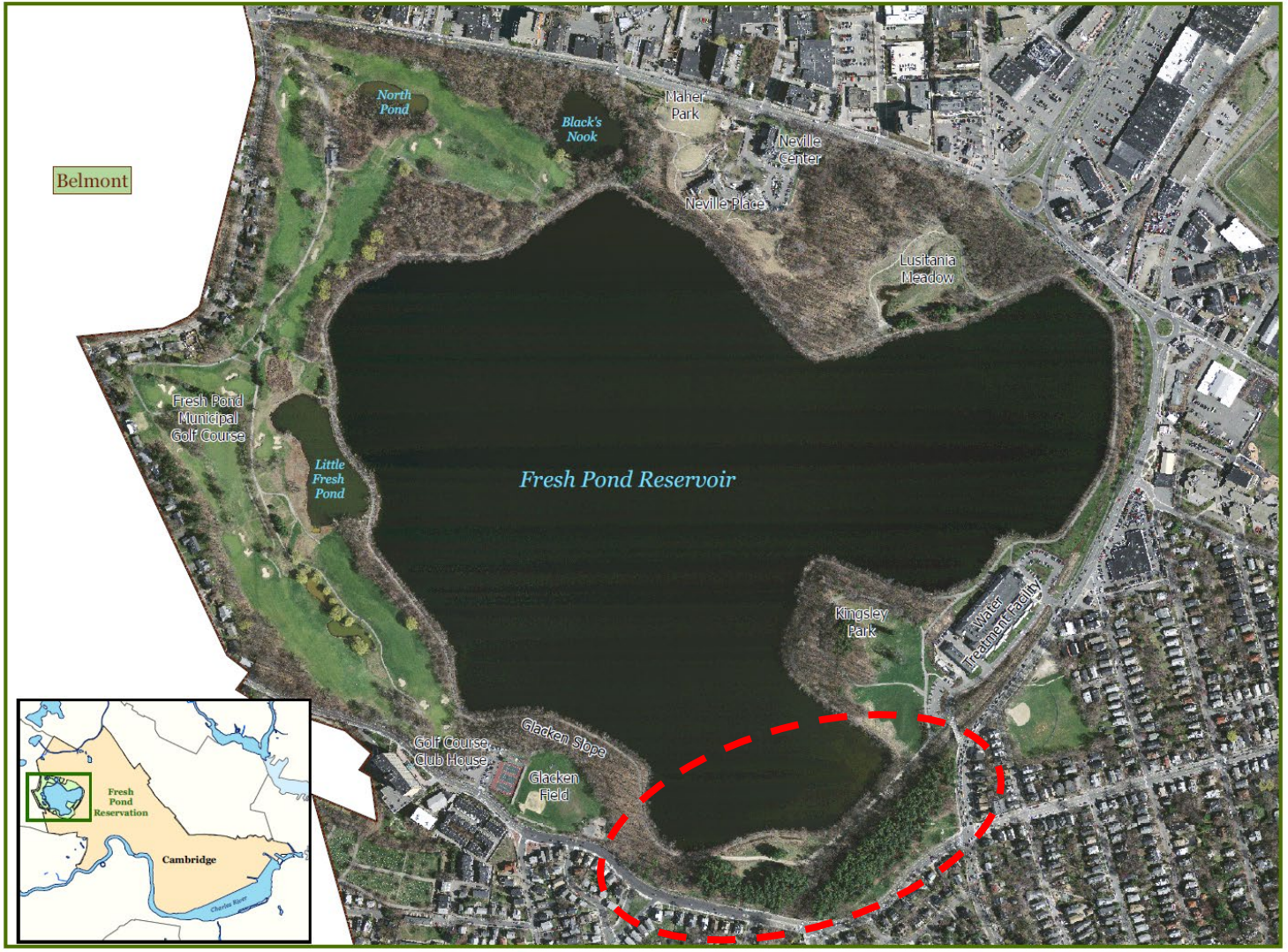
WHITE PINE FOREST - PLANT PATHOLOGIST

– Nick Brazee, University of Massachusetts

ECOLOGICAL RESTORATION, GREEN INFRASTRUCTURE, LANDSCAPE ARCHITECTURE, CERTIFIED ARBORIST

– HATCH

PROJECT AREA

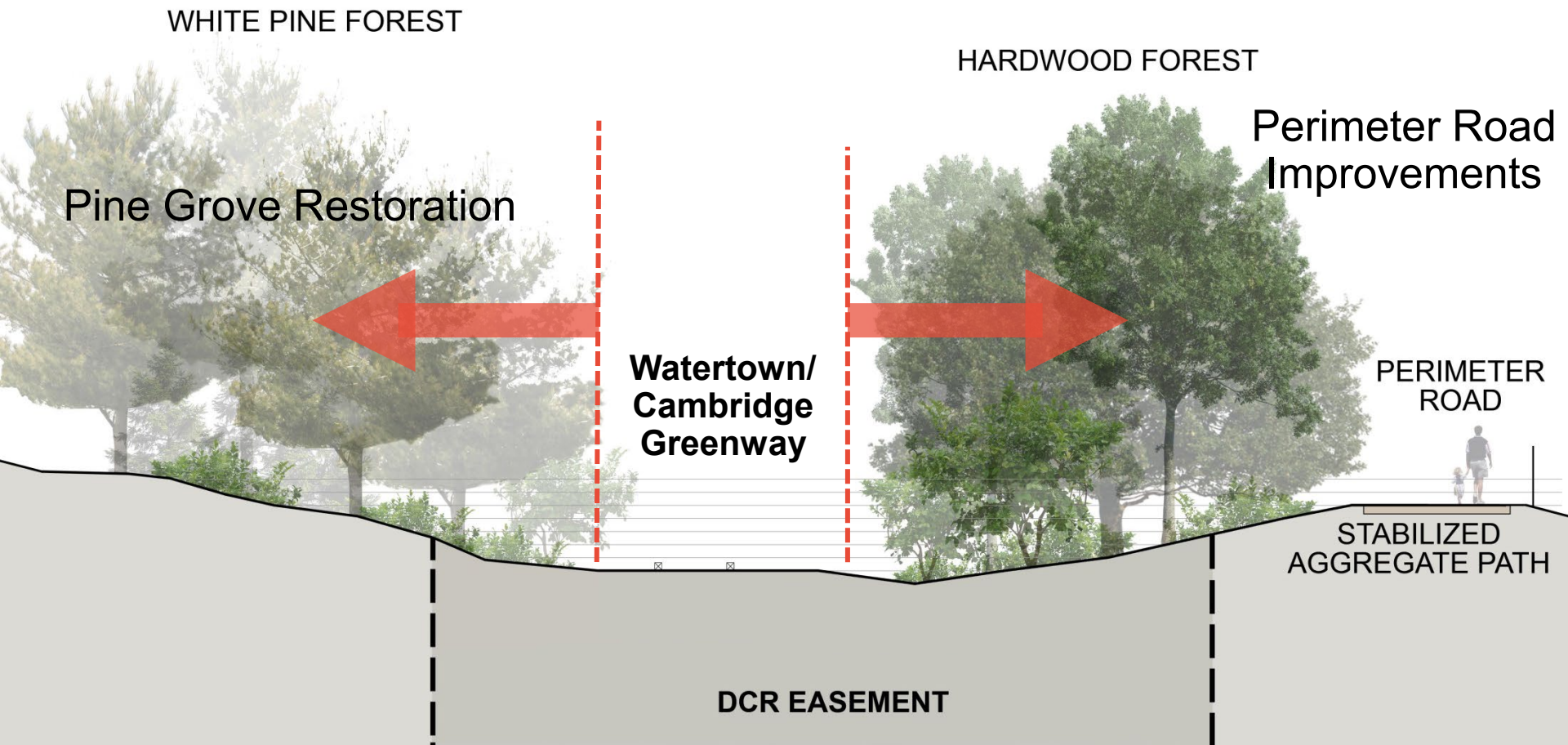


PROJECT AREA


PERIMETER ROAD IMPROVEMENTS
Kingsley Park
Glacken Slope
Fresh Pond
Perimeter Road
Watertown/Cambridge Greenway
Fresh Pond Parkway
Weir Meadow
Huron Ave


PINE GROVE
RESTORATION
Kingsley
Park
Fresh Pond
Glacken
Slope
Glacken
Field
Perimeter Road
Fresh Pond Parkway
Watertown/Cambridge Greenway
Weir
Meadow
Huron Ave

Project Areas (Multiple Phases)

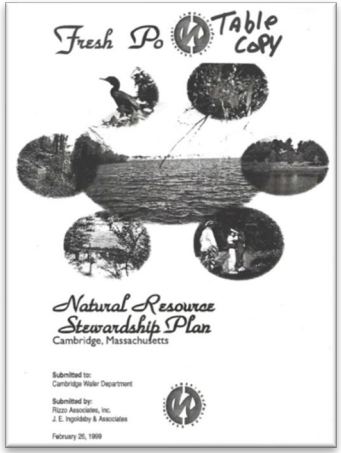


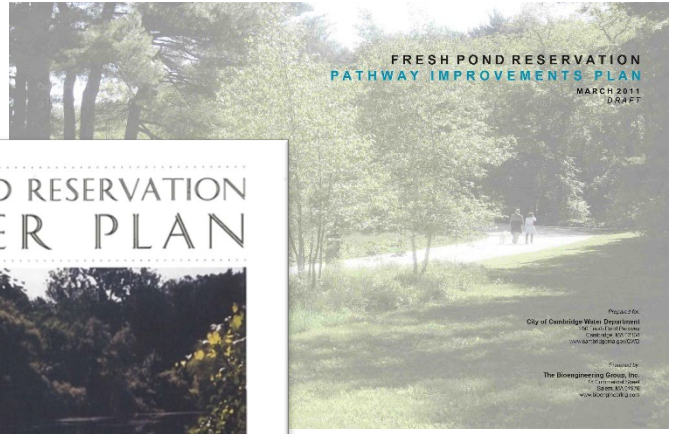
Watertown/Cambridge Greenway

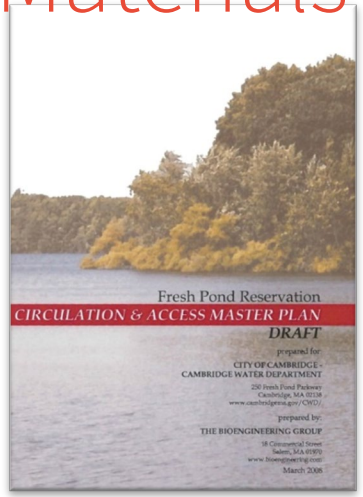
2019

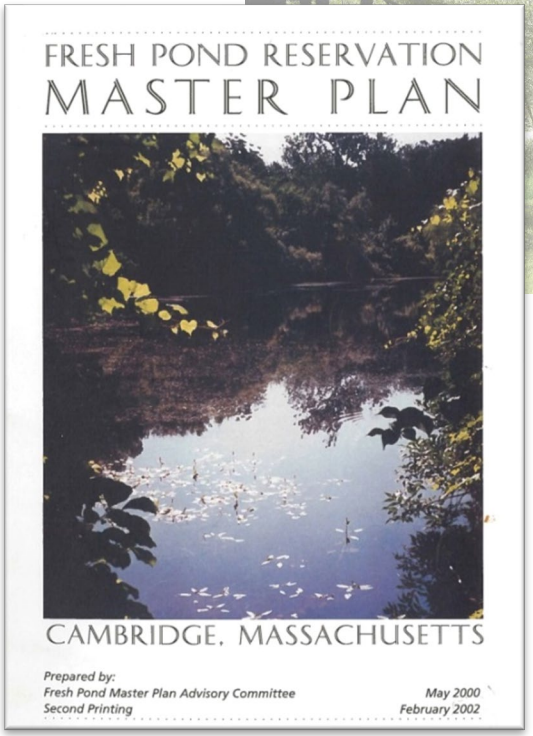
2023

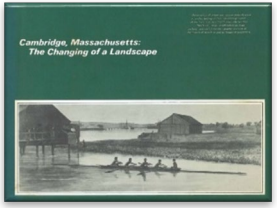
Previous Planning Studies/Reference Materials

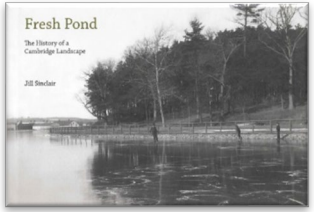












Stewardship Plan Priorities – Pine Grove (1999)

1. Maintain pine grove to prevent & control pests, disease, and damage.
2. Redesign primary trails to reduce impacts of erosion and compaction.
3. Redirect secondary trail traffic to primary trails; revegetate secondary trails.
4. Remove invasive plant species, i.e. buckthorn.

White Pine Regeneration

Glossy Buckthorn

Stewardship Plan Priorities – Pine Grove (1999)

5. Underplant with native shrubs and groundcovers.
6. Enhance west-facing clearing area surface with porous material(s) to reduce runoff.
7. Enhance the clearing edges with understory plantings.
8. Enhance Reservoir views from the clearing.

Canada Mayflower, Maple-leaf Viburnum, and Bracken Fern

Master Plan Priorities (High) – Weir Meadow and Pine Grove (2000)

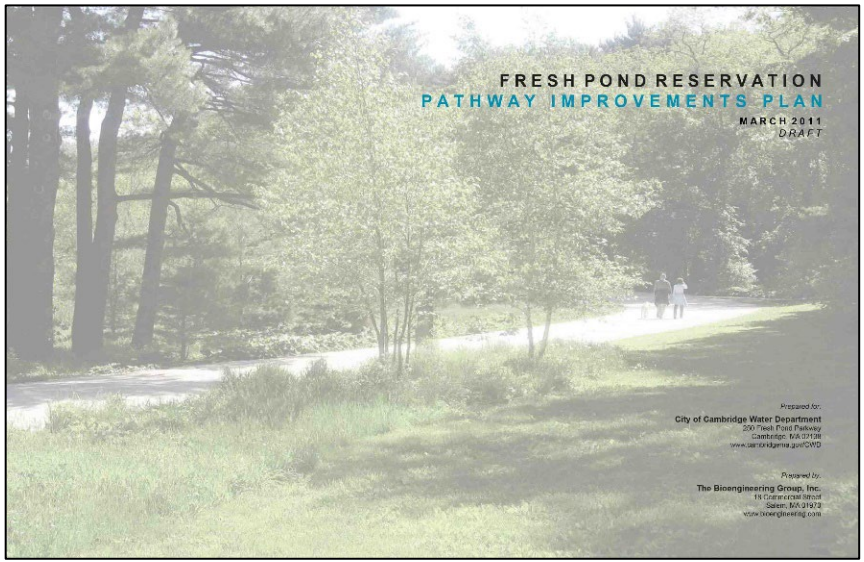
1. Shoreline and slope stabilization
2. Forest management
3. Perimeter Road improvements
4. Wetland buffer enhancement
5. Lawn rehabilitation
6. Shared Use Plan (2011) designates Paths for All Users in Pine Grove

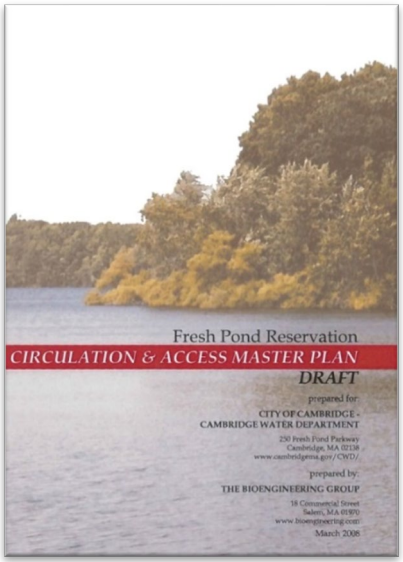
Project Goals

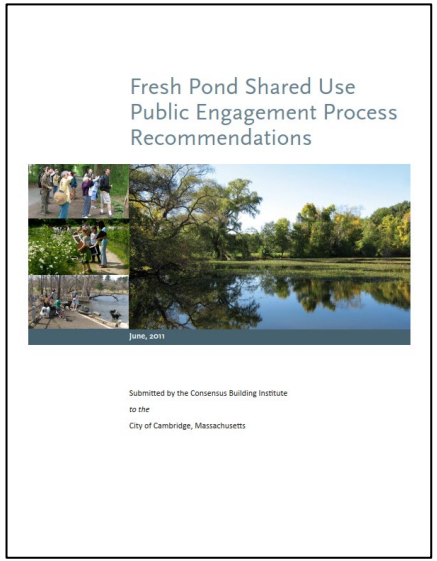
1. Develop a better understanding of Pine Grove understory and lack of regeneration.
2. Reconstruct uniform path surface connecting Glacken Slope to Kingsley Park (porous bituminous concrete), approx. 0.35 miles.
3. Meet ADA Compliance standards for new connector paths.
4. Create formal connection between Cambridge/Watertown Greenway and Perimeter Road.
5. Improve drainage and protection of drinking water supply.
6. Restore existing vegetative buffers.

Circulation and Access Studies

1. FPR Circulation and Access Master Plan (2008)
2. Path Implementation Plan (draft 2010 document)
3. FP Shared Use Recommendations (2011)







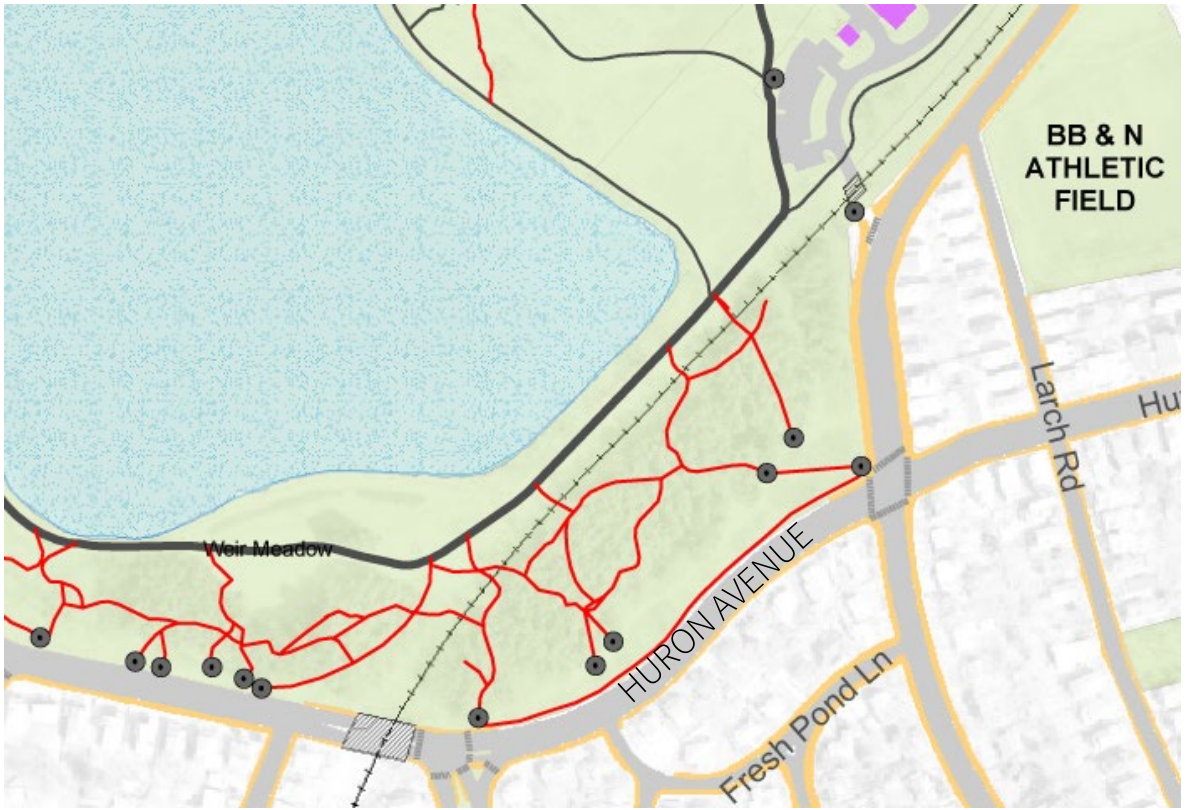
Previous Circulation Studies – Pine Grove

Existing Trail Conditions and User Conflicts

1. 9 (nine) trail crossings over new Greenway.
2. Steep gradient, erosion and soil compaction.
3. Open to walkers and joggers; closed to cyclists.
4. On- and off-leash dogs are allowed.
5. Dogs vs. slope and forest restoration.
6. Greenway commuter cyclists.

Circulation Studies

Existing Unofficial Trails



LEGEND

- Water Bodies
- Wetlands
- Open Space
- CityBoundary
- Railway Lines
- Major Streets
- Crosswalks
- Sidewalks
- Access Points

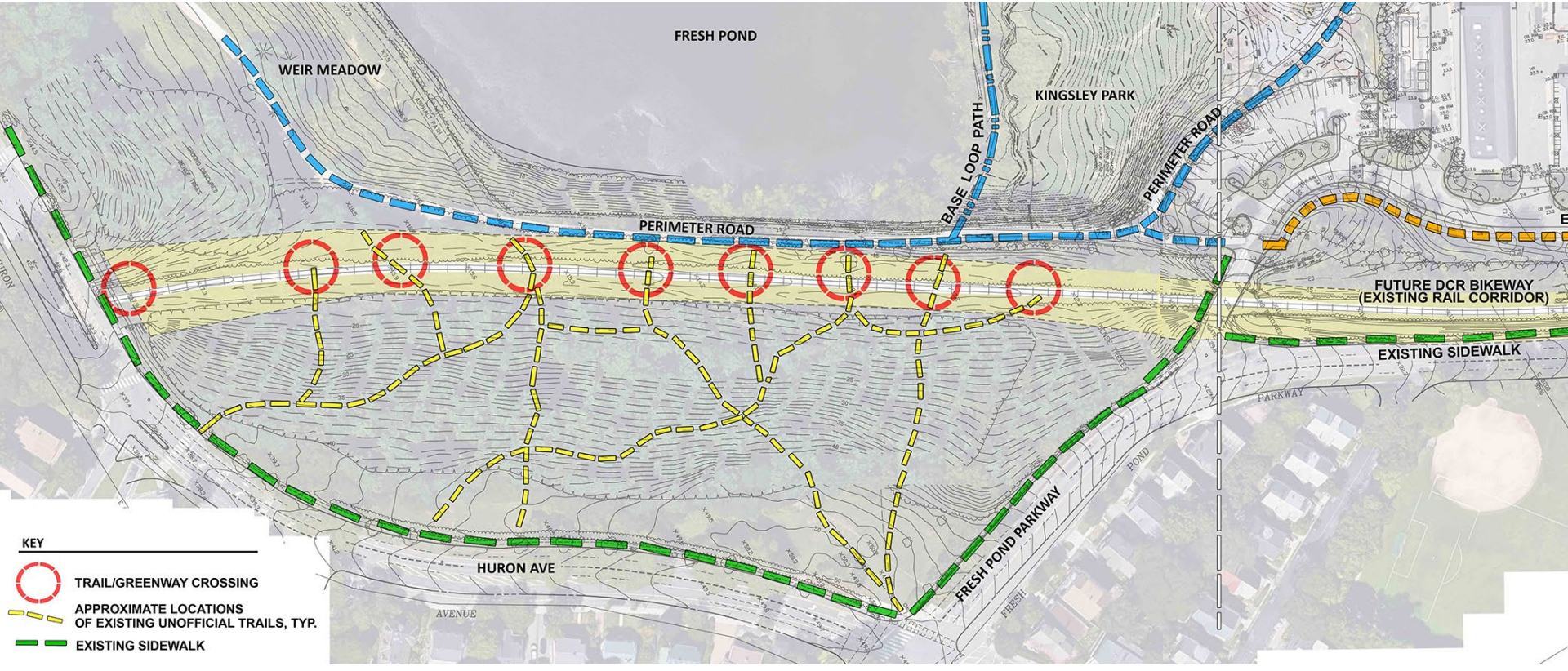
Paths and trails

Type

- Official
- Unofficial

Circulation Studies

Existing Path and Trail Crossings



Previous Pine Grove Circulation Studies

Alternative Analysis Elements

1. Closure of minor trails and controlled access points.
2. On-leash trails from Huron Avenue to Perimeter Road.
3. ADA-compliant path/trail from Huron Avenue.
4. Maintenance/snow removal.
5. Emergency vehicles.
6. Restoration (slope and woodland).

Pine Grove Assessment

1. Vegetation
2. White Pine Pathology
3. Soil Testing and Recommendations

PINE GROVE ASSESSMENT

Project History:

1. Visual Assessment September and October 2019.
2. Requires updated topo survey for slopes, paths, soils and drainage.
3. Vegetation analysis distinguishes Inner Pine Grove habitat versus Edge habitat.

PINE GROVE ASSESSMENT

Overstory/Canopy:

1. Core samples – 80 to 100 years old.
2. White Pines possible transplants from Kingsley Park.
3. No white pine saplings, seedlings, or pine cones observed.
4. Very few oaks observed.

PINE GROVE ASSESSMENT

Understory (Woody):

1. Gaps in canopy promote invasive tree and shrub growth.
2. Dominant species buckthorn, Norway maple and black cherry.
3. Subdominant species include hornbeam, black birch, black walnut, mountain ash, ground hemlock, honeysuckle, and Russian olive.

PINE GROVE ASSESSMENT

Understory (Herbaceous):

1. Dominant species include Lily of the Valley (introduced) and poison ivy (native).
2. Subdominant species include white wood aster, nightshade, false Solomon's seal, avens, Virginia creeper, and pokeweed.
3. Red maple and black cherry seedlings.

PINE GROVE ASSESSMENT

Edge Habitat – Trees and Shrubs:

1. Same species as Pine Grove.
2. Additional native species include slippery elm, bird cherry, sugar maple, N. red oak, black locust, white ash, and shagbark hickory.
3. Additional non-native species include tree of heaven, red mulberry, and Japanese knotweed.

PINE GROVE ASSESSMENT

Edge Habitat - Groundcovers:

1. Same species as Pine Grove.
2. Additional native species include three–sided mercury & jewelweed.
3. Additional non-native species include celandine, goutweed, garlic mustard, and ragweed.

WHITE PINE PATHOLOGY STUDY

Initial Call with Nick Brazee, UMass

1. Overview: Pine grove estimated at 3.8 acres within larger hardwood forest.
2. Highly adaptive native species that can live to at least 150 years.
3. Many municipalities planted dense stands of white pines with the intention of thinning out over time.
4. Pine Grove at Fresh Pond to be a medium to high density stand.
5. Since 2010 white pine needle blight caused by (native) beetles has impacted white pines in New England, especially New Hampshire and Maine.

WHITE PINE PATHOLOGY STUDY

Initial Call with Nick Brazee, UMass

1. White Pine Disease (multiple types) is due to an increase in pathogens associated with climate change components:
   a. Higher temperatures
   b. Increased drought conditions
   c. More frequent rain evens in late spring
2. Disease can impact trees of all ages, especially those stressed with root rot and lack of water.
3. White pines will hold three (3) years of needles; diseased trees will lose their last two (2) years of needles and typically won't be visible until the next growing season.

WHITE PINE PATHOLOGY STUDY

Nick Brazee, University of Massachusetts

1. White pine disease at Fresh Pond Reservation consistent with diseases observed in eastern Massachusetts.
2. NB ascertained no white pine regeneration in undergrowth a result of heavy deer browse.
3. Nick Brazee to complete disease assessment site visit (December 5th, 2023).
4. Umass Fact Sheets on diseases impacting white pine.

WHITE PINE PATHOLOGY STUDY

Initial call with Nick Brazee, UMass

Initial Recommendations:

1. In areas of high density, thin out trees to improve air circulation and increase light.
2. Plant white pines in areas with openings in the canopy.
3. Protect new plantings from deer with tall fencing and water during periods of drought.
4. Perform soil tests, especially in areas where there is open canopy, to identify cause of white pines not regenerating.
5. Only plant Canadian hemlocks if willing to treat once/if impacted.

Soil Testing and Analysis

1. Soil Characterization (24” depth)
2. Soil Compaction
3. Soil Testing (3-depths):
   - ✓ Physical and Chemical Properties
   - ✓ Permeability (6” depth & bottom)
   - ✓ Biological and Microbiological Analysis*

*Soil Foodweb NY Lab analyses forthcoming

Test Pit Locations

Test Pits and Soil Analysis

Test Pit #1

Soil Compaction Probe Testing

Soil Analysis

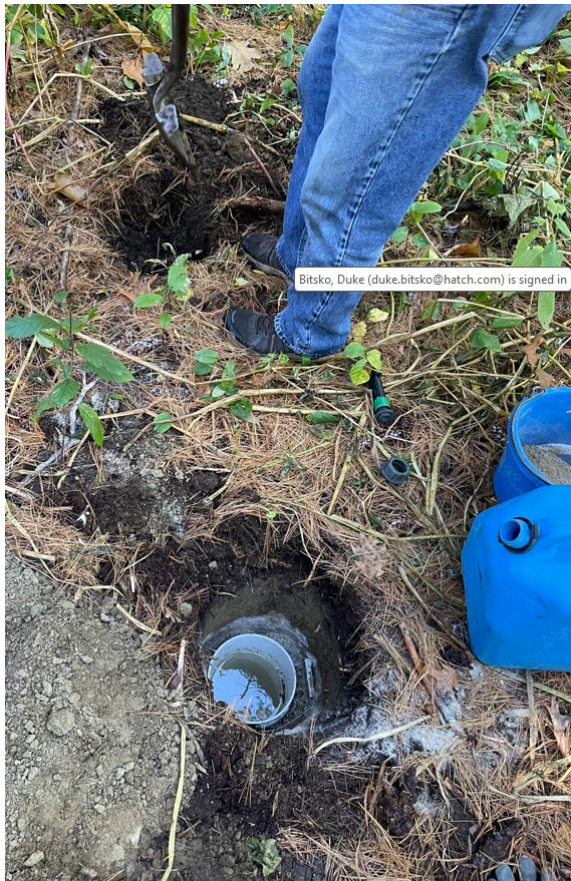
Field Investigation Findings

1. 2” thickness of O-horizon forest duff (typ.).
2. A-horizon topsoils (6”-8” depth) consisting of uniformly graded sands and silts (some clay).
3. B-horizon subsoils (12”-14”) same as A-horizon.
4. Soil density low to moderate, with compaction increasing with depth.
5. Subsoils at 24” depth highly compacted, with a higher percentage of silt and clay.
6. The soil fines, particularly the clay fraction, increases significantly w/ sampling depth.

Soil Analysis

Field Investigation Findings (contd.)

7. Little gravel/coarse sand present.
8. Soils well-aerated and well-drained (ideal for plant growth).
9. Plant rooting deep and dense; healthy tree roots at 24” depth and deeper (blow-overs).
10. Upper soils (0-8” depth) capable of rapid infiltration (up to 20”/hour); mid-soils 3.6”/hour; and lower soils 0.3”/hour.
11. Minimum planting soil infiltration capacity (accepted) = 1”/hour.
12. Earthworms and other macrofauna observed.
13. Fungal hyphae observed in both O- and A- horizons.



Soil Analysis

Laboratory Results and Conclusions

Table 1 Summary of Laboratory Test Reports November 13, 2023					
Sample ID	**pH**	**%Organic**	**% Fines (silt+clay)**	**%Clay**	**Soluble Salts (mmohs/cm)**
TP-1 (0-6”)	4.3	13.8	44.2	3.6	0.09
TP-1 (6-12”)	4.5	4.2	51.5	18.1	0.06
TP-1 (18-24”)	4.8	1.6	73.0	29.0	0.04
TP-2 (0-6”)	4.3	29.8	63.1	17.4	0.09
TP-2 (6-12”)	4.3	6.3	75.0	30.5	0.08

Soil Analysis

Laboratory Results and Conclusions (contd.)

1. Topsoils classified as Loam to Fine Sandy Loam.
2. Soil profile for both test pits is suitable for white pine and typical of a mature forest.
3. Percentage of organic matter, nutrient and salt levels are within acceptable ranges.
4. The very low acidity level (pH) of upper soils may be contributing to poor germination and /or white pine seedling establishment.
5. Acceptable pH range = 5.0 to 7.0 for white pine.
6. Other factors may include: low sunlight; invasive plant allelopathy; and/or insects and disease.

Soil Analysis

Recommendations

1. Direct replanting of white pine using nursery stock and protective fencing.
2. Use of white pine plugs or seedlings.
3. Manual removal and/or chemical treatment (hand wand) to remove invasive species.
4. Soil amendments (limestone) to increase pH not recommended; can cause significant damage within O-horizon and could enter watershed.


PERIMETER ROAD IMPROVEMENTS
Kingsley Park
Glacken Slope
Fresh Pond
Perimeter Road
Watertown/Cambridge Greenway
Fresh Pond Parkway
Weir Meadow
Huron Ave

Kingsley Park and Glacken Slope Porous Asphalt Paving

Perimeter Road Drainage Strategies

1. Provide positive drainage.
2. Minimize standing water.
3. Infiltrate runoff (where feasible).
4. Utilize existing stormwater BMP’s and structures.
5. Identify all maintenance requirements and alternatives.

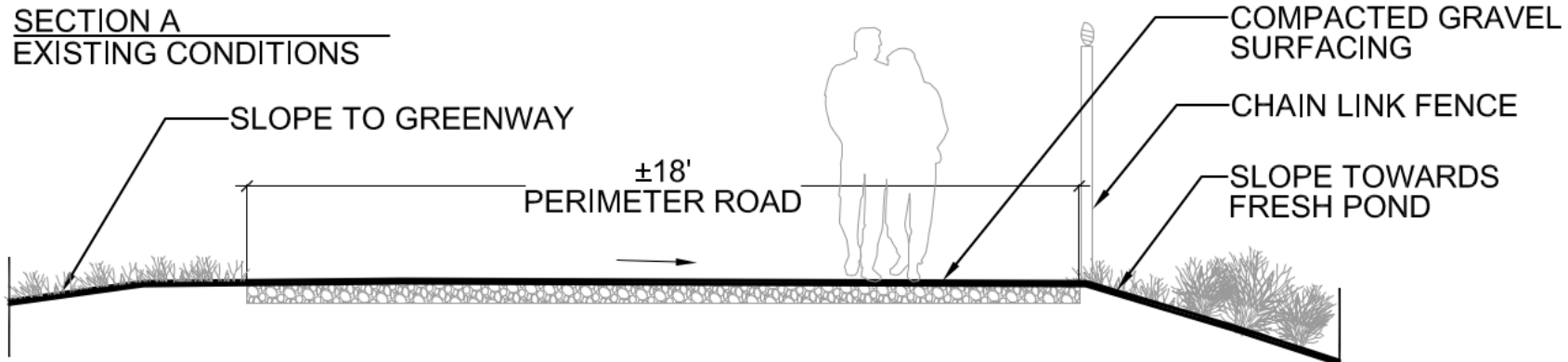
Perimeter Road - Porous Asphalt Surfacing

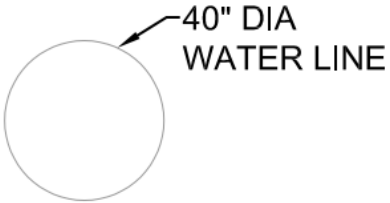
Kingsley Park – Asphalt Surfacing

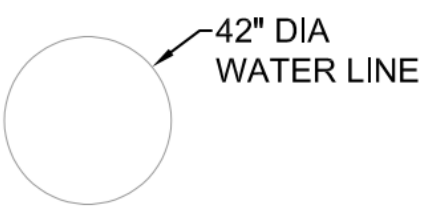
Kingsley Park – Porous Asphalt Surfacing

Perimeter Road Near Kingsley Park

Existing Conditions

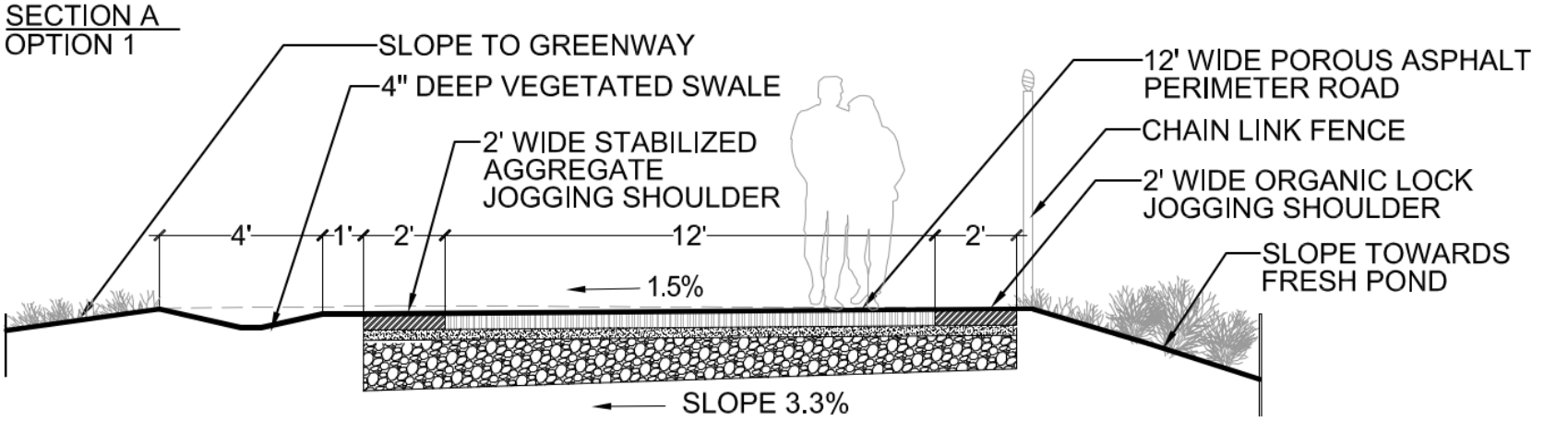


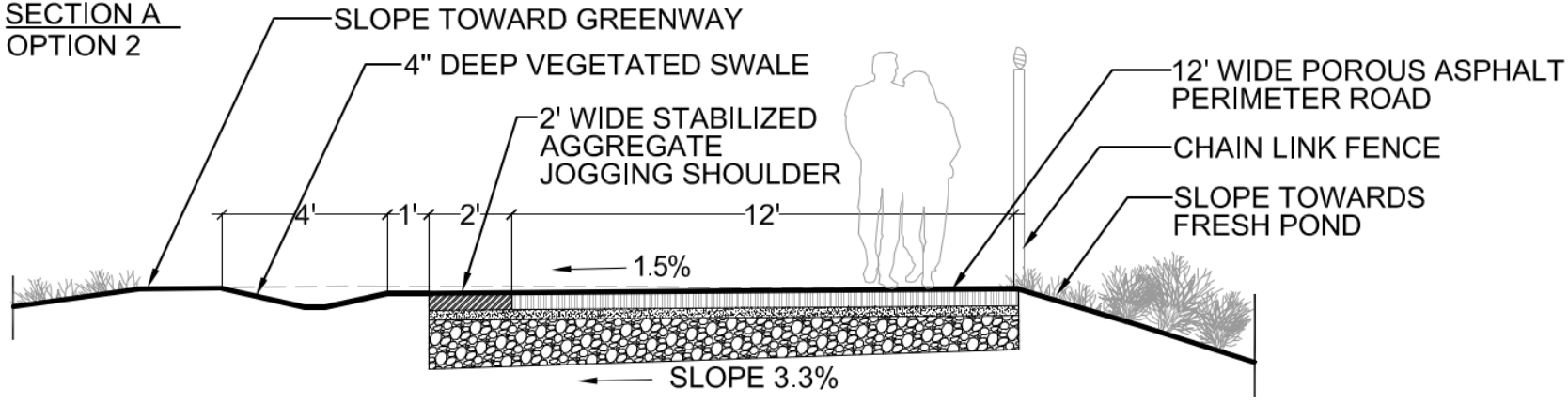




Perimeter Road Layout and Surfacing

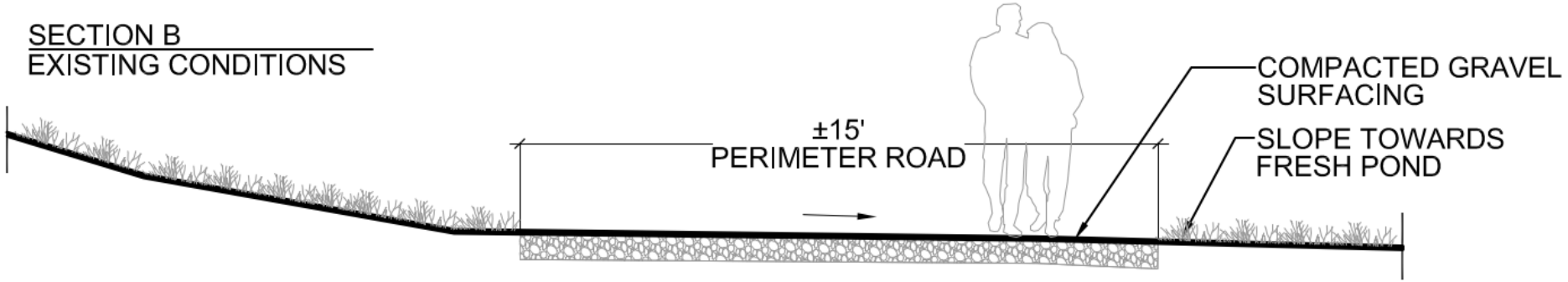
Proposed Alternatives





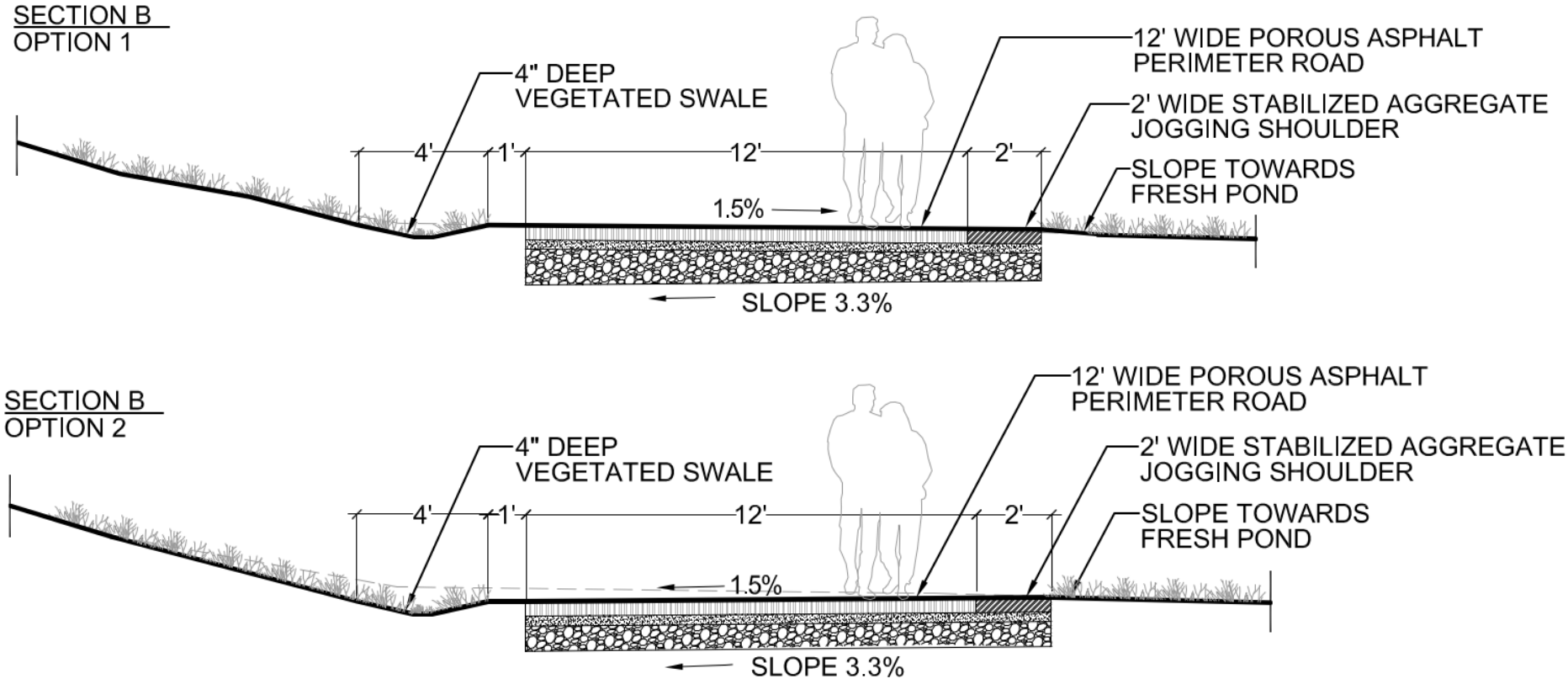
Perimeter Road at Weir Meadow

Existing Conditions



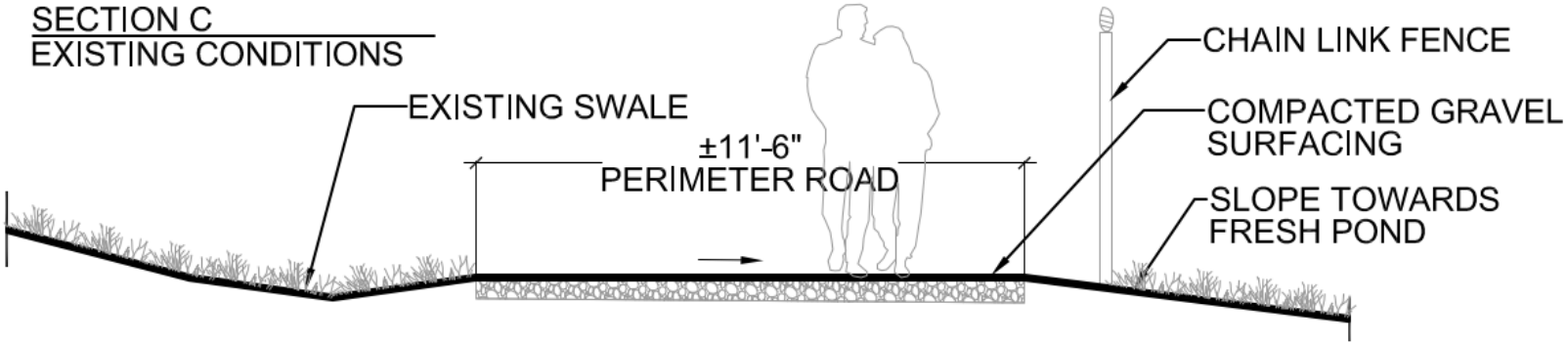
Perimeter Road at Weir Meadow

Proposed Alternatives



Perimeter Road below Glacken Slope

Existing Conditions

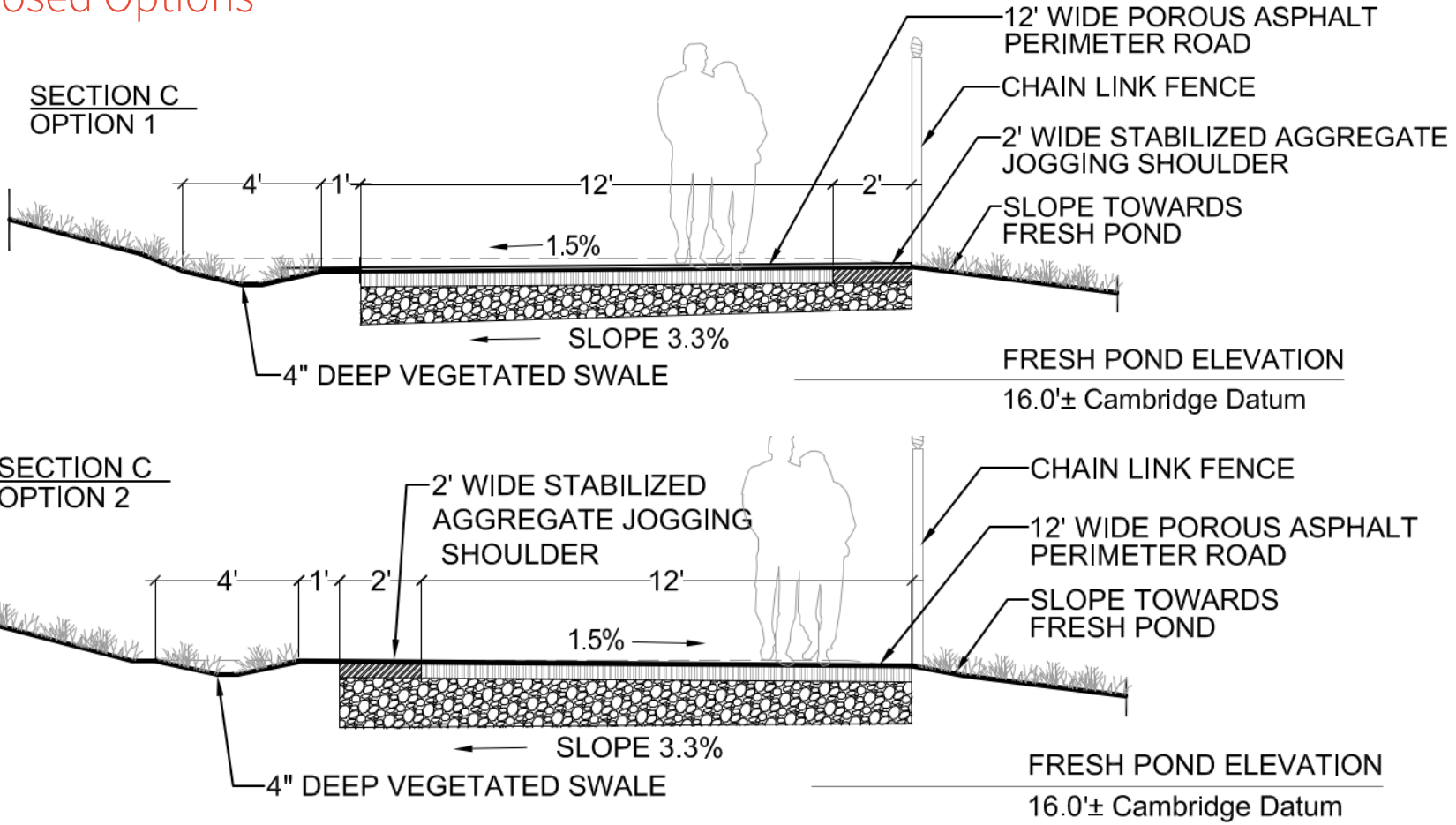


FRESH POND ELEVATION

16.0'± Cambridge Datum

Perimeter Road below Glacken Slope

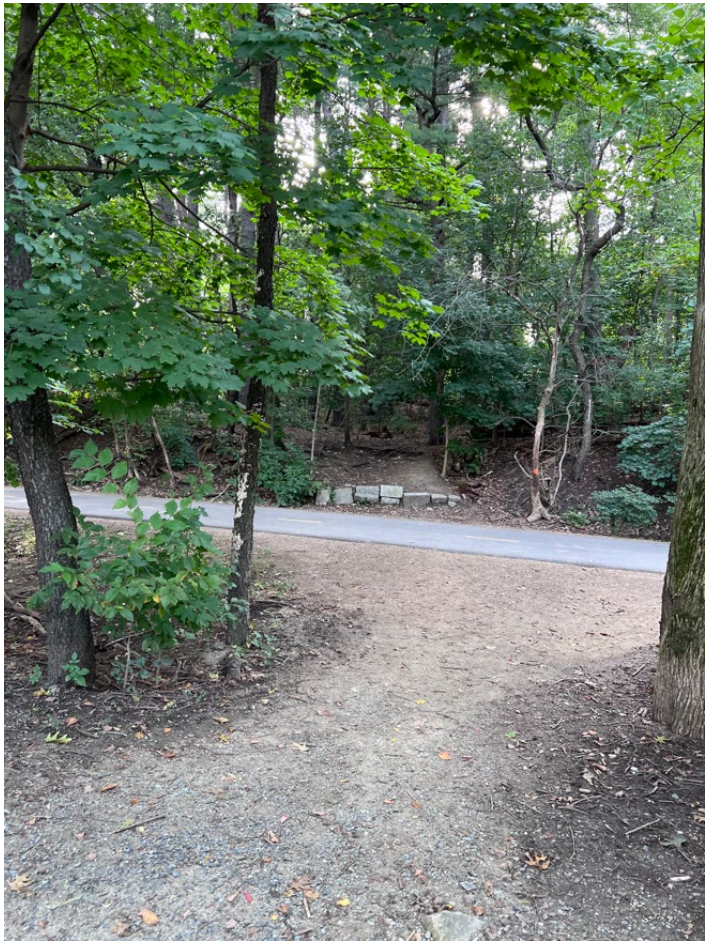
Proposed Options



Proposed Connection Perimeter Road to Greenway

Proposed Connection Perimeter Road to Greenway

1. Raised connection (asphalt to asphalt).
2. MUTCD and AASHTO bicycle signage and striping (Greenway only).
3. Drainage culvert for greenway swale.
4. Snow plowed (CWD).
5. Reservation signage.



Perimeter Road / Greenway Connection

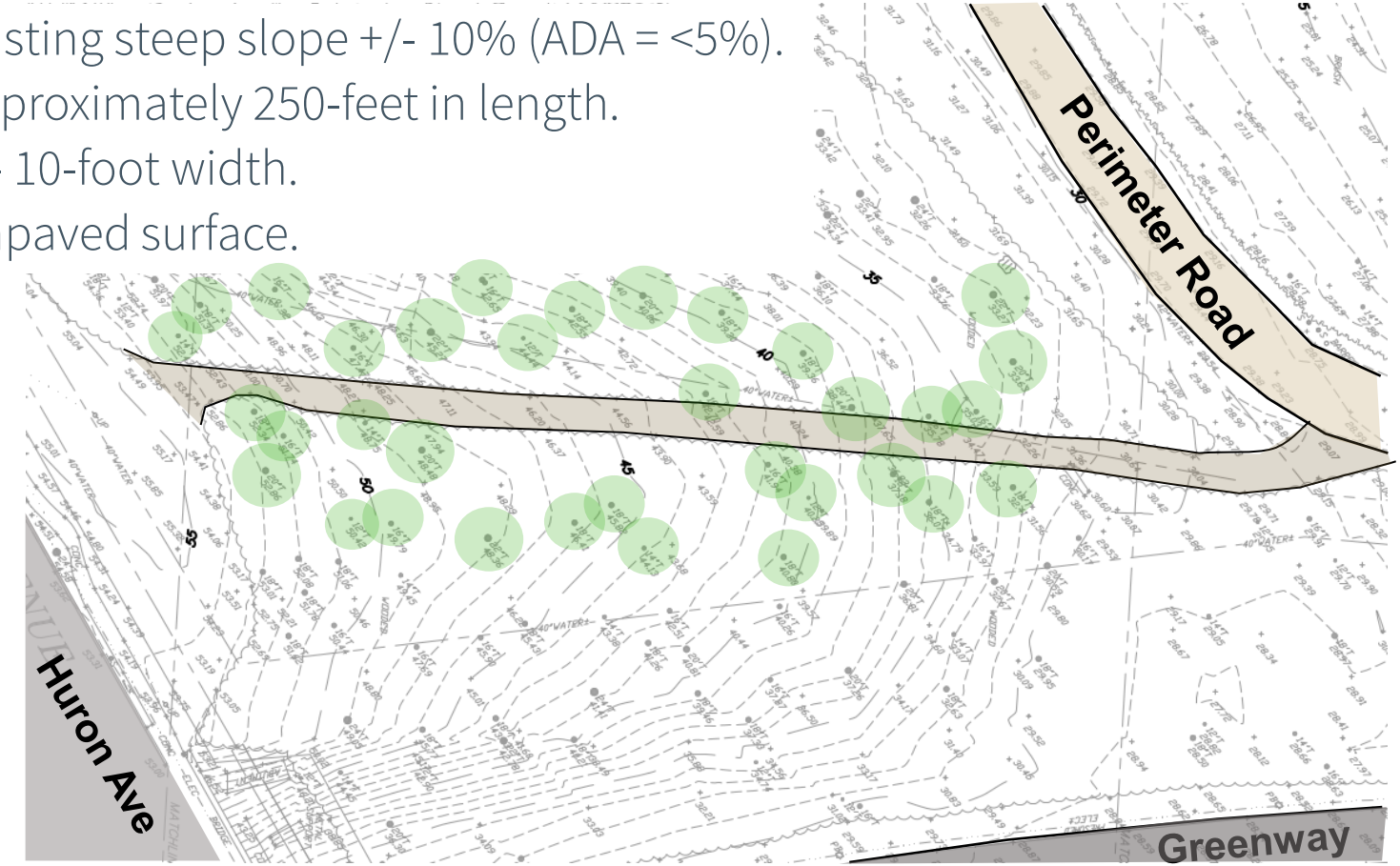
Signage

1. Best location and siting option.
2. Communicate FPR regulations, goals and vision statement.
3. Wayfinding map; historical, recreational and ecological components (2-sided).

Strawberry Hill ROW to Perimeter Road (Existing)

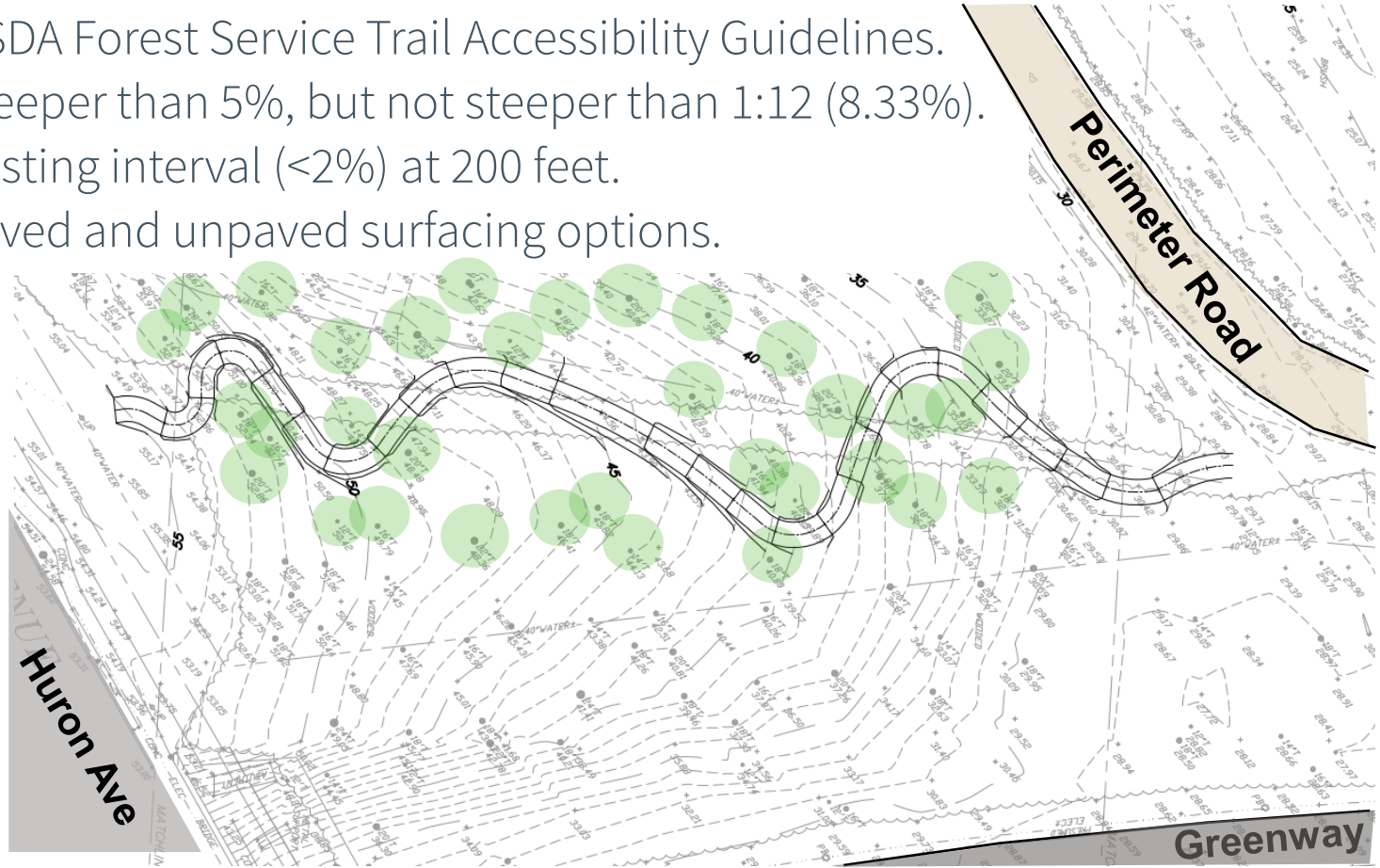
Strawberry Hill ROW to Perimeter Road (Existing)

1. Existing steep slope +/- 10% (ADA = <5%).
2. Approximately 250-feet in length.
3. +/- 10-foot width.
4. Unpaved surface.



Strawberry Hill Trail to Perimeter Road

1. USDA Forest Service Trail Accessibility Guidelines.
2. Steeper than 5%, but not steeper than 1:12 (8.33%).
3. Resting interval (<2%) at 200 feet.
4. Paved and unpaved surfacing options.



Strawberry Hill Path to Perimeter Road

1. ADA universal accessibility (<5%).
2. Switchback alignment avoiding existing trees and reducing earthwork.
3. Paved only option.

Vegetated Buffer Improvements

1. Remove Invasive Trees, Shrubs and Groundcovers
2. Amend Soils
3. Plant Native Understory Species
4. Install Plant Protection Fencing

Next Steps

1. Nick Brazee (UMass Plant Pathologist) Site Visit (12/5/2023).
2. Full Soil Testing Results and Recommendations (Pine Grove).
3. 30% Design Development Perimeter Road Improvement Drawings.
4. Pine Grove Restoration and Pilot Project (Future Phases).