

Glover Town Office/Library & School Green Stormwater Retrofits

Concept Plans //
Stakeholder Input



Holly Greenleaf, Ecological Landscape Designer
Patrick Hurley, Memphremagog Watershed Association

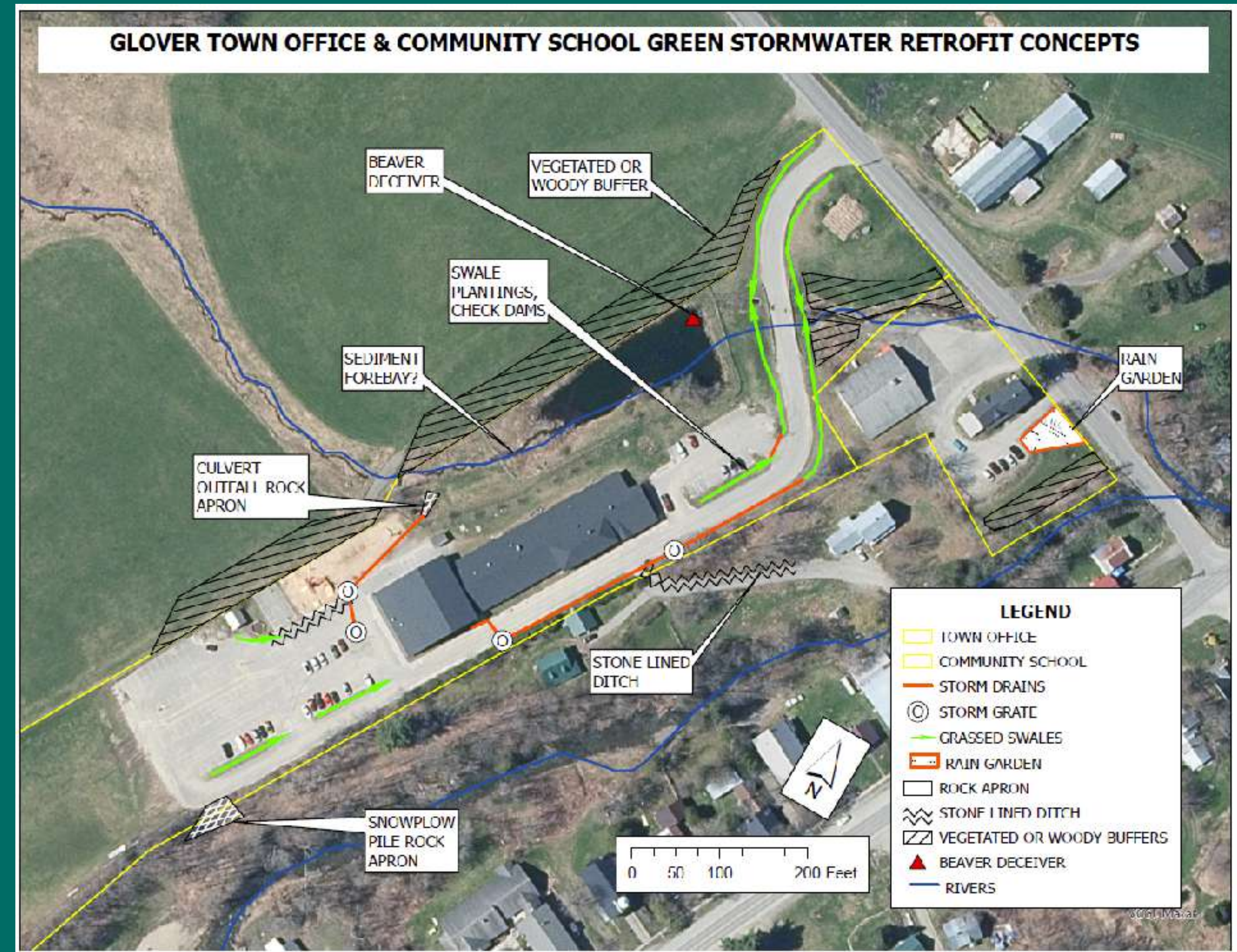


GREENLEAF DESIGN, LLC
ECOLOGICAL LANDSCAPE DESIGN
ILLUSTRATION & GRAPHIC DESIGN



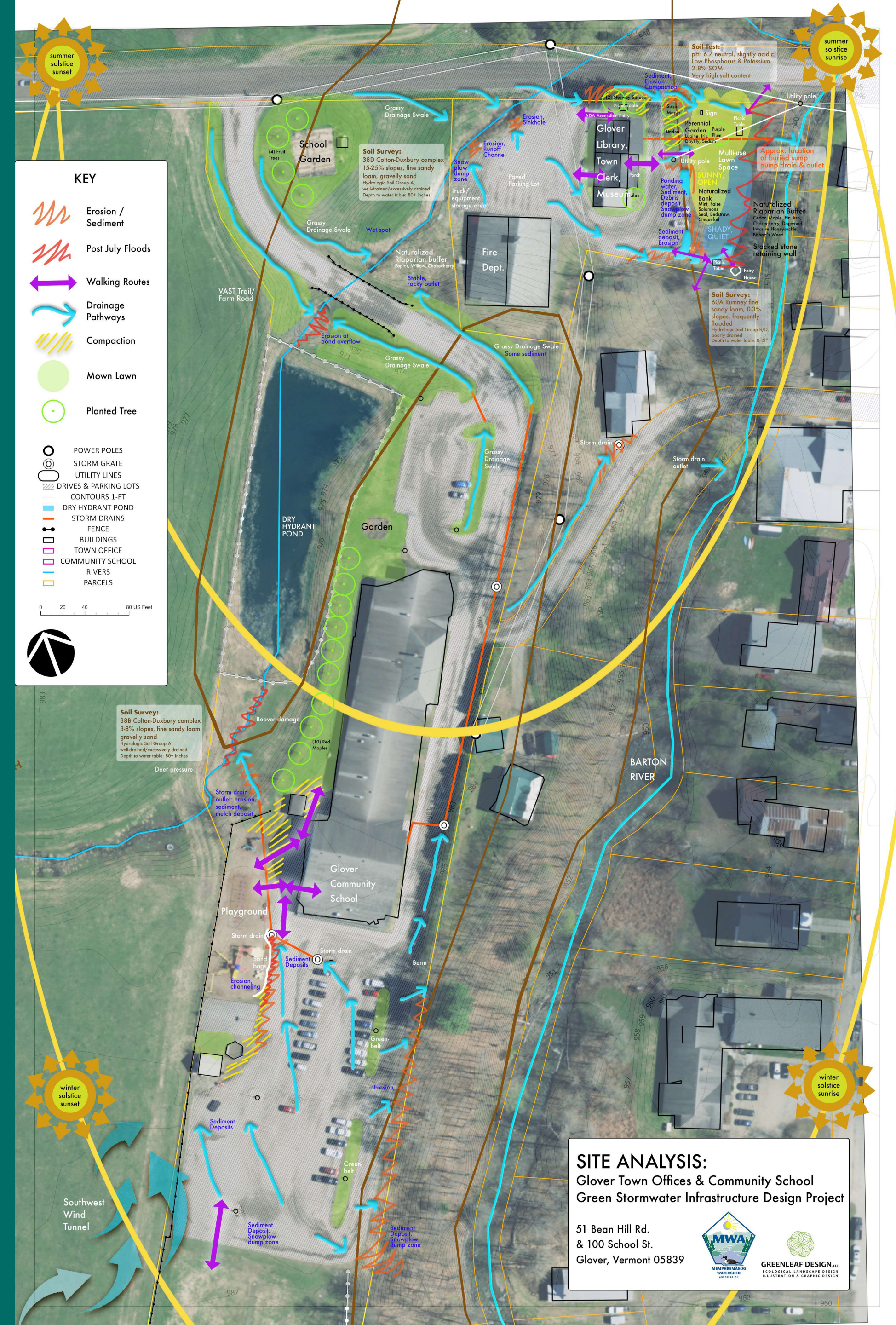
Background & Goals

- Protect water quality in Barton River
- Reduce stormwater runoff, erosion, and sediment washing off developed areas and into nearby waterways
- Filter pollutants out of stormwater runoff and infiltrate into ground with treatment practices
- Expand naturally vegetated river and stream buffers to stabilize soils, improve flood resiliency, and create wildlife habitat and corridors
- Create aesthetic and educational amenities for the school and community
- Water Quality Block Grant from VT DEC with Memphremagog Watershed Association



Site Analysis

- Sediment deposits on parking lots and at storm drain outlets
- Stormwater runoff and erosion along parking lots, roadways, and in waterways and ditches
- Compaction in high traffic areas
- Salt build up in soils
- Flooding and erosion in stream channels and floodplains
- Mostly native plants, some invasive species in Barton River buffer



Context Map & Proposed Project Locations

A. Town Offices/ Library

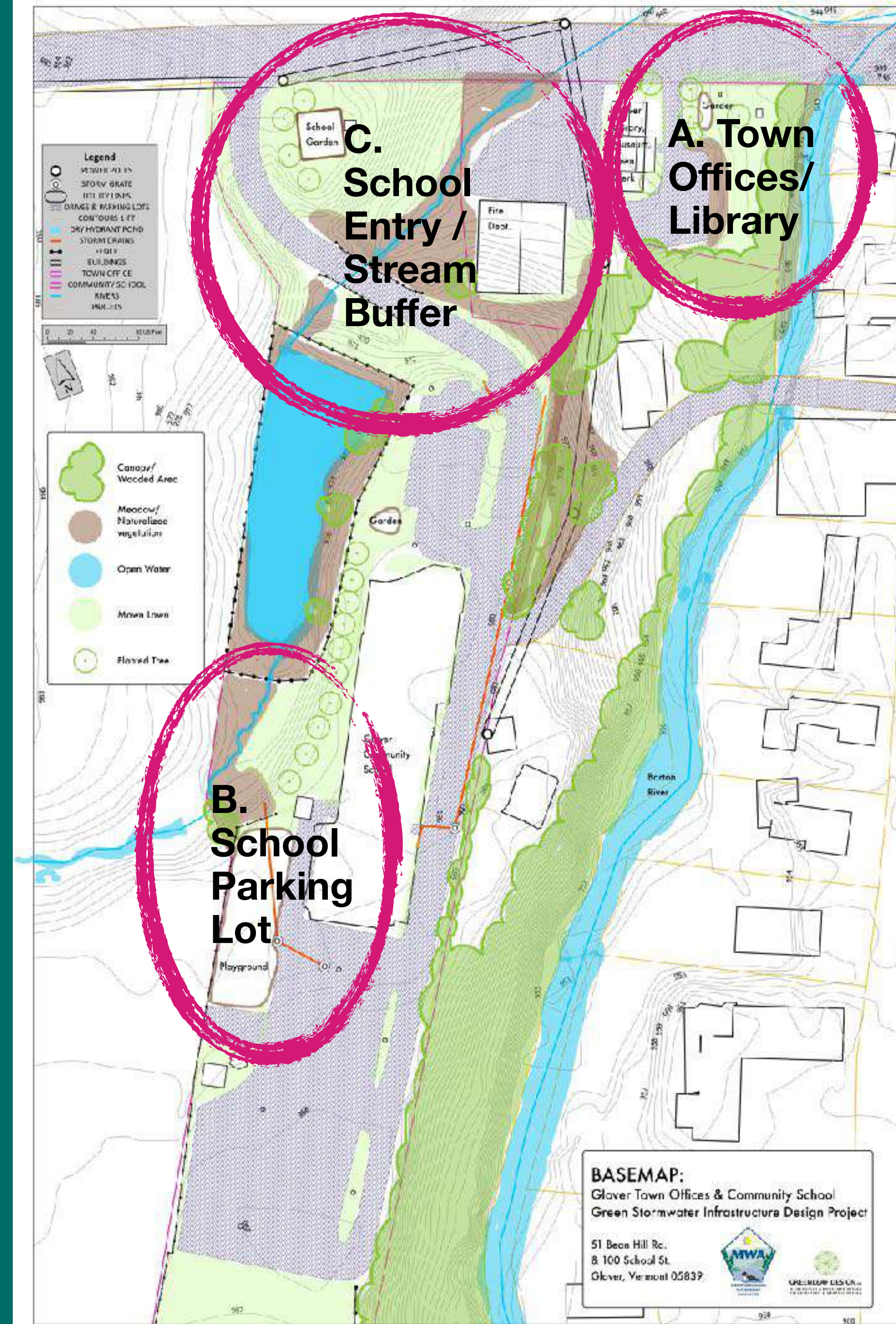
- Rain Gardens/Swales
- Expand River Buffer

B. School Parking Lot

- Rain Gardens/Bioretenion
- Storm Drain Outlet Stabilization & Erosion Control
- Vegetated Stream Buffer

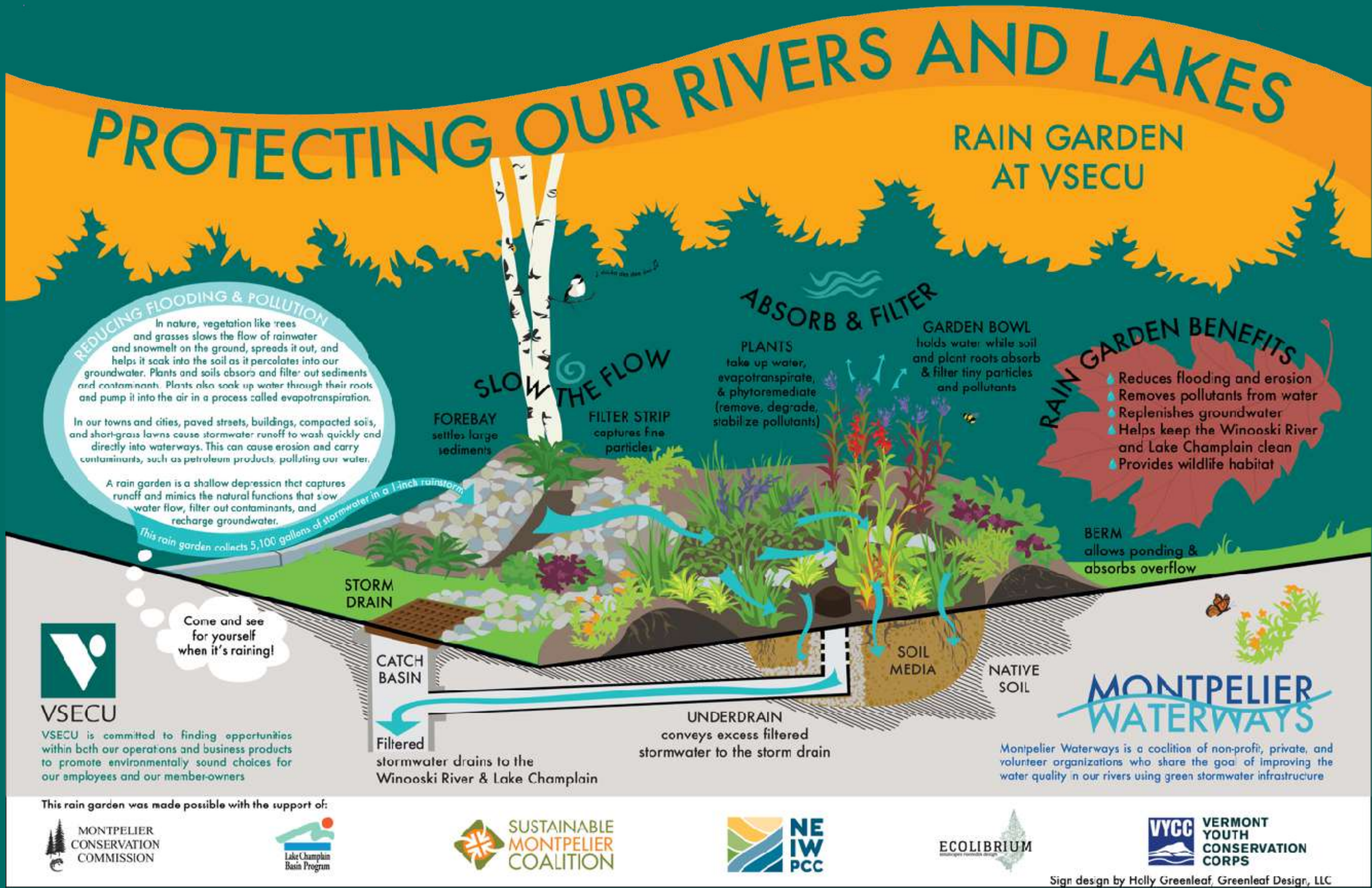
C. School Entry / Fire Dept. Field

- Stream Buffer
- Ditch Retrofits



Why green stormwater infrastructure?

- **Offsets** impacts of developed areas & mimics natural hydrology
- **Slow & spread** - reduce runoff volume & velocity, erosion, flooding
- **Sink** - infiltration, recharge groundwater, filter pollutants from runoff, nutrient sinks
 - Physical (settling of suspended solids)
 - Biological (plant uptake of pollutants and evapotranspiration)
 - Physiochemical (adsorption of phosphorus)
- **Re-use** water in landscape
- **Protect** water quality in streams and lakes
- **Co-benefits:**
 - Biodiveristy, habitat for pollinators, birds, amphibians, other wildlife
 - Shade, sequester CO2, regulate temperatures
 - beauty, education, connection



Rain Garden

- A depressed garden/cell/basin/swale designed to capture and absorb stormwater
- Bioretention = amended soil/filter media
 - 70/30 Sand, topsoil, Low-phosphorus compost
- Underdrains for storm sewer connection, urban areas, clay soils, or high water table

Anatomy of a Rain Garden

Entrance: Prevent sediments from clogging the rain garden. Filter sediments uphill. To remove more, pretreat the stormwater by installing a forebay (a small depression where sediments settle) before the entrance. Occasional maintenance includes removing trash, sediments, and debris from the forebay. Protect the entrance from erosion.

Temporary six-inch ponding.

Filter bed:

A layer of sandy soil mix that helps store and filter stormwater. Filter beds are especially helpful, and often necessary, in places where the existing soil drains poorly or there are other site constraints. Temporary storage occurs within the soil pores of the filter bed.

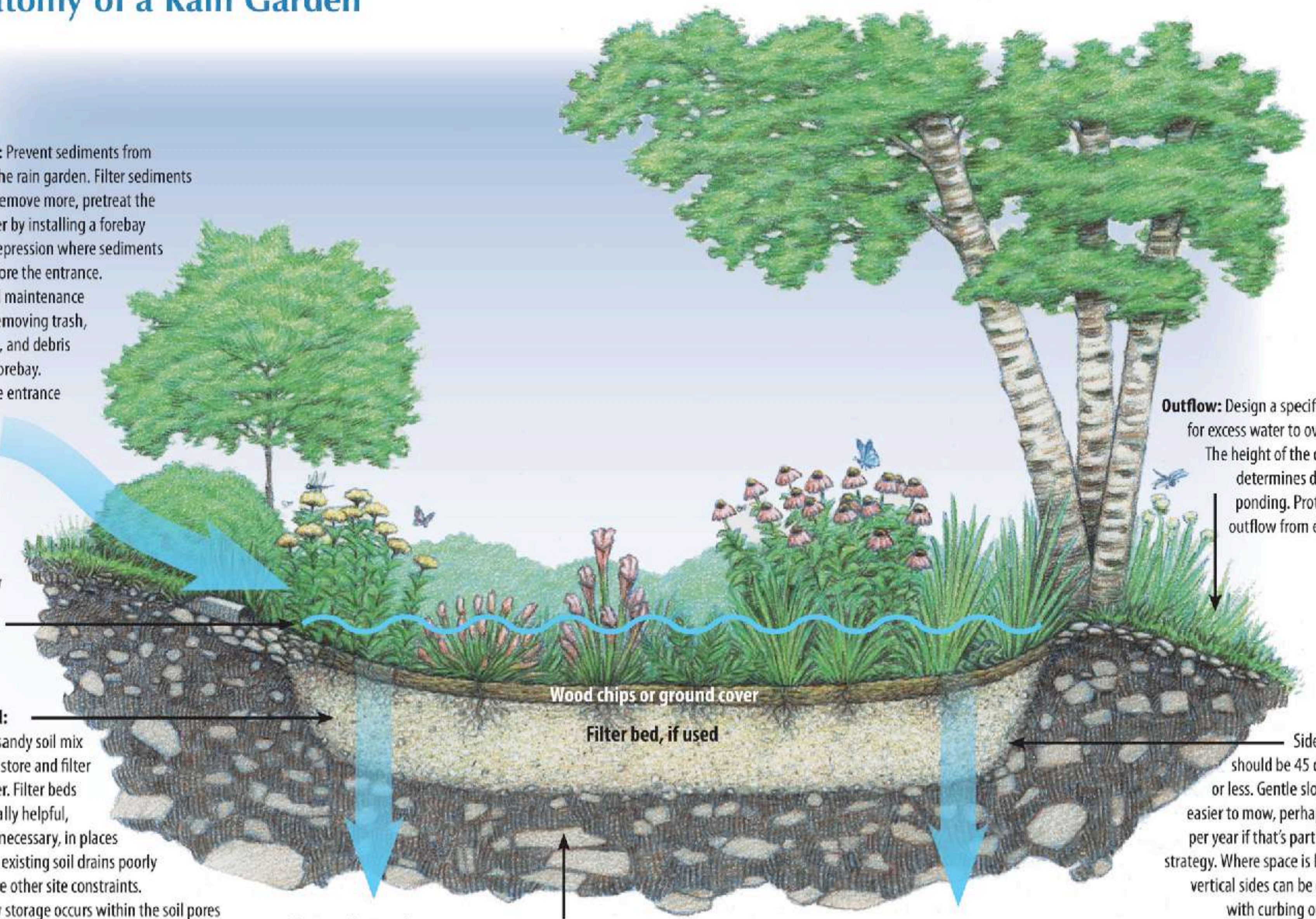
Temporarily-stored stormwater soaks into the ground within 24 hours.

Existing soil: Minimize compaction. Healthy biological communities living within plant root zones help reduce the amount of pollutants that reach groundwater.

Outflow: Design a specific place for excess water to overflow. The height of the outflow determines depth of ponding. Protect the outflow from erosion.

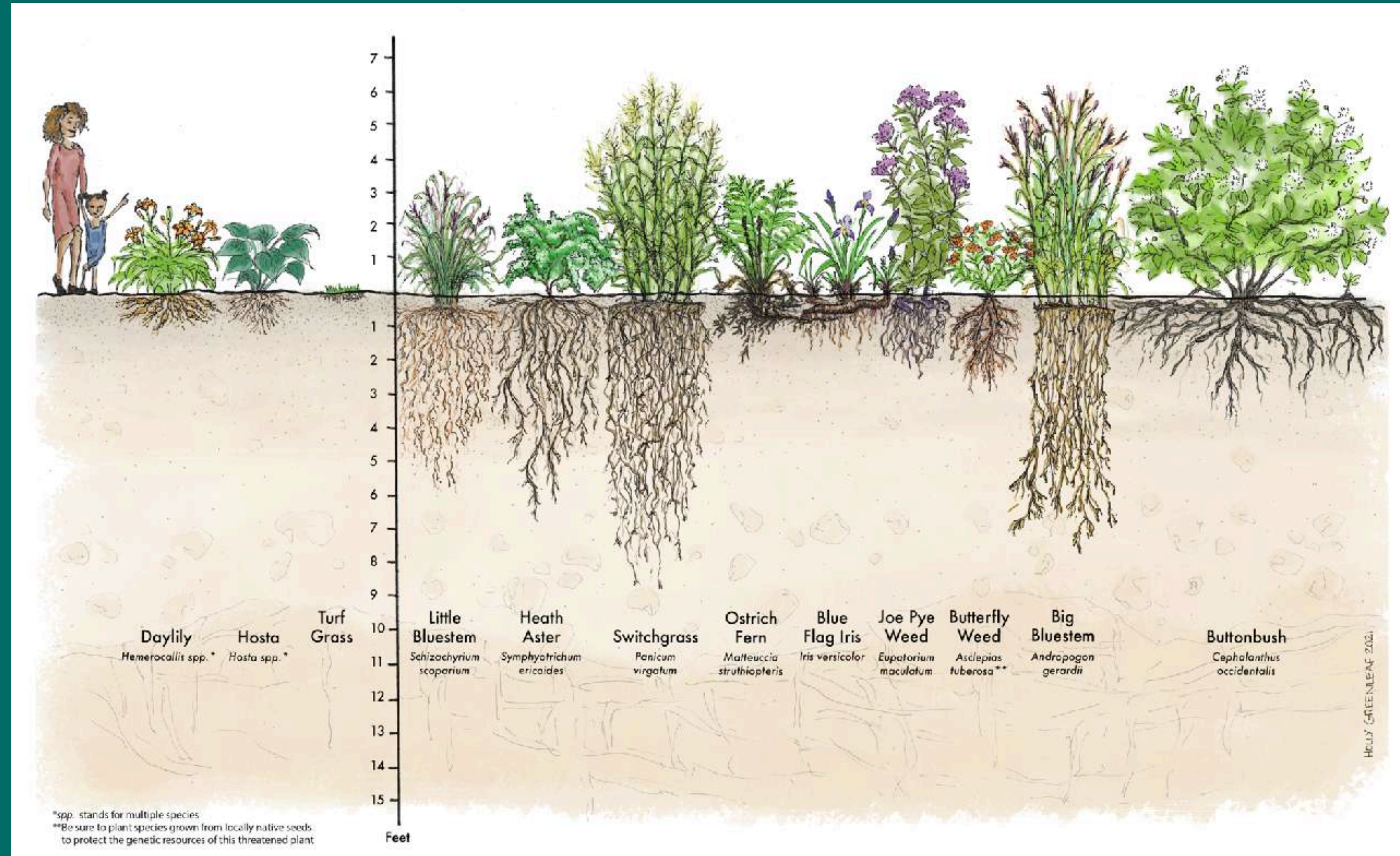
Side slopes should be 45 degrees or less. Gentle slopes are easier to mow, perhaps once per year if that's part of your strategy. Where space is limited, vertical sides can be created with curbing or stone.

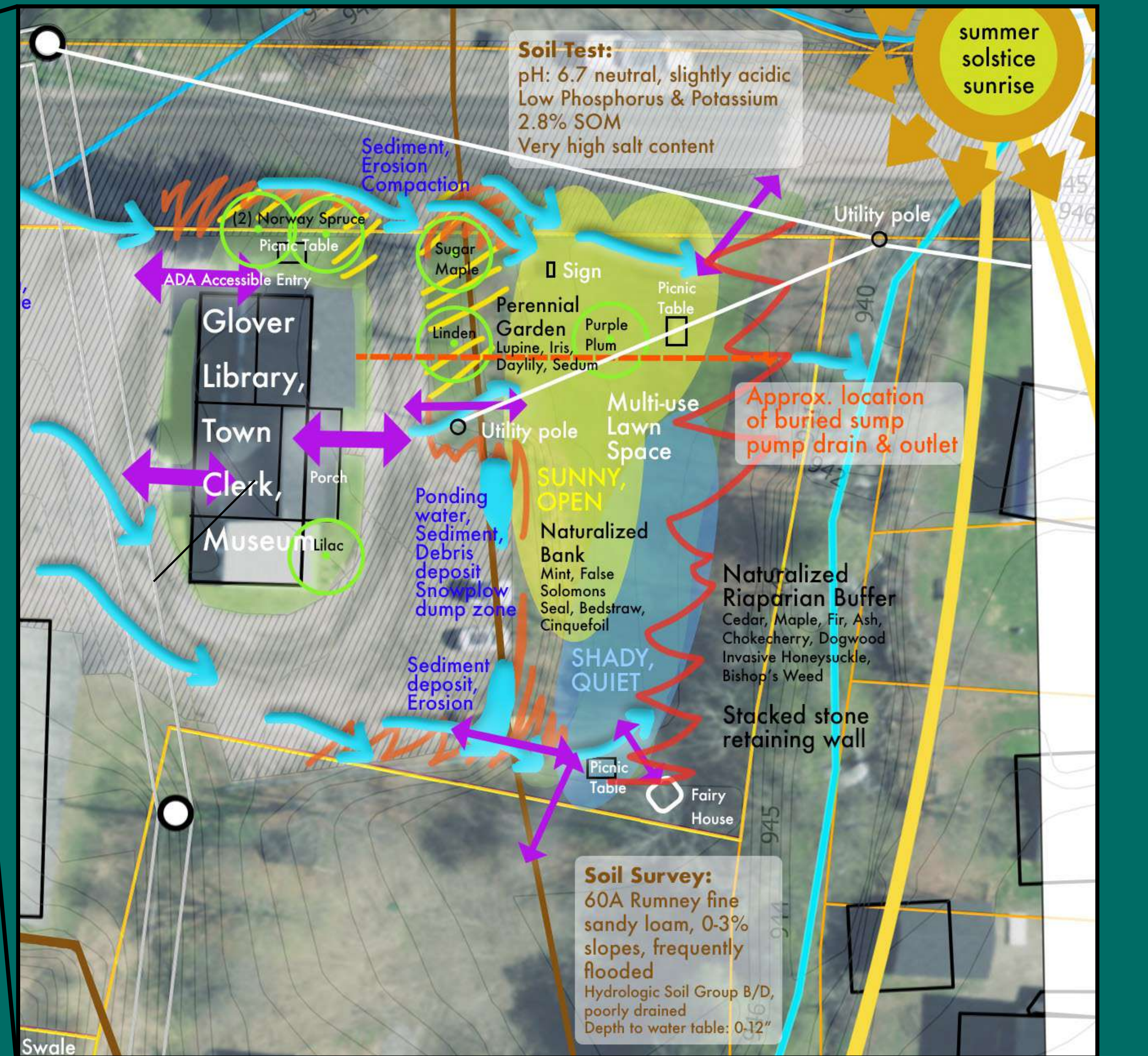
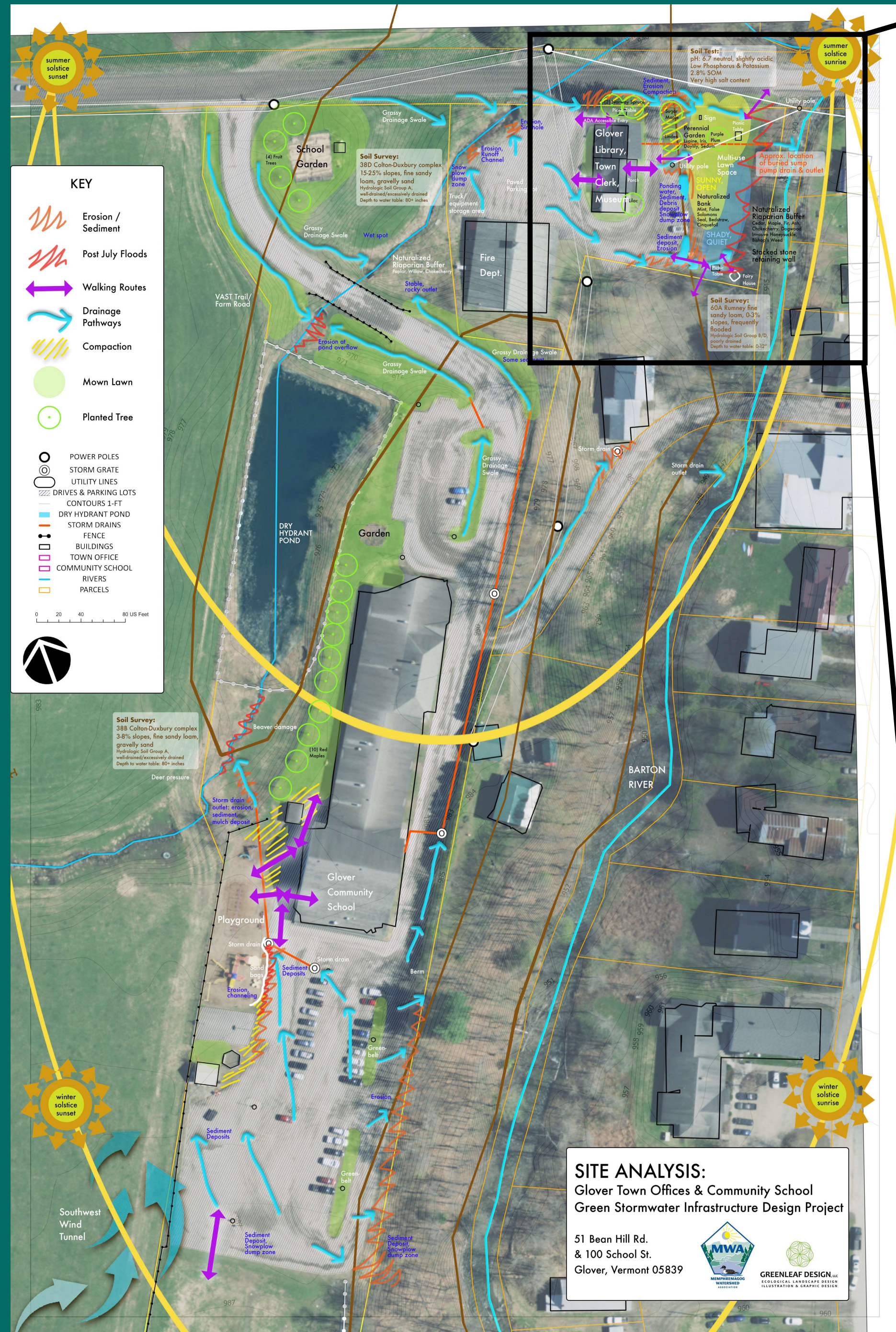
Figure 4

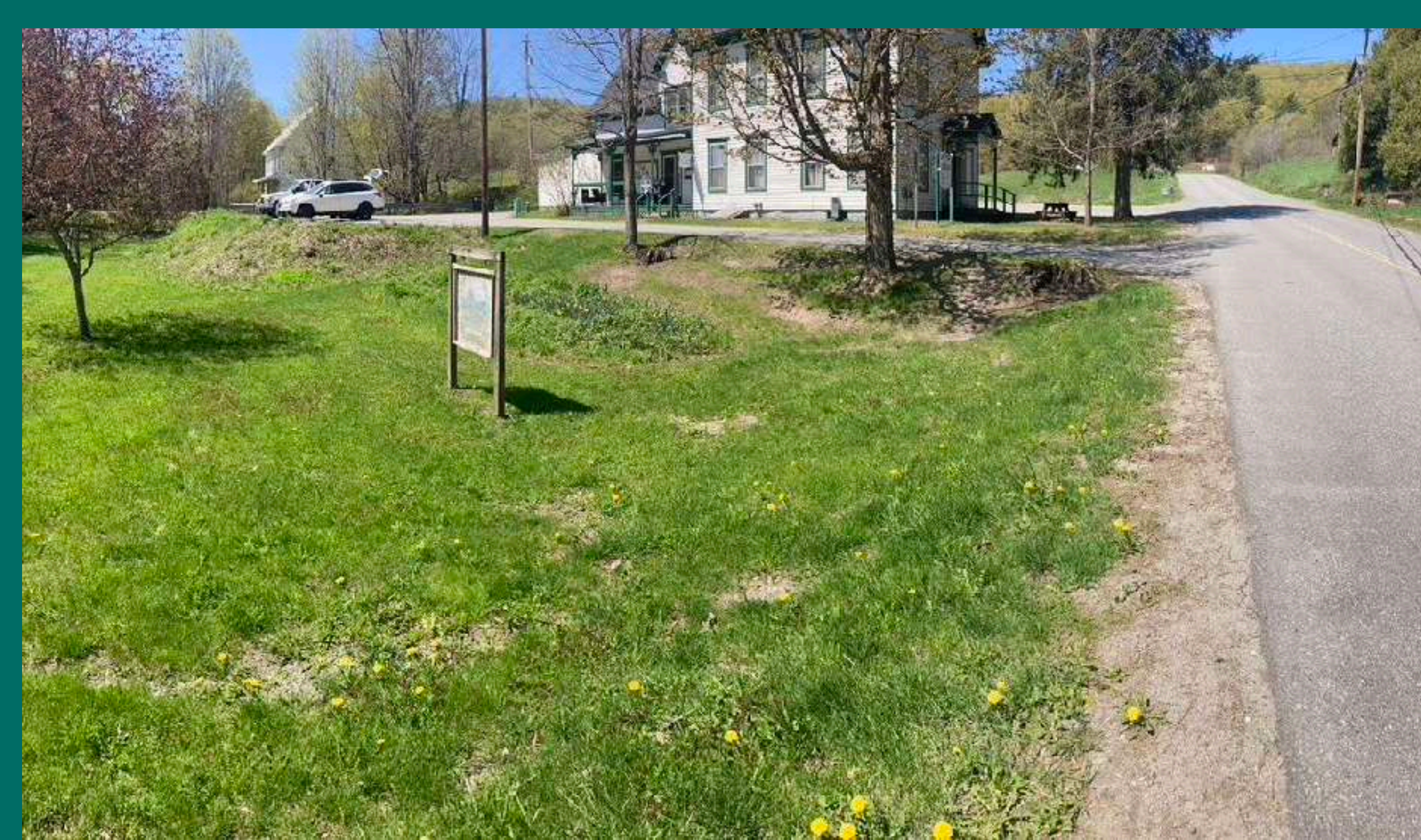
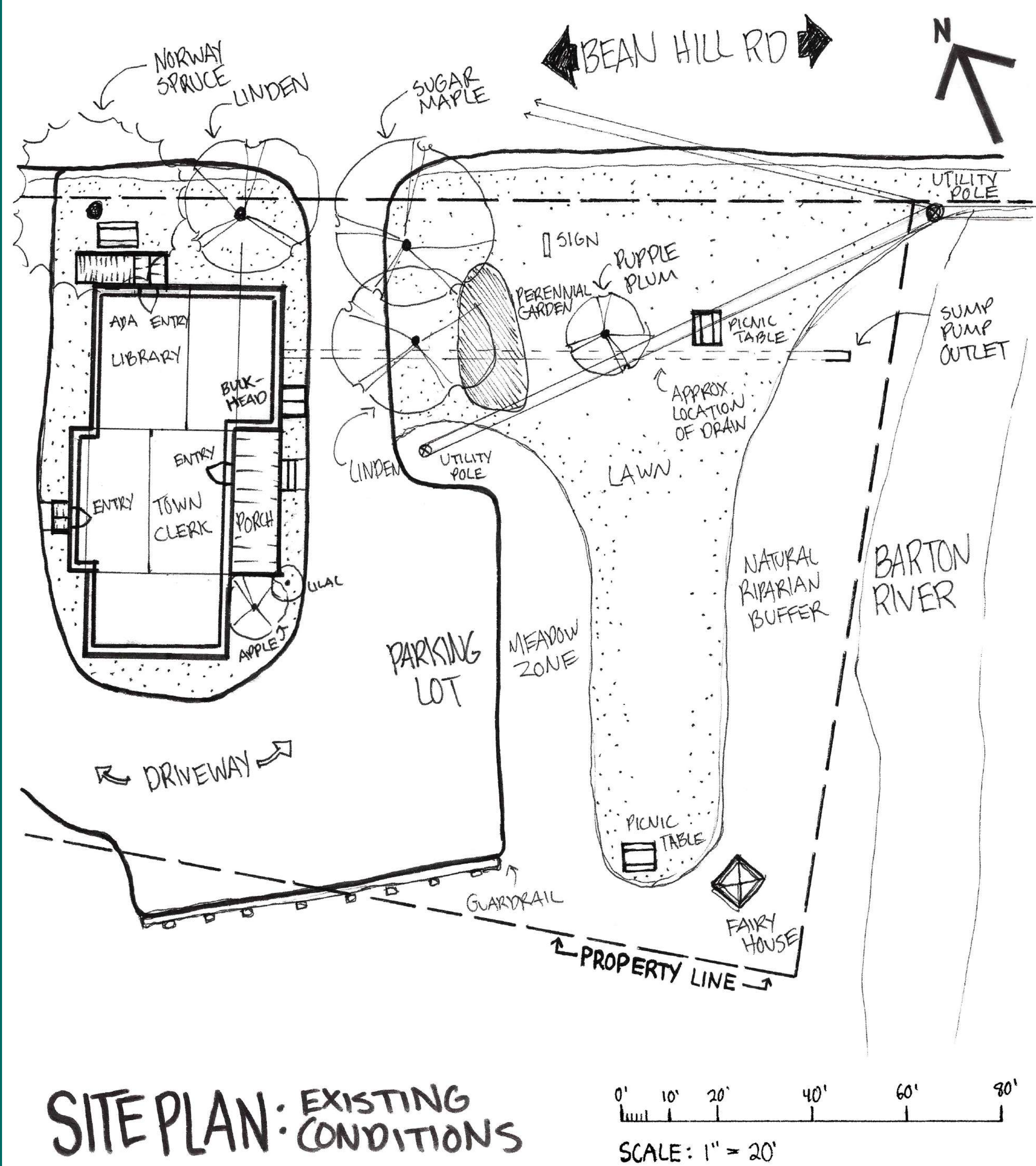


Native Plants

- Biological & Physiochemical water filtration
- Increases soil tilth (aggregates, aeration, infiltration capacity)
- Adds organic matter (microbial biomes, fertility, holds water)
- Reverse compaction (roots, worms, microbes, drainage)
- Habitat for pollinators & other wildlife







Town Offices/Library

Town Offices/Library - Concept 1

Three Satellite Rain Gardens



KEY

- NATIVE PLANTINGS
- RE-NATURALIZED AREA/NO-MOW
- STORMWATER TREATMENT
- STONE/HARDSCAPING
- WATER RUNOFF
- INTERPRETIVE SIGN
- EXISTING GARDEN

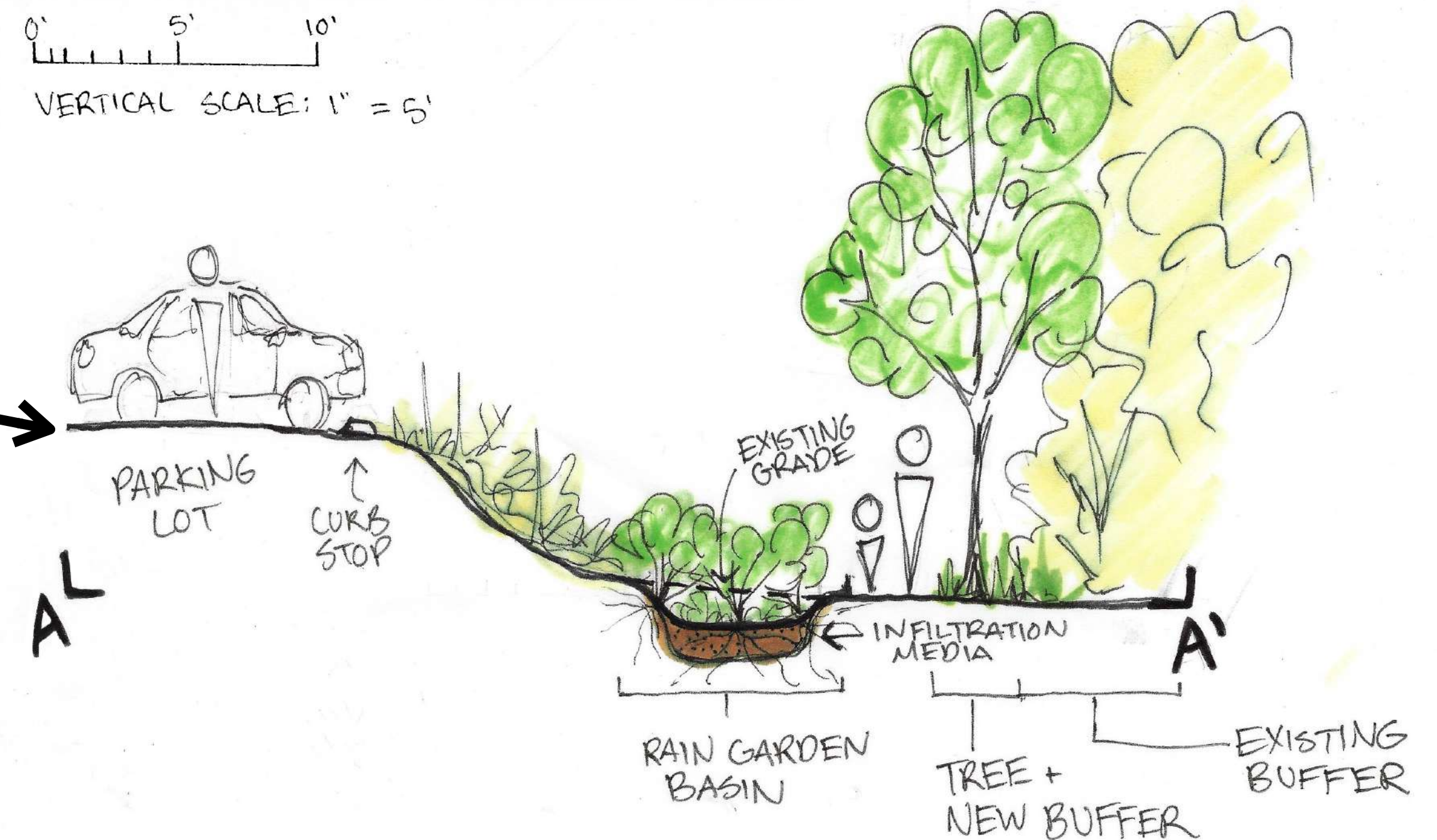
CONCEPT 1: THREE SATELLITE RAIN GARDENS

0' 10' 20'

HORIZONTAL SCALE: 1" = 10'

0' 5' 10'

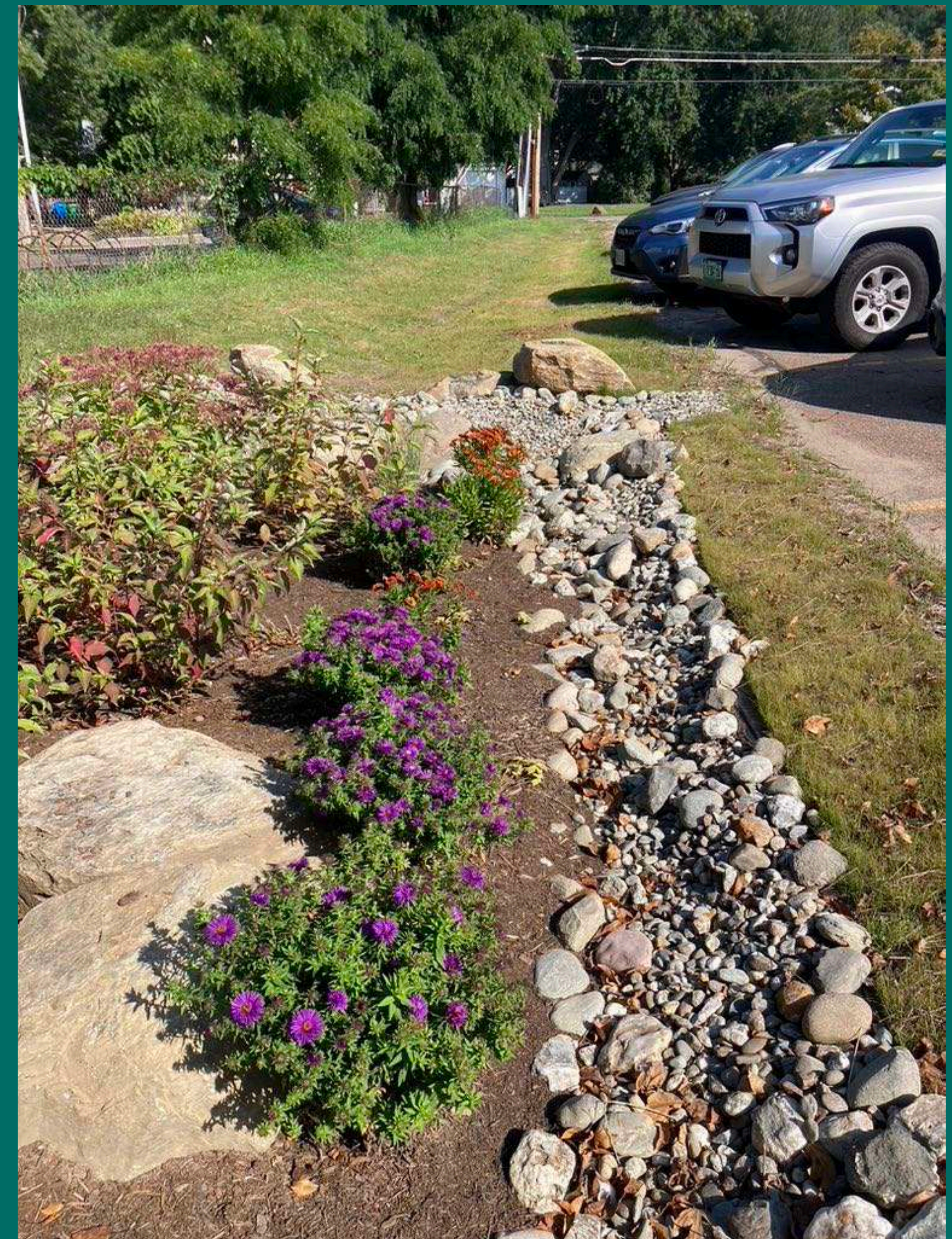
VERTICAL SCALE: 1" = 5'



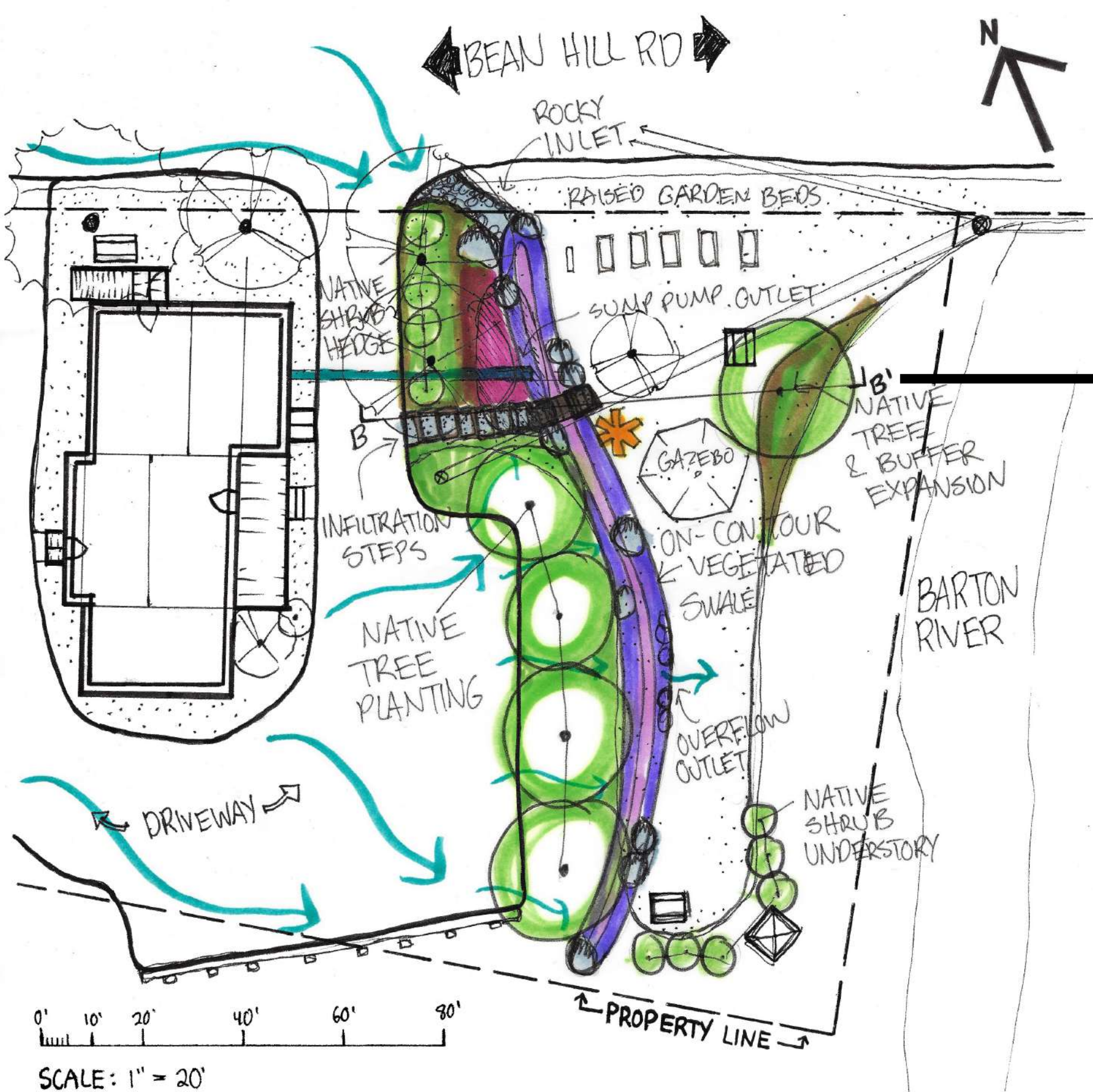
SECTION A-A': CONCEPT 1

Town Offices/Library - Concept 1

Rain garden basin with rocky inlets



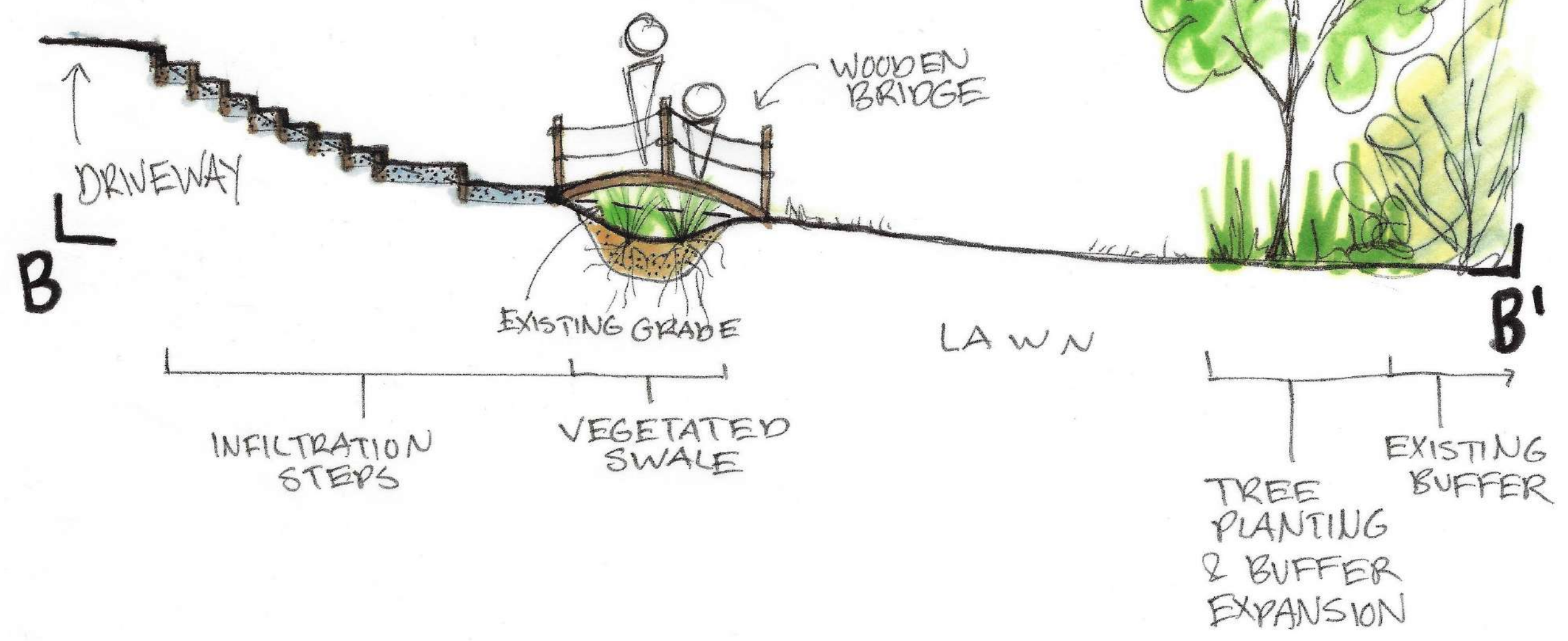
Town Offices/Library - Concept 2 Linear Swale & Tree Row



KEY	
	NATIVE PLANTINGS
	RE-NATURALIZED AREA/NO-MOW
	STORMWATER TREATMENT
	STONE/HAROSCAPING
	WATER RUNOFF
	INTERPRETIVE SIGN
	EXISTING GARDEN

CONCEPT 2: LINEAR SWALE & TREE ROW

0' 10' 20'
HORIZONTAL SCALE: 1" = 10'
0' 5' 10'
VERTICAL SCALE: 1" = 5'



SECTION B-B': CONCEPT 2 WITH BRIDGE

Town Offices/Library - Concept 2

Vegetated swale/Bioswale and infiltration steps



Yestermorrow Design/Build School



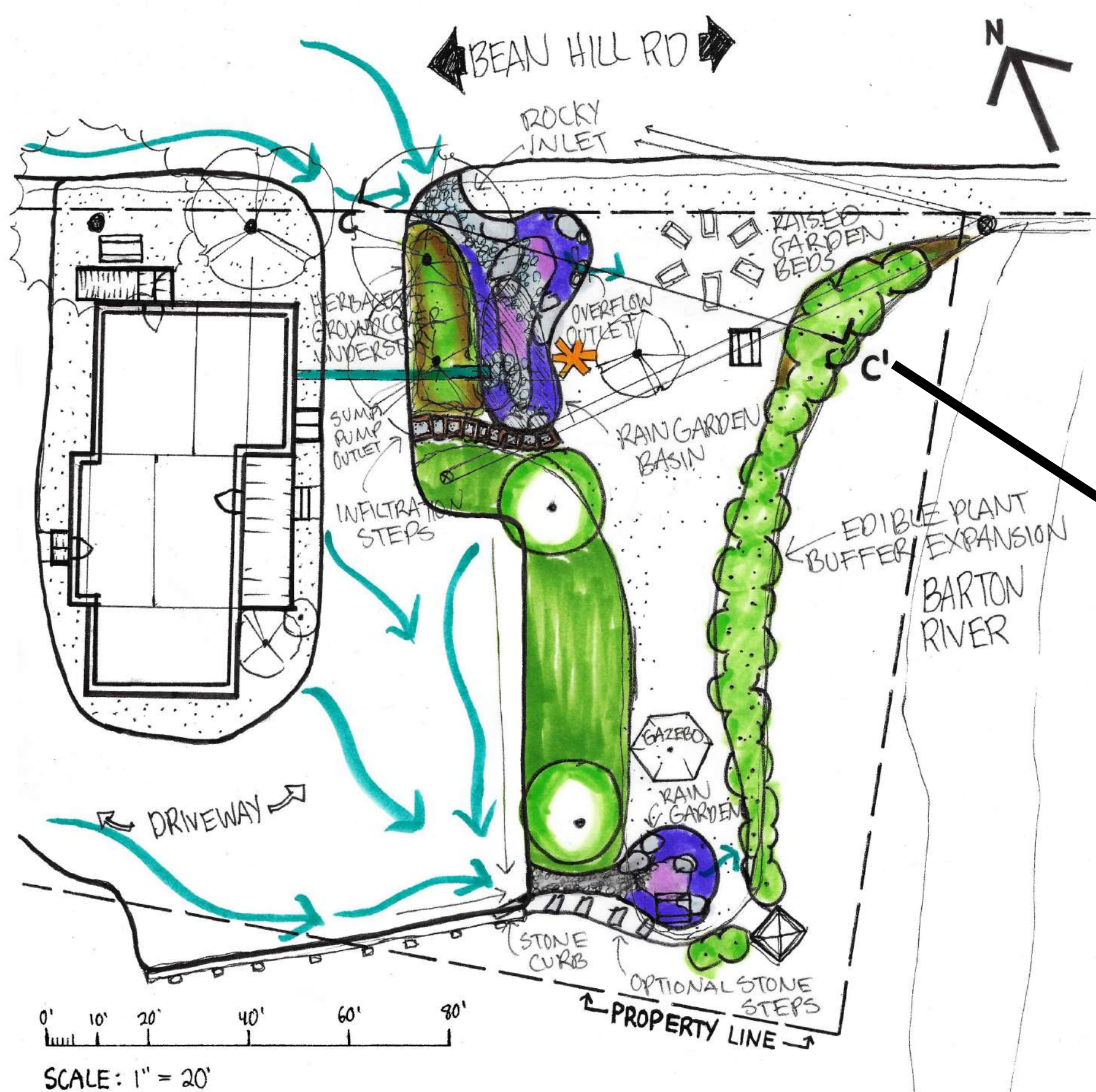
VT DEC Lake Wise Program

Town Offices/Library - Concept 2

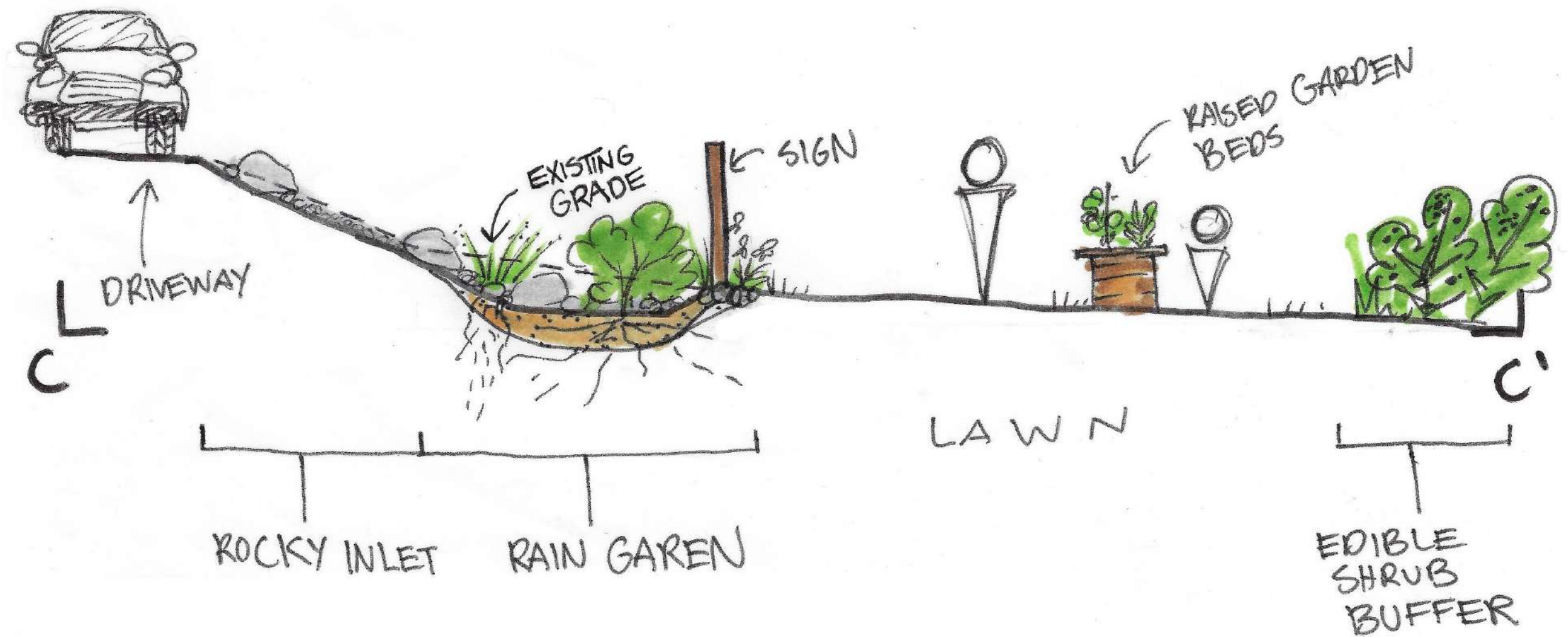
Vegetated swale/Bioswales



Town Offices/Library - Concept 3 Two Bigger Rain Garden Basins & Edible Buffer



0' 10' 20'
HORIZONTAL SCALE: 1" = 10'
0' 5' 10'
VERTICAL SCALE: 1" = 5'



SECTION C-C': CONCEPT 3

- KEY**
- NATIVE PLANTINGS
 - RE-NATURALIZED AREA/NO-MOW
 - STORMWATER TREATMENT
 - STONE/HARDSCAPING
 - WATER RUNOFF
 - INTERPRETIVE SIGN
 - EXISTING GARDEN

CONCEPT 3: TWO RAIN GARDEN BASINS & BIGGER BARTON RIVER BUFFER

Town Offices/Library - Concept 3

Edible Buffer: Elderberry, Blueberry, Chokeberry/Aronia, Persimmon, Mulberry, etc.



NC Extension Elderberry Buffer

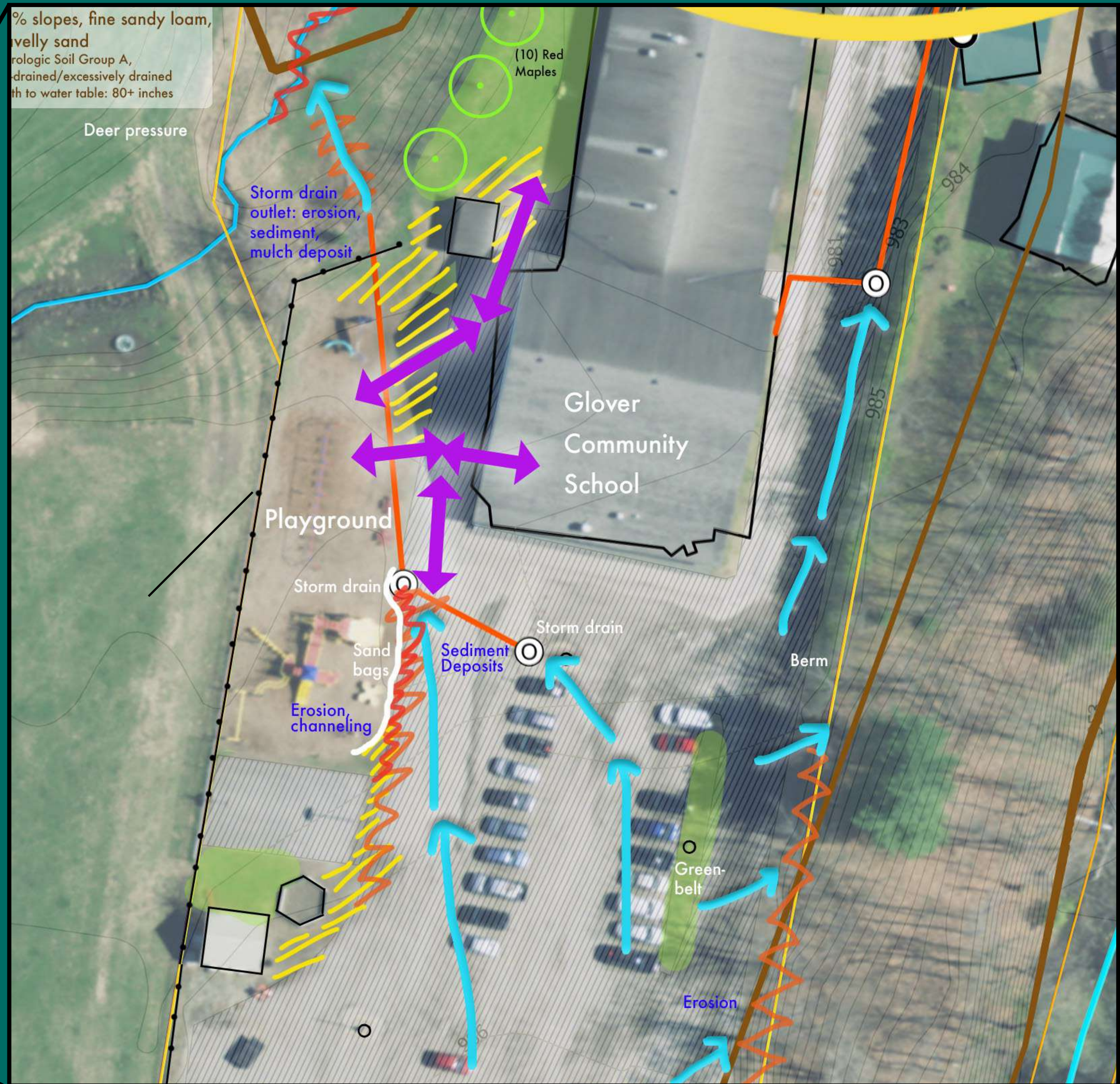
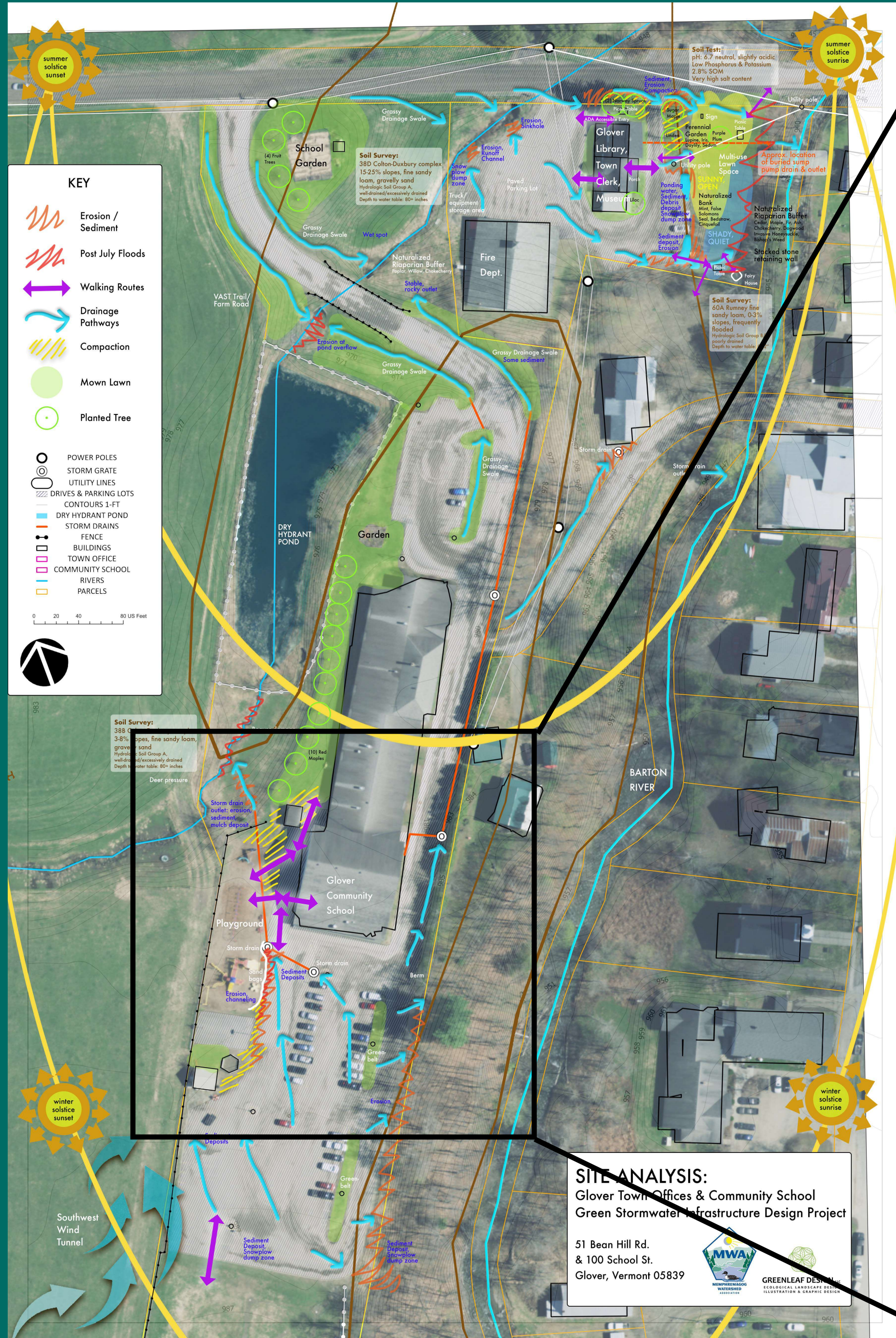


Black Chokeberry in Fall

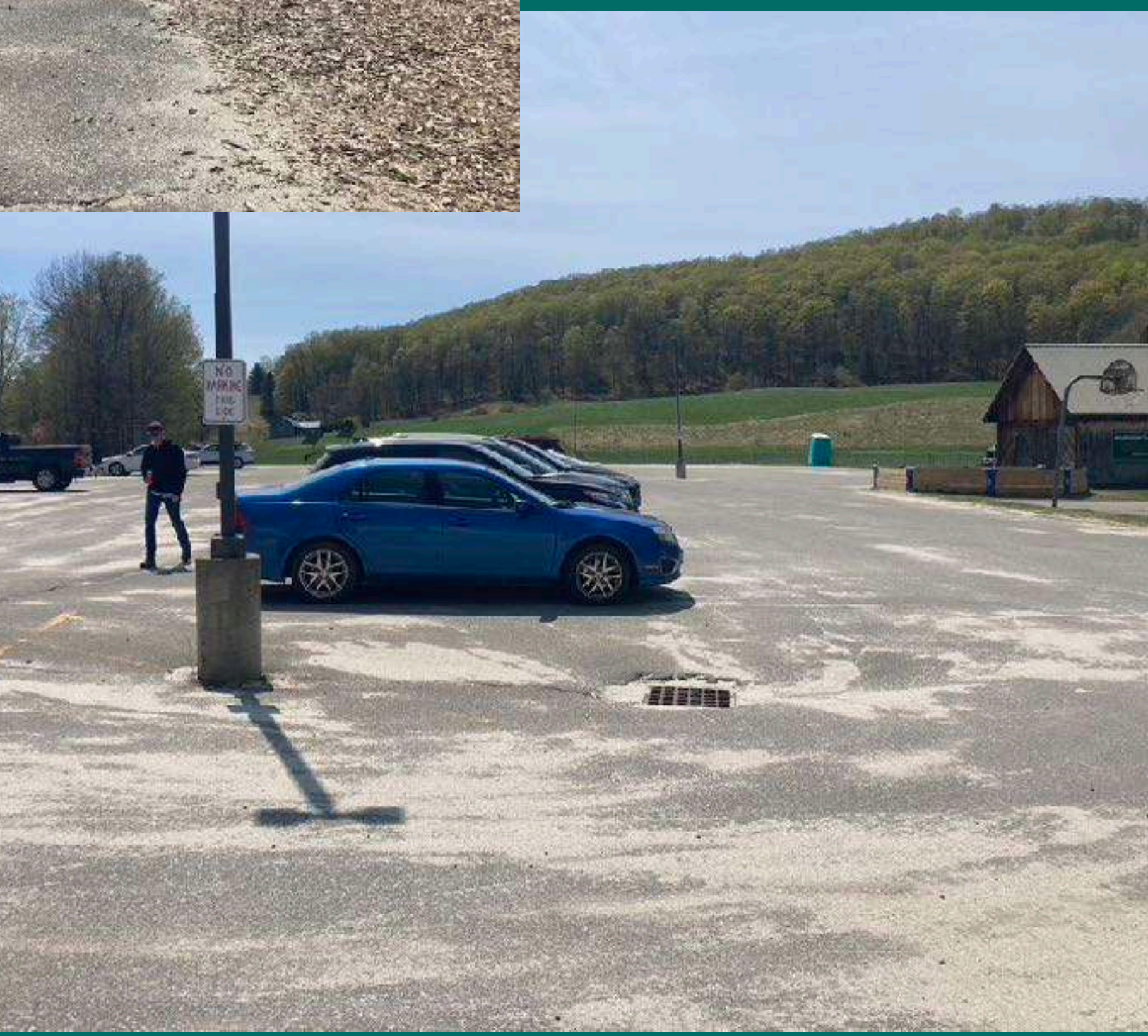
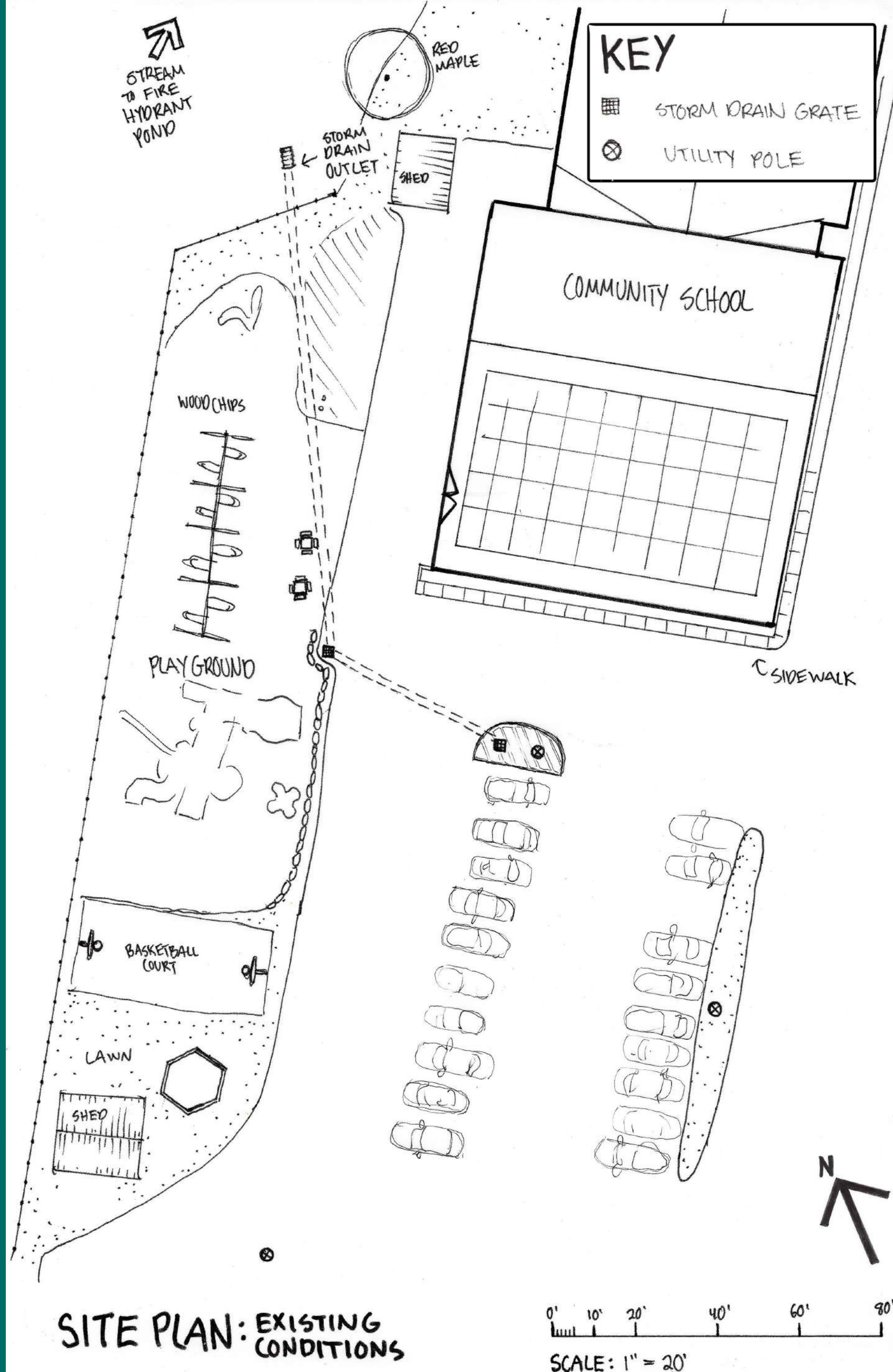
Town Offices/Library - Concept 3

Bigger Rain Garden Basin & Interpretive Sign

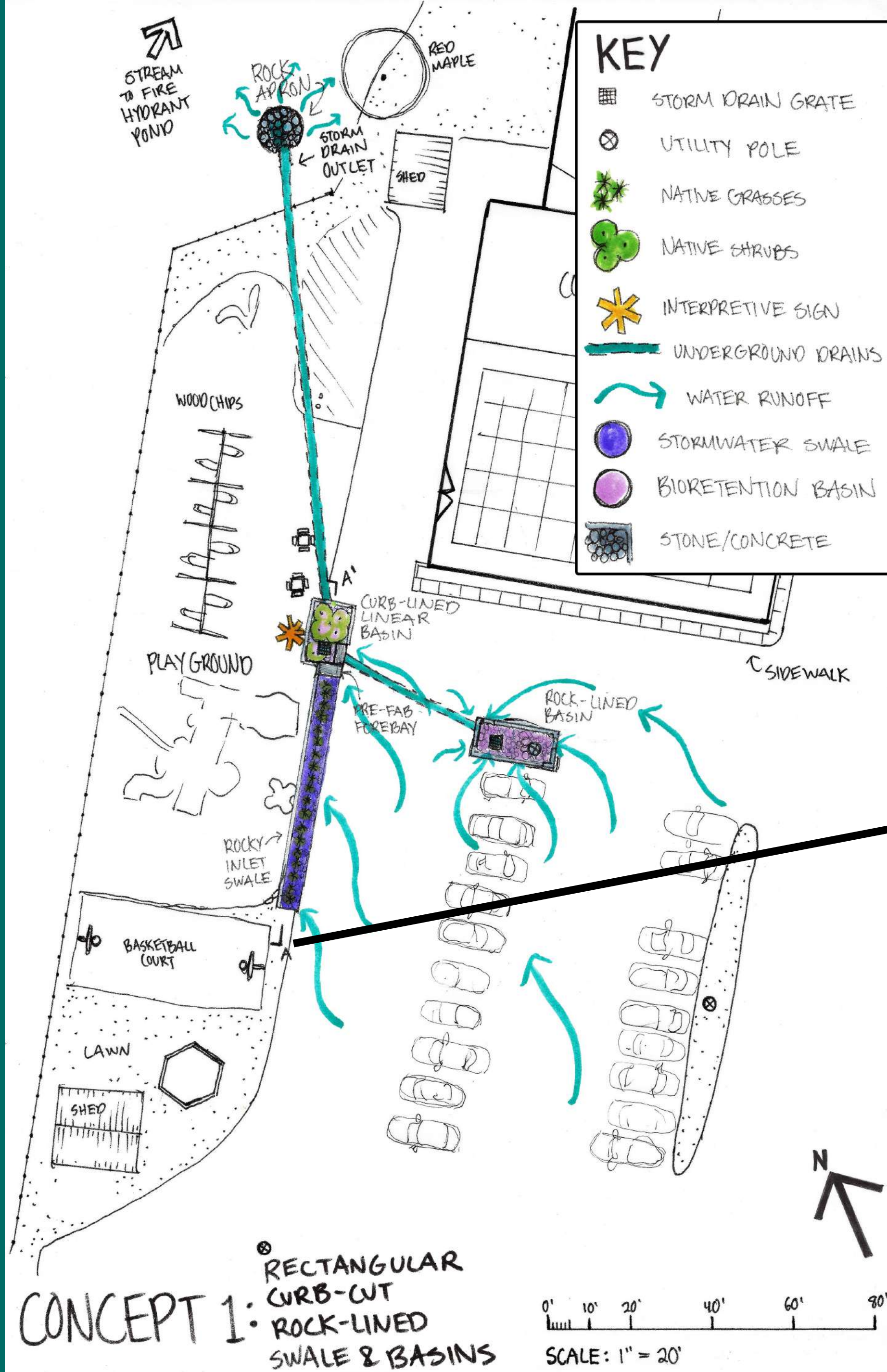




School Parking Lot

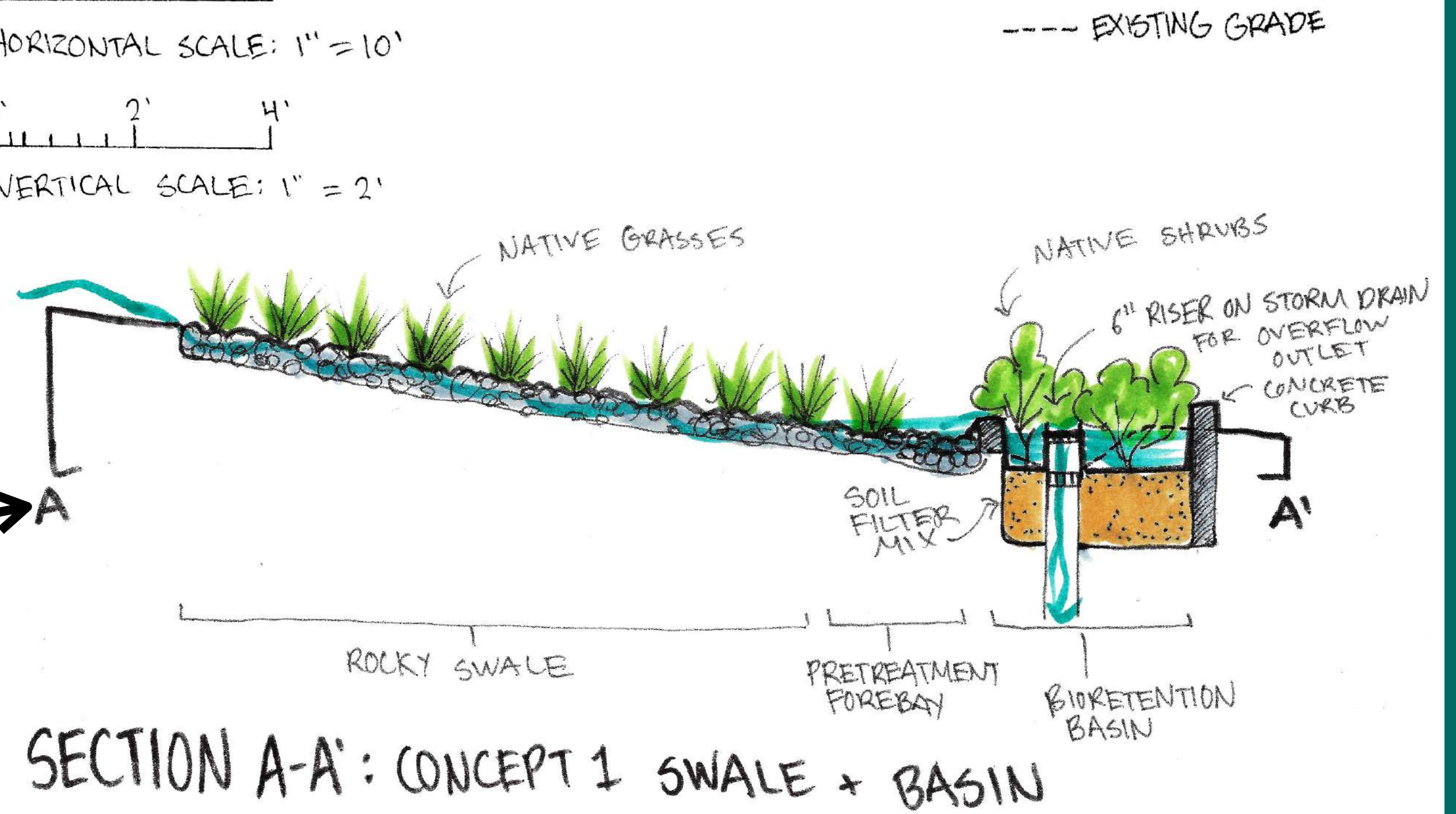


School Parking Lot - Concept 1 Rectangular Curb-cut Rock-lined Swale & Basins



0' 10' 20'
HORIZONTAL SCALE: 1" = 10'

0' 2' 4'
VERTICAL SCALE: 1" = 2'



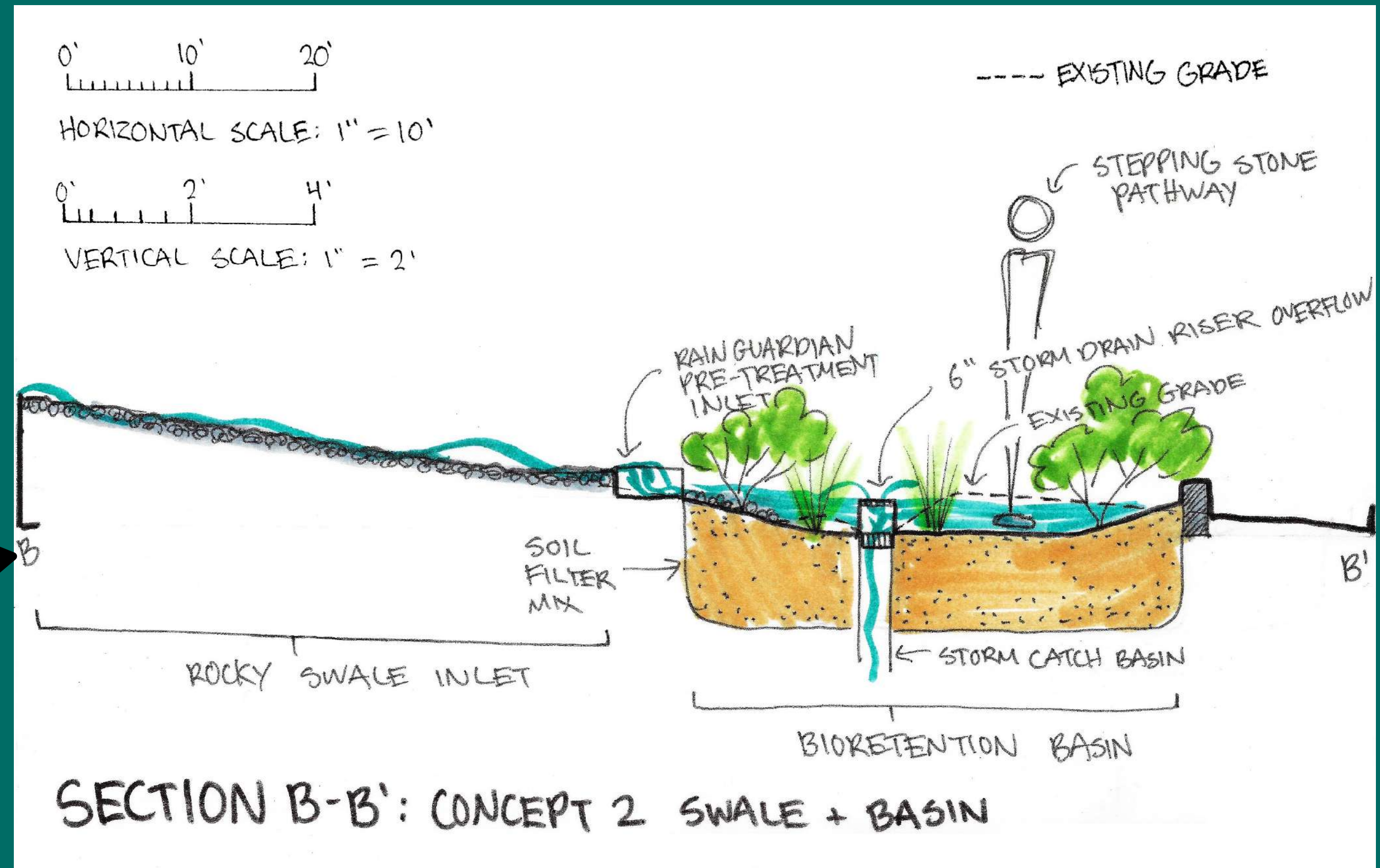
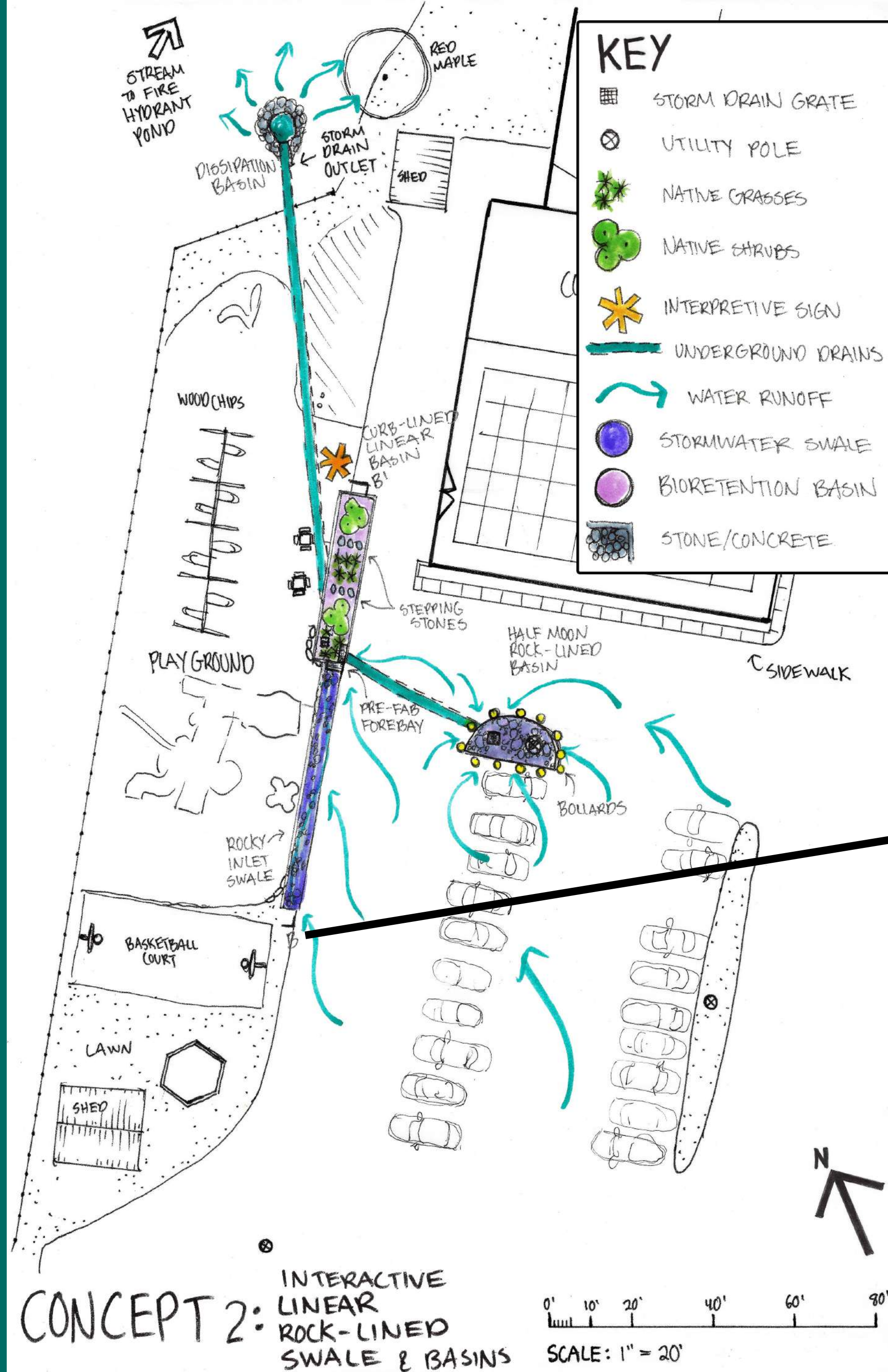
School Parking Lot - Concept 1

Pre-treatment Forebay, Curb-cut
Bioretention Basin, & Rock-lined Swale



School Parking Lot - Concept 1

Interactive Linear Rock-lined Swale & Basins



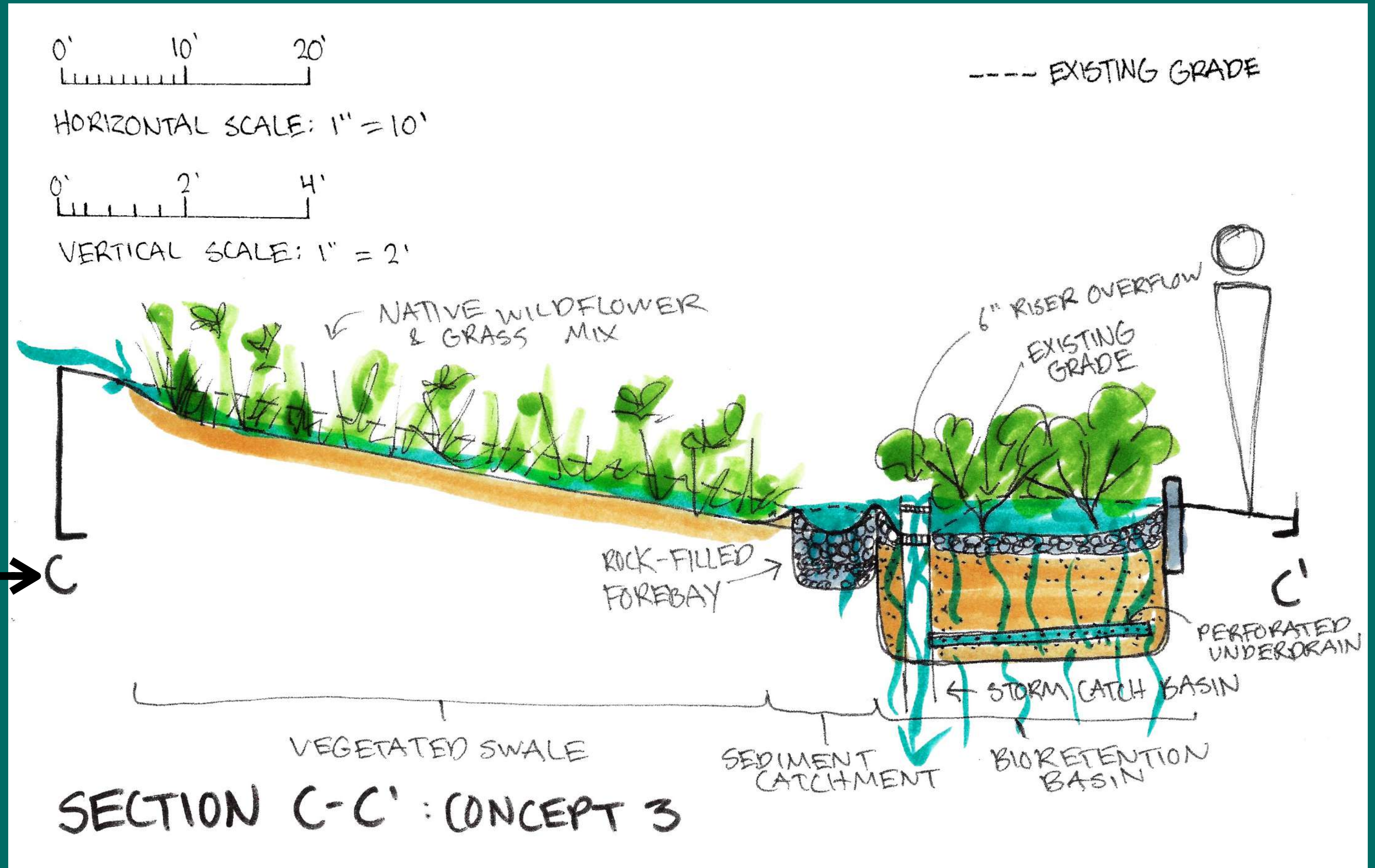
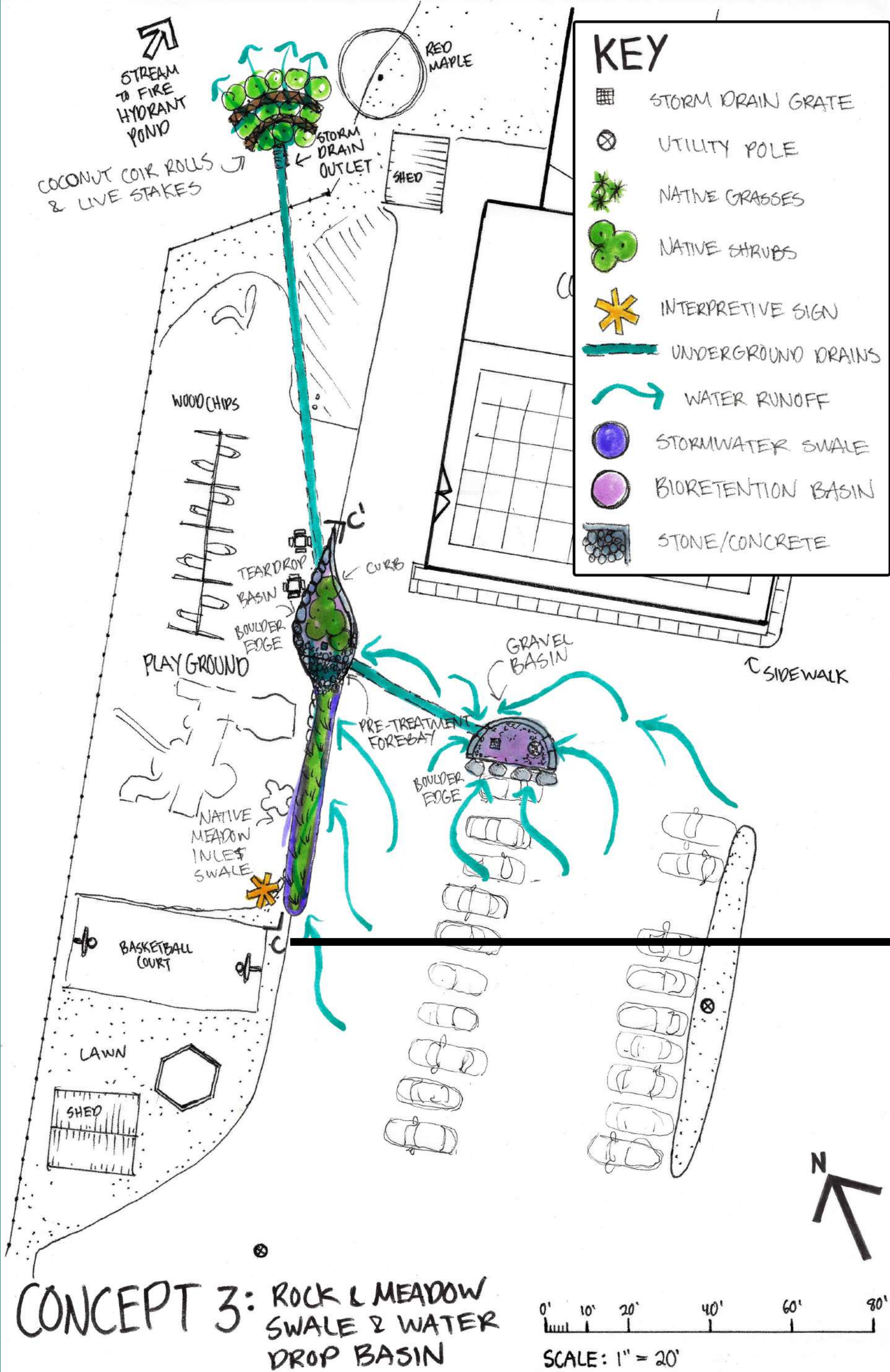
School Parking Lot - Concept 2



Curb-cut Bioretention Basin, Rain Guardian Pre-treatment Inlet, & Storm Drain Riser Overflow

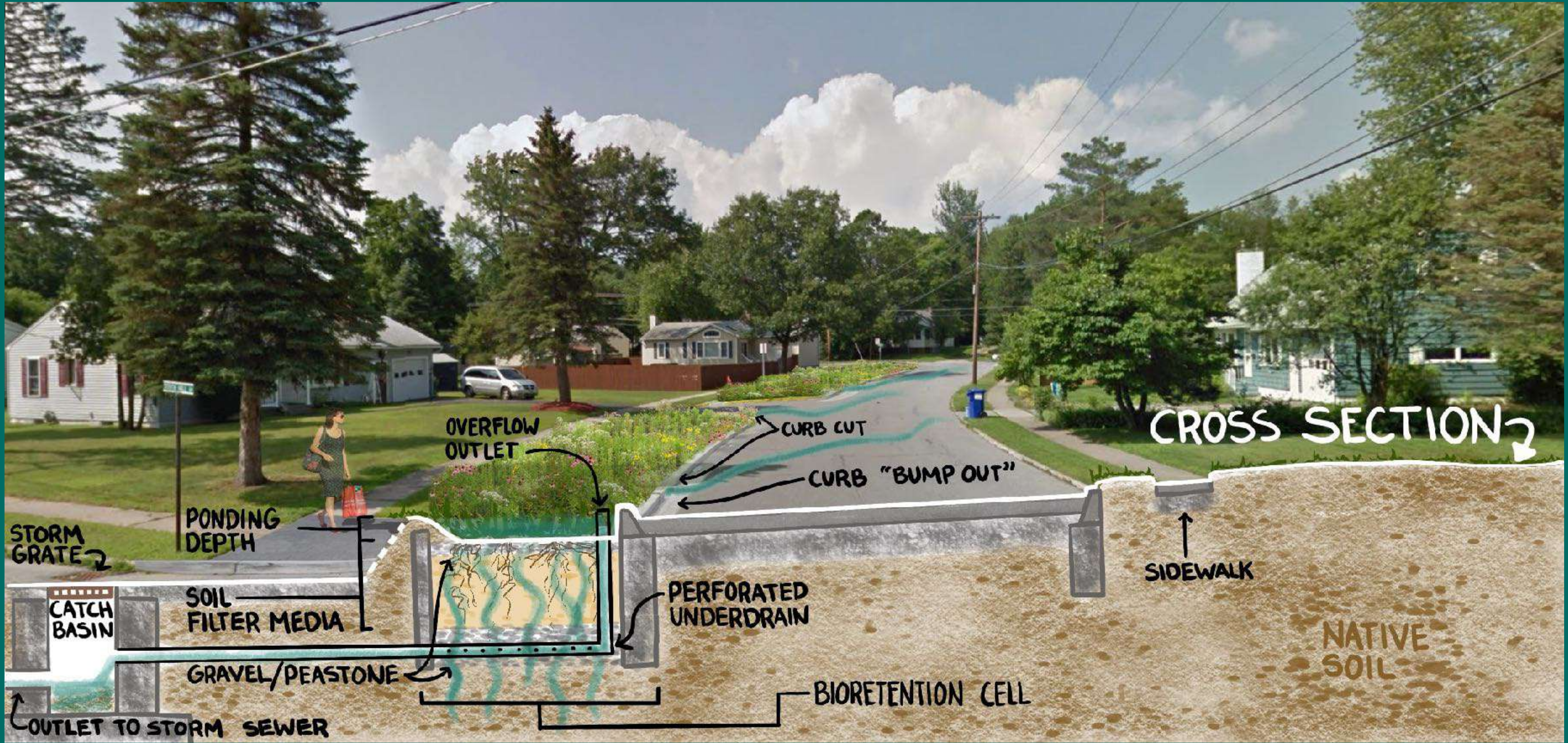


School Parking Lot - Concept 3 Rock & Meadow Swale & Water Drop Basin



School Parking Lot - Concept 3

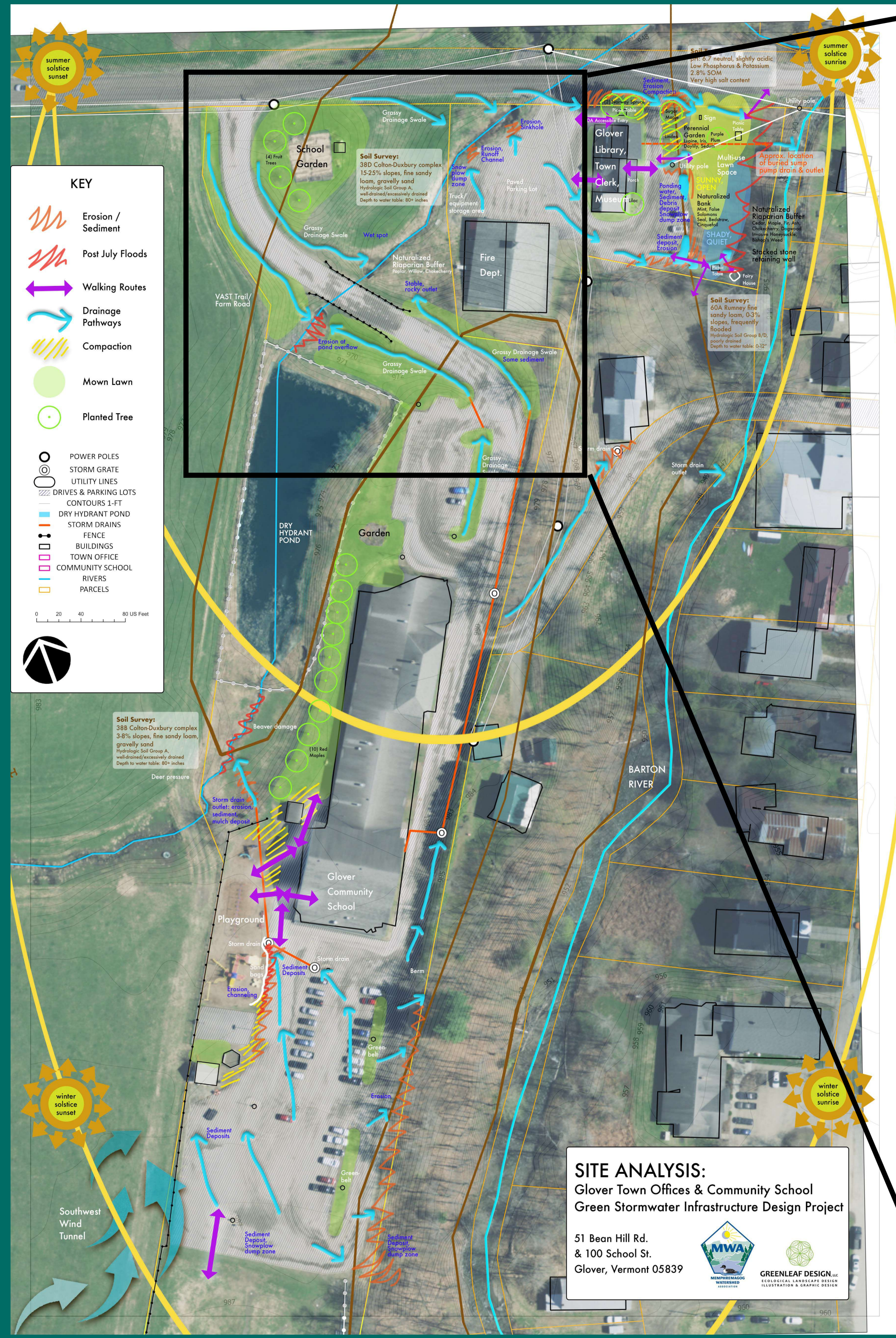
Curb-cut Basin with Underdrain



School Parking Lot - Parking Lot Basin

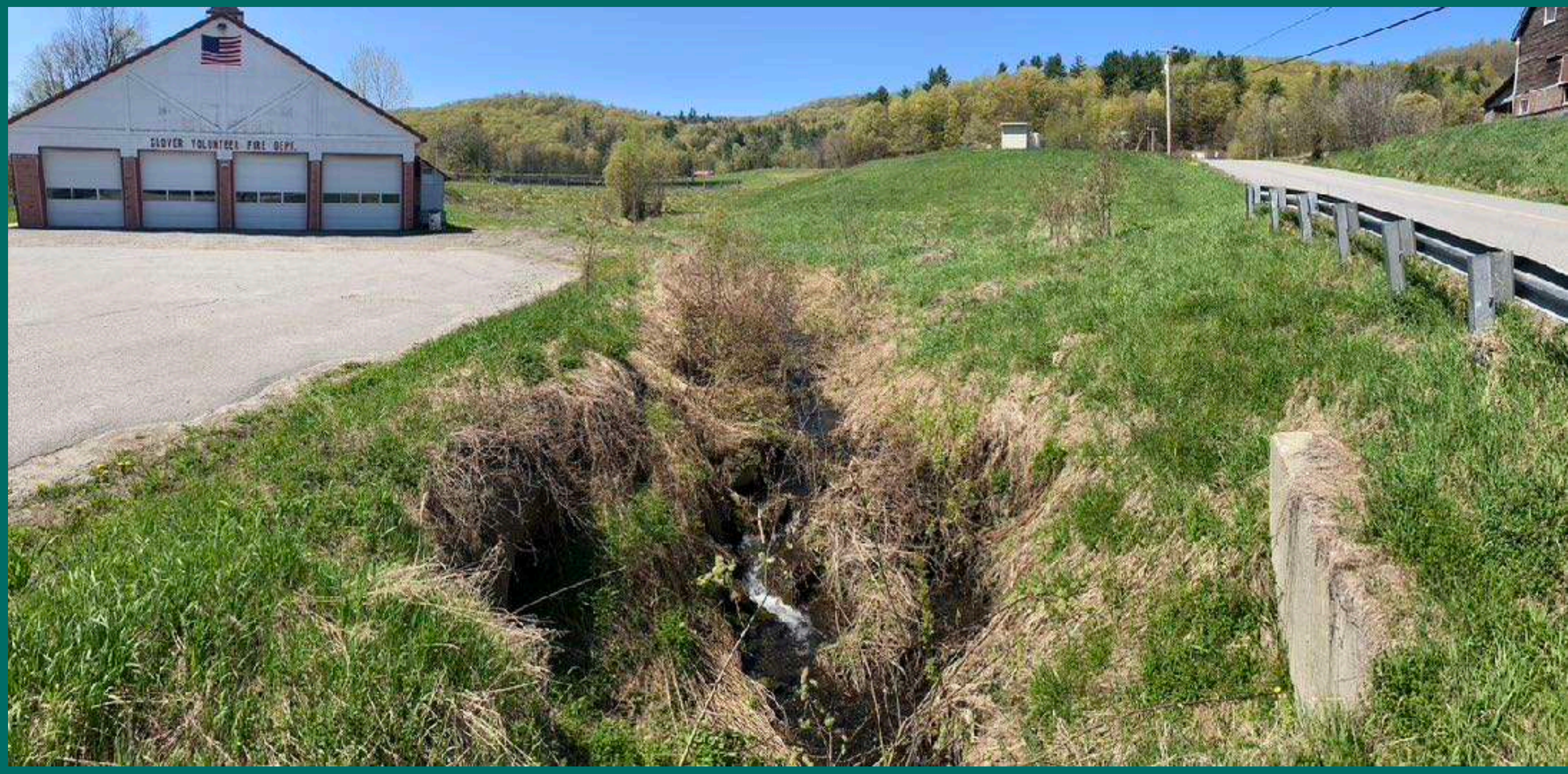
Rock-lined sediment catchment, bollards, & boulder edge





- KEY**
-  POWER POLES
 -  STORM GRATE
 -  UTILITY LINES
 -  DRIVES & PARKING LOTS
 -  CONTOURS 1-FT
 -  DRY HYDRANT POND
 -  STORM DRAINS
 -  FENCE
 -  BUILDINGS
 -  TOWN OFFICE
 -  COMMUNITY SCHOOL
 -  RIVERS
 -  PARCELS
 -  GUARDRAIL

School / Fire Department Field



CONCEPT PLAN
 Glover Town Offices & Community School
 Green Stormwater Infrastructure Design Project
 51 Bean Hill Rd. & 100 School St.
 Glover, Vermont 05839




0' 10' 20' 30' 40' 60' 80' NORTH

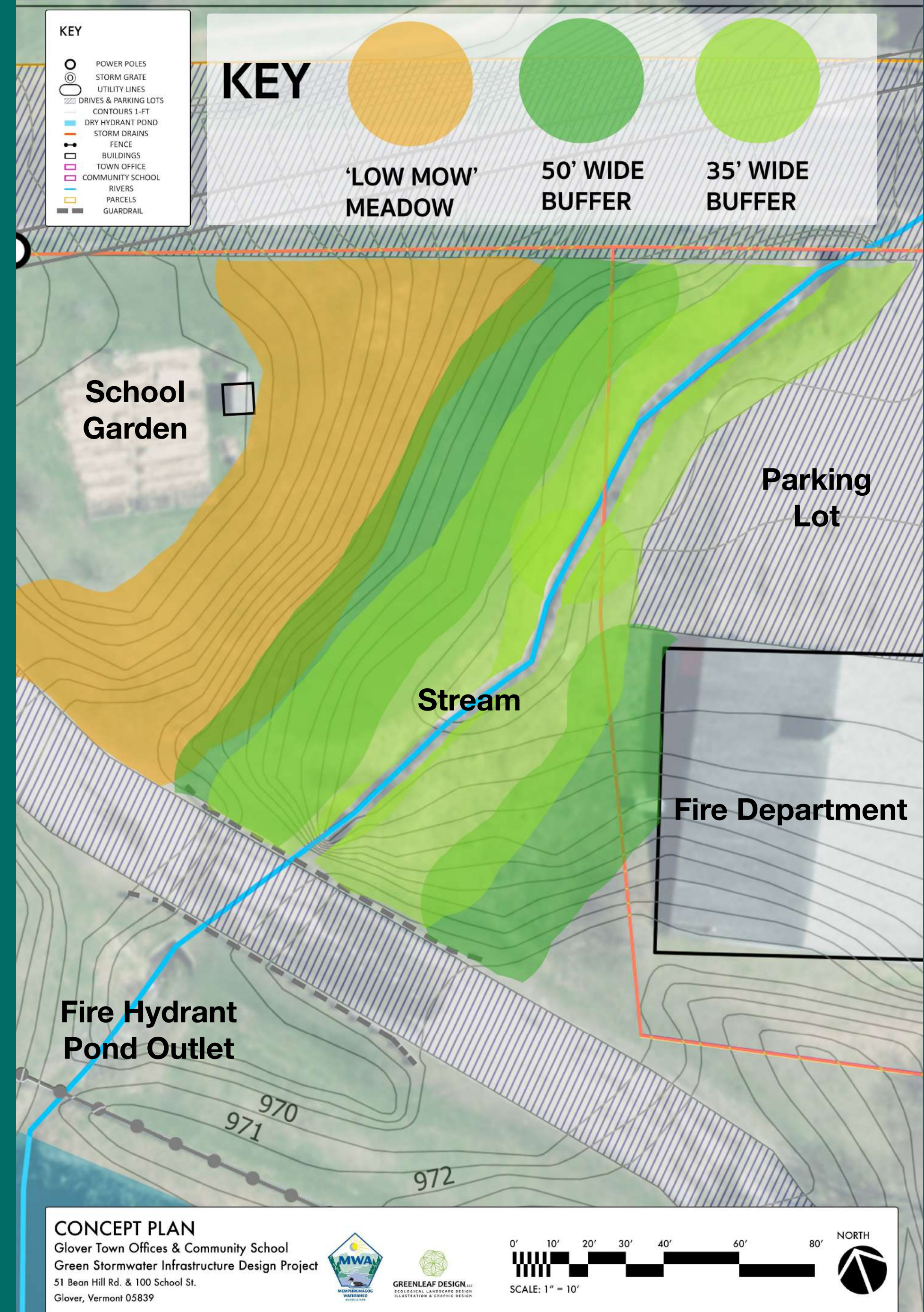


SCALE: 1" = 10'



School / Fire Dept. Field

1. 50' Wide Restored Natural Stream Buffer + Meadow - Stream Wise!
2. 35' Wide Natural Stream Buffer + Meadow - Minimum buffer width for stream stabilization
 - 'No-mow': Allow natural succession of trees & shrubs
 - Optional: Plant trees and shrubs to speed up succession and establish desired trees
 - 'Low Mow' Upland Meadow: mow once every 1-3 years in fall



School / Fire Dept. Field

Naturally vegetated stream buffer

- Native species
- Low-maintenance: minimal mowing
- Stabilizes stream bank
- Reduces in-stream erosion
- Soaks up water in floodplain
- Slows floodwaters
- Protects infrastructure

Some species already present:

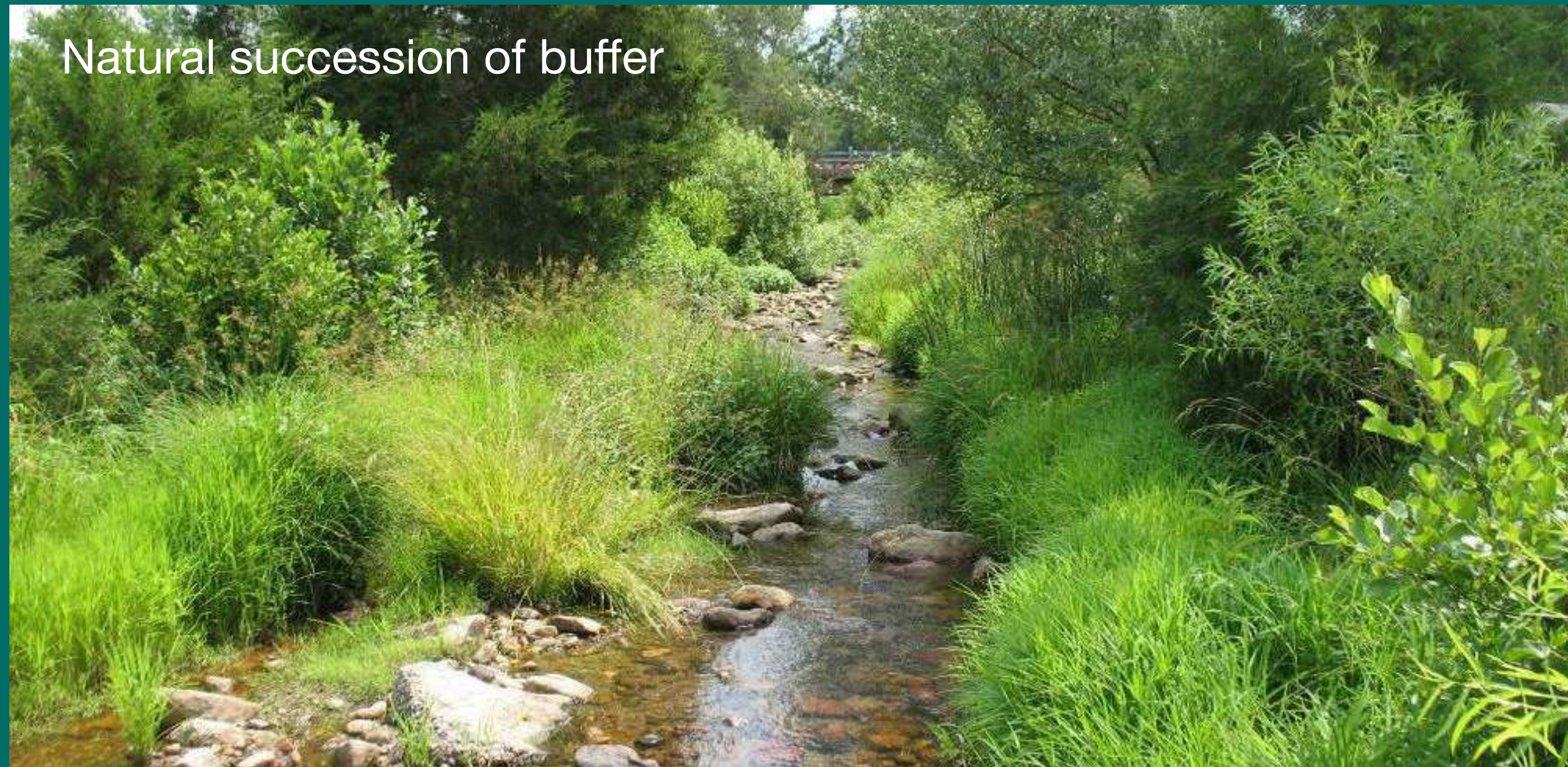
- Balsam Poplar, *Populus balsamifera*
- Shrub Willow, *Salix spp.*
- Chokecherry, *Prunus*

See possible plant species on next pages.

Buffer planted with trees



Natural succession of buffer



Preliminary Tree List



Swamp White Oak, *Quercus bicolor*

Serviceberry, *Amelanchier laevis*

E. White Cedar, *Thuja occidentalis*

Red Maple, *Acer rubrum*

River Birch, *Betula nigra*

Preliminary Shrub List



Summersweet, *Clethra alnifolia*



Sweetfern, *Comptonia peregrina*



Black Chokeberry, *Aronia melanocarpa*



Gray Dogwood, *Cornus racemosa*



Arrowwood, *Viburnum dentatum*



Shrub Willow, *Salix sp.*

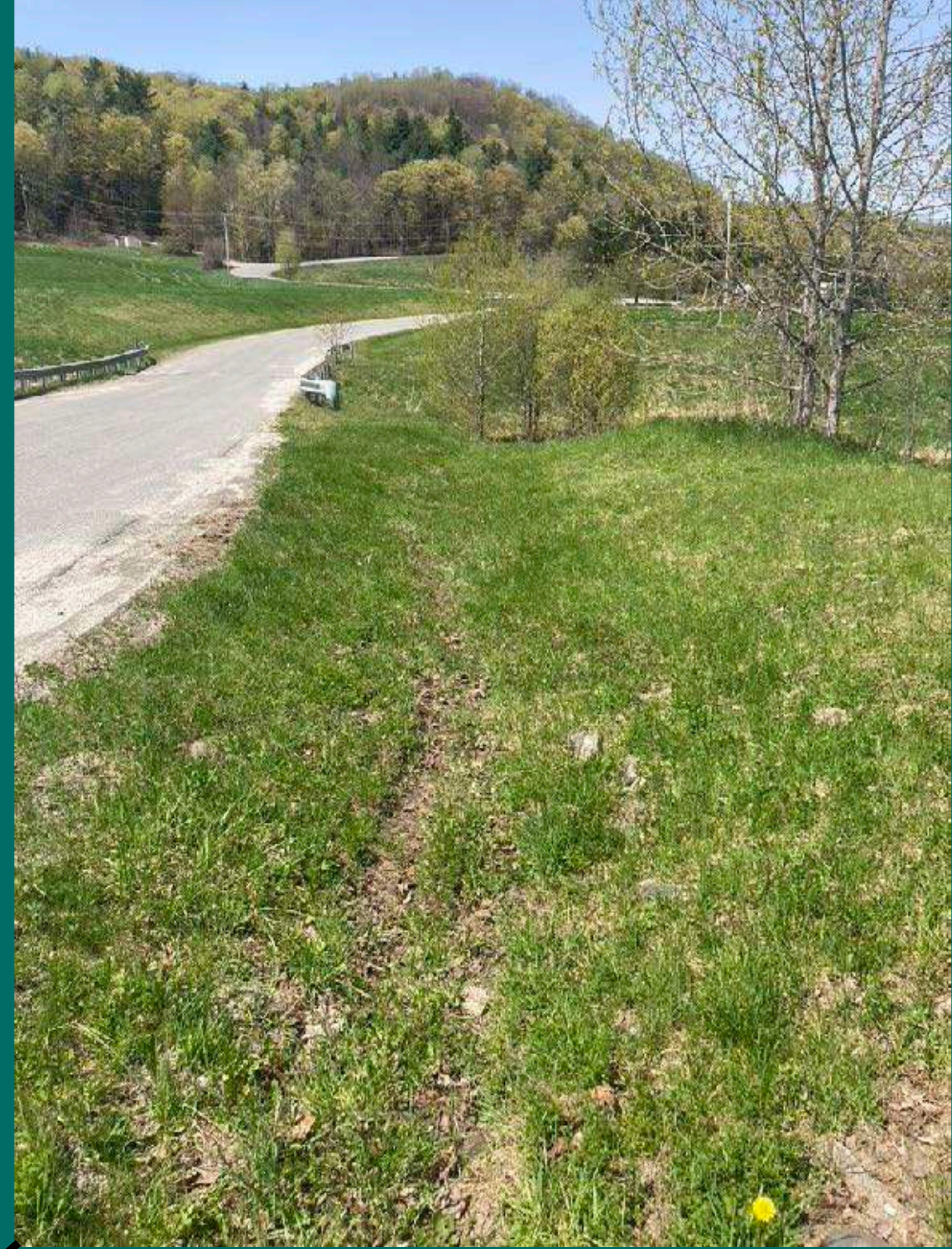
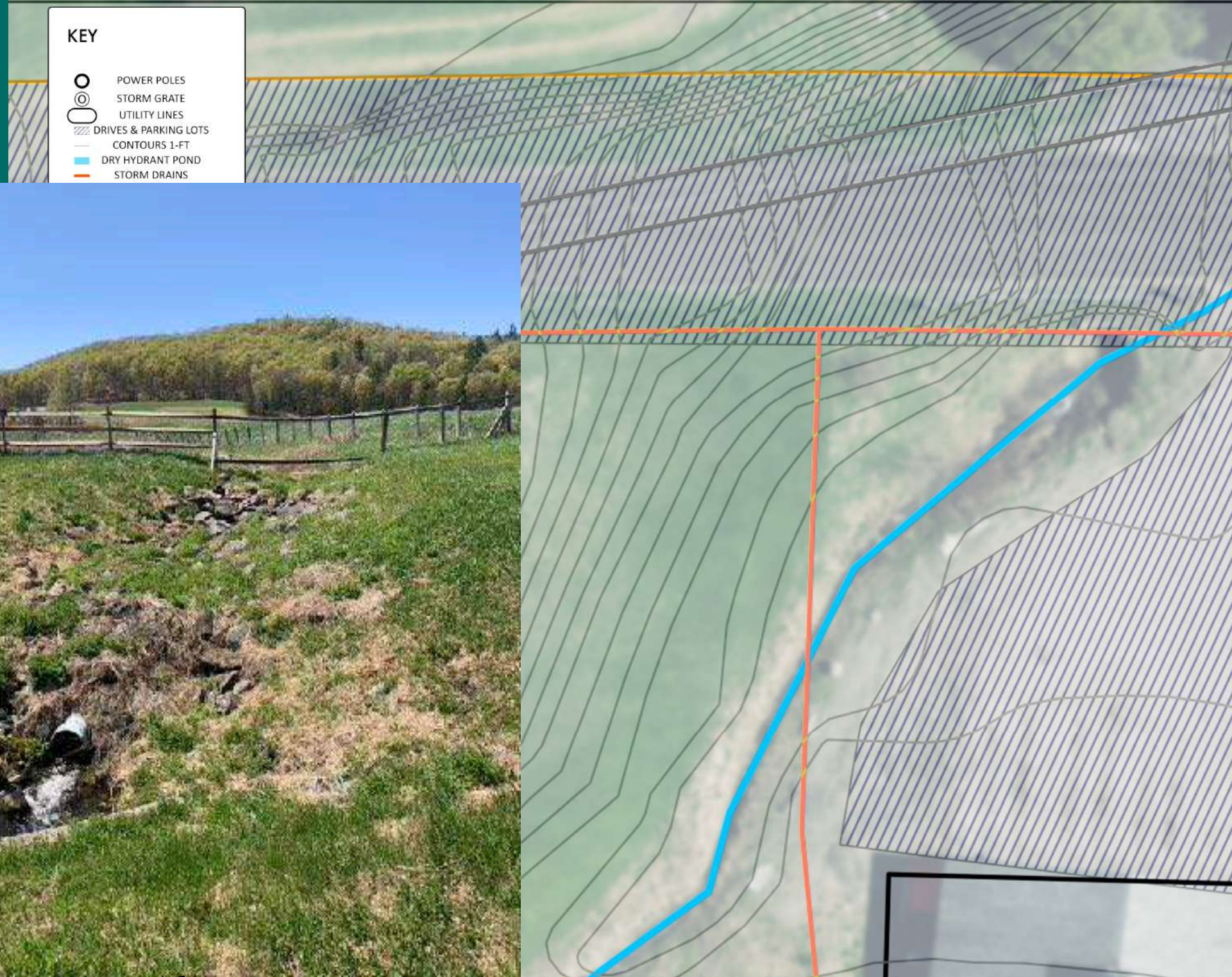


Red Osier Dogwood, *Cornus sericea*

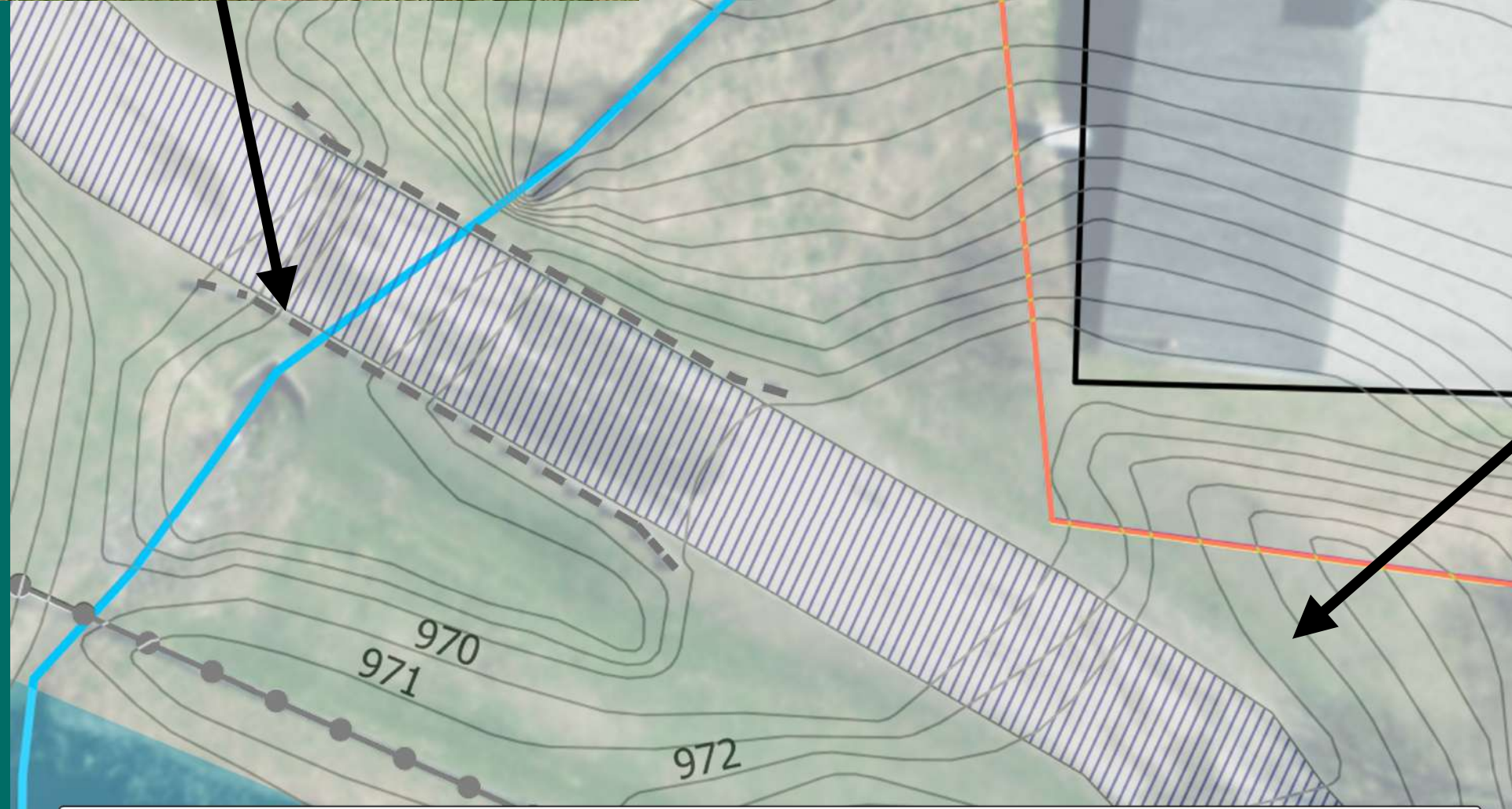


Witchhazel, *Hamamelis virginiana*

School Entry



- Some erosion in ditches and at fire hydrant pond outlet during July 2023 floods



CONCEPT PLAN
Glover Town Offices & Community School
Green Stormwater Infrastructure Design Project
51 Bean Hill Rd. & 100 School St.
Glover, Vermont 05839

0' 10' 20' 30' 40' 60' 80' NORTH
SCALE: 1" = 10'

School Entry

- Row of Native Trees Along Driveway
 1. Evergreen - winter wind break
 2. Deciduous - fall color
 3. Mix of both



School Entry

- Slow down and soak up water, capture sediment, prevent erosion:
 - Stone Check Dams
 - Naturally vegetated ditches
 - Woody shrubs & lawn
 - Wildflower & Grass Wetland Meadow Mix
 - 'Low-Mow' Meadow (mow less)



Stone Check Dams



Red Osier Dogwood Planting



Wildflower & Grass Wetland Meadow Mix

Fire Hydrant Pond

- Restore Inlet and Outlet Streams
 - Plant native shrubs & trees to stabilize soils, slow and soak up water
- Beaver dam analogs to prevent incision in stream channel and allows water to access floodplain
- Larger stone in pond outlet to prevent erosion during overflows



Buffer planting with tree tubes to prevent beaver and deer browse



Beaver Dam Analog

Glover Town Office/Library & School Green Stormwater Retrofits

Concept Plans //
Stakeholder Input



Thank You!

Please fill out form or list
preferences and email to
greenleafholly@gmail.com

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